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## Effects of Moderate Swim Exercise on Adiposity and Metabolic Function in Mice

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## A-29 Exercise is Medicine/Poster - Body Composition, Diabetes, Cancer, Disease Management

May 30, 2012 7:30 AM - 12:30 PM

ROOM: Exhibit Hall

1220 Board #1 May 30 9:30 AM - 11:00 AM

### Sitting Time Was Highly Associated With Physical Activity Level And Obesity In Brazilian Public Employees

Luiz Guilherme G. Porto<sup>1</sup>, João Luis A. E. S. P. Leitão<sup>2</sup>, Évelin D. R. dos Santos<sup>2</sup>, Felipe F. Cavalcante<sup>2</sup>, Allan R. Mello<sup>2</sup>, Rayane G. A. Costa<sup>2</sup>, Leiriane V. Gregório<sup>2</sup>.  
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(No relationships reported)

Public health recommendations for physical activity (PA) have focused on the minimal PA that everyone should accumulate on a regular basis. Recently, studies have shown that sedentary behavior, as sitting time, could also be important in the public health context.

**PURPOSE:** To analyze the association between sitting time, PA level and body composition among Brazilian civil servants from the Superior Labour Court (TST).

**METHODS:** A cross-sectional study was done with a sample of 404 TST employees (189 women - 46.8%), aged 42.1±10.1 yrs and BMI: 26.0±4.3 kg/m<sup>2</sup>, randomly recruited and stratified by sex. Sitting time (ST) was assessed by questionnaire as proposed by Katzmarzyk et al (Med Sci Sports Exerc 41(5)), with data grouped in 2 categories: those who reported Longer ST Period (≥3/4 of day time - LSTP) and those who reported a Shorter ST Period (≤1/2 of day time - SSTP). PA level was characterized by the IPAQ Questionnaire, considering 2 PA categories: Insufficient Active group (IA - those who didn't met PA recommendations) and Active group (AT - those who met PA recommendations). Body composition was analyzed by BMI and obesity was considered when BMI≥30 kg/m<sup>2</sup>. Chi-square (X<sup>2</sup>) was used to analyze variable associations and Odds Ratio (95% CI) (OR) was calculated to evaluate the strength of the associations. Differences were considered statistically significant when p<0.05.

**RESULTS:** 181 volunteers (44.8%) reported a LSTP, 193 (47.8%) were IA and 68 (16.8%) were obese. ST frequencies and association analysis are shown on Table 1.

**CONCLUSIONS:** We observed a negative association between ST and PA level as for the body composition. Volunteers who reported a longer ST period showed a higher risk (estimated by OR) of been insufficiently active and obese.

Table 1: Absolute and relative frequencies of ST with Chi-square (X<sup>2</sup>) and OR analysis (n=404)

| Variables | LSTP        | SSTP        | X <sup>2</sup> | p       | OR (95% CI)        |
|-----------|-------------|-------------|----------------|---------|--------------------|
|           | n = 181     | n = 223     |                |         |                    |
| PA level  |             |             |                |         |                    |
| IA        | 110 (57.0%) | 83 (43.0%)  | 22.2           | <0.0001 | 2.61 (1.75 - 3.91) |
| AT        | 71 (33.6%)  | 140 (66.4%) |                |         |                    |
| BMI       |             |             |                |         |                    |
| ≥ 30      | 38 (55.9%)  | 30 (44.1%)  | 4.06           | = 0.04  | 1.71 (1.01 - 2.89) |
| < 30      | 143 (42.6%) | 193 (57.4%) |                |         |                    |

1221 Board #2 May 30 9:30 AM - 11:00 AM

### Body Mass Index of North American Participants at the World Masters Games

Mark DeBeliso<sup>1</sup>, Joe Walsh<sup>2</sup>, Kent J. Adams, FACSM<sup>3</sup>, Mike Climstein, FACSM<sup>4</sup>, Ian T. Heazlewood<sup>5</sup>, Stephen Burke<sup>2</sup>, Jyrki Kettunen<sup>6</sup>. <sup>1</sup>Southern Utah University, Cedar City, UT. <sup>2</sup>Australian Catholic University, Sydney, Australia. <sup>3</sup>California State University Monterey Bay, Seaside, CA. <sup>4</sup>Bond University, Gold Coast, Australia. <sup>5</sup>Charles Darwin University, Darwin, Australia. <sup>6</sup>Arcada University, Invalidisäätiö, Finland.

(No relationships reported)

World Masters Games (WMG) athletes have either pursued a physically active lifestyle for an extended period of time or have initiated exercise/sport in later life. This unique cohort of middle- to older-aged adults remains relatively uninvestigated with regards to various measures of health. With a need for multifaceted solutions to the obesity epidemic, investigating special populations such as those competing in sport at older ages may further the understanding of the nexus between aging, physical activity and obesity.

**PURPOSE:** To investigate the body mass index (BMI) of North American WMG competitors with respect to national health guidelines and demographics.

**METHODS:** An online survey was utilized to collect demographic information from athletes competing at the Sydney WMG. BMI was derived using the participant's height and body mass.

**RESULTS:** A total of 928 (46.7% male, 53.3% female) participants from Canada and the United States (age 52.6±9.8 yrs, range 27 to 87 yrs) completed the survey. The top 5 sports in which participants competed were football (25.6%), track/field (15.4%), swimming (8.4%), volleyball (8.2%), and softball (7.8%). Female and male BMI (kg/m<sup>2</sup>) across all sports were: >30 (obese-13.9%), 25-29.9 (overweight-34.1%), 18.5-24.9 (normal-50.3%), and <18.5 (underweight-1.7%). Data indicated that BMI was a health risk factor for 13.9% of the participants and a developing risk factor for 34.1% of the participants. Analysis demonstrated a significantly reduced (p<0.001) classification of obesity of the North American WMG competitors when compared to summary statistical values for the Canadian and United States national populations.

**CONCLUSIONS:** It is believed that adherence to exercise improves indices of general health. A key index of health (obesity) is significantly lower in incidence for North American WMG competitors when compared to Canadian and US populations.

1222 Board #3 May 30 9:30 AM - 11:00 AM

### The Health Benefits of Exercise are Independent of Weight Loss in Obese Men and Women.

Phillipa Caudwell<sup>1</sup>, Catherine Gibbons<sup>1</sup>, Mark Hopkins<sup>1</sup>, Neil King<sup>2</sup>, Erik Naslund<sup>3</sup>, Graham Finlayson<sup>1</sup>, John Blundell<sup>1</sup>. <sup>1</sup>University of Leeds, Leeds, United Kingdom. <sup>2</sup>Queensland University of Technology, Brisbane, Australia. <sup>3</sup>Karolinska Institute, Stockholm, Sweden.

(No relationships reported)

Exercise is often prescribed as a method of weight loss and weight management, whilst other health benefits of exercise are less emphasized. Weight loss is not the only benefit of exercise and may not be the most appropriate marker of health.

**PURPOSE:** To examine the relationship between weight change and changes in health parameters during a supervised exercise program.

**METHODS:** 107 overweight and obese men (n=35) and women (n=72) with a mean BMI=31.4±4.2kg/m<sup>2</sup> and age= 40.9±9.2years, completed a supervised 12 week exercise program designed to increase gross energy expenditure (EE) by 2500kcal/wk at an intensity of 70% of their maximum heart rate. Various health markers including blood pressure (BP), aerobic fitness (AF), resting heart rate (RHR), and body composition were measured at weeks 0 and 12.

**RESULTS:** There was a significant reduction in mean body mass ( $-3.2 \pm 3.2$  kg,  $p < 0.0001$ ), however, there was large individual variability (range:  $-14.7 - +3.7$  kg) and approximately half ( $n=59$ ) failed to change body composition as predicted - body mass ( $-0.81 \pm 2.11$  kg) and fat mass ( $-1.3 \pm 2.1$  kg). Despite this, their mean improvement in measured health markers was statistically significant: AF ( $+5.6 \pm 7.2$  ml/kg/min-1,  $p < 0.0001$ ) and fat free mass ( $+0.56 \pm 1.3$  kg,  $p = 0.002$ ) significantly increased, while RHR ( $-3.7 \pm 7.5$  bpm), Diastolic BP ( $-2.4 \pm 6.6$  mmHg,  $p = 0.008$ ), waist circumference ( $-3.2 \pm 2.7$  cm,  $p < 0.00001$ ) and % fat mass ( $-1.4 \pm 1.8$ ,  $p < 0.0001$ ) significantly decreased. Improvements in blood pressure changes were more marked when hypertensive (135/90 mmHg) individuals were examined separately. This group became normo-tensive by reductions in systolic ( $-13.0 \pm 10.1$  mmHg) and diastolic ( $-8.3 \pm 5.9$  mmHg) BP, which were independent of weight loss.

**CONCLUSIONS:** These data demonstrate that significant and meaningful exercise-induced health benefits can be achieved even with little or no weight loss. Therefore, the current public health focus on weight loss should be reduced and more attention focussed on improving general health. Supported by: Biotechnology and Biological Sciences Research Council (BB51/B/05079 and BB/G005524/1).

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**1223** Board #4 May 30 9:30 AM - 11:00 AM

**Minimal Changes in Breathing Mechanics at Peak Exercise in Endurance-trained Obese Individuals**

Santiago Lorenzo<sup>1</sup>, J. Todd Basset<sup>2</sup>, Raksa B. Moran<sup>2</sup>, Jessica N. Pineda<sup>2</sup>, Tony G. Babb, FACSM<sup>3</sup>. <sup>1</sup>Texas Health Presbyterian Hospital Dallas and UT Southwestern Medical Center, Dallas, TX. <sup>2</sup>Texas Health Presbyterian Hospital Dallas, Dallas, TX. <sup>3</sup>UT Southwestern Medical Center, Dallas, TX.

(No relationships reported)

**PURPOSE:** Alterations in respiratory mechanics predisposes healthy obese individuals to low lung volume breathing at rest and during exercise, which places them at risk of developing expiratory flow limitation (EFL). The high ventilatory demand in endurance-trained obese adults further increases their risk of developing EFL as well as their work of breathing. Therefore, we measured breathing mechanics and ventilatory dynamics during exercise in endurance trained obese individuals.

**METHODS:** Seven (5W/2M) endurance-trained obese adults ( $35 \pm 3$  yr,  $37 \pm 5\%$  body fat,  $33 \pm 4$  BMI, mean  $\pm$  SD) underwent hydrostatic weighing, pulmonary function testing, submaximal and maximal cycle exercise testing, and the determination of the oxygen cost of breathing during eucapnic voluntary hyperpnea (EVH).

**RESULTS:** Pulmonary function was normal (FVC  $109 \pm 14\%$  predicted, FEV1  $108 \pm 11\%$  predicted, PEF  $119 \pm 13\%$  predicted, MVV  $129 \pm 6\%$  predicted, TLC  $101 \pm 13\%$  predicted, FRC  $45 \pm 6\%$  TLC). Peak  $\dot{V}O_2$  and work rate were  $135 \pm 16$  and  $133 \pm 9\%$  predicted, respectively. Peak ventilation, tidal volume, and breathing frequency were  $125 \pm 36$  L/min ( $77 \pm 11\%$  MVV),  $2.6 \pm 0.6$  L ( $56 \pm 5\%$  FVC), and  $49 \pm 8$  bpm, respectively. During submaximal exercise end-expiratory lung volume dropped slightly but it returned to resting levels at peak exercise (rest  $41.5 \pm 5.7$ , submaximal  $38.1 \pm 8.5$ , peak  $42.0 \pm 7.2\%$  TLC). Slight EFL at peak ( $16 \pm 5\%$  of tidal volume) without desaturation ( $98 \pm 1\%$ ) was observed in 6 subjects (5W/1M). During submaximal exercise the ventilatory response ( $\dot{V}E/\dot{V}CO_2$  slope) was  $25 \pm 1$ , and at peak exercise the rating of perceived breathlessness (Borg 0-10 scale) was  $7.7 \pm 1.6$ . The estimated oxygen cost of breathing during EVH was  $1.75 \pm 0.74$  ml/L and during peak exercise averaged  $7 \pm 3\%$  of peak  $\dot{V}O_2$ .

**CONCLUSIONS:** Fit obese individuals were able to adequately increase ventilation and match the elevated metabolic demand associated with high fitness without substantial alterations in breathing mechanics. We conclude that endurance-trained obese individuals with normal lung function are not limited by breathing mechanics, which is good news for otherwise healthy obese adults who wish to participate in vigorous exercise training.

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**1224** Board #5 May 30 9:30 AM - 11:00 AM

**Fat Free Mass Response Of Overweight Males Following 12 Weeks Of High-intensity Intermittent Exercise**

Mehrdad Heydari<sup>1</sup>, Judith Freund<sup>2</sup>, Stephen H. Boutcher, FACSM<sup>1</sup>. <sup>1</sup>University of New South Wales, Sydney, Australia. <sup>2</sup>St Vincent's Hospital, Sydney, Australia.

(Sponsor: Stephen Boutcher, FACSM)

(No relationships reported)

The effect of high-intensity intermittent exercise (HIIE) on fat free mass (FFM) of overweight males is undetermined.

**PURPOSE:** To examine the effect of a 12-week HIIE intervention on FFM levels of sedentary overweight men.

**METHODS:** Thirty eight males aged  $24.9 \pm 4.3$  years, with a BMI of  $28.7 \pm 3.1$  kg/m<sup>2</sup>, and body mass of  $88.4 \pm 11.9$  kg underwent a  $\dot{V}O_{2max}$  test pre- and posttraining. Total body fat and FFM was assessed by dual energy x-ray absorptiometry. Subjects, who were randomly assigned to HIIE ( $n=20$ ) or control groups ( $n=18$ ), exercised three times a week for 12 weeks under supervision. The HIIE group completed 20 minutes of exercise (8 s sprint, 12 s recovery) each session, whereas controls performed no structured exercise for 12 weeks. Dietary intake was monitored through food diaries.

**RESULTS:**  $\dot{V}O_{2max}$  was significantly improved,  $P < 0.05$ , by an increase of 15% in the HIIE group ( $34.2 \pm 4.4$  to  $39.4 \pm 3.5$  ml.kg<sup>-1</sup>.min<sup>-1</sup>) and remained unchanged in the control group. Total FFM was significantly increased,  $P < 0.05$ , in the exercise group by 1.2 kg ( $54.3 \pm 6.5$  to  $55.5 \pm 6.1$  kg) and remained unchanged in controls ( $53.8 \pm 6.5$  to  $54.2 \pm 6.1$  kg). FFM increased by 0.4 kg in the leg ( $18.6 \pm 2.5$  to  $19.0 \pm 2.4$  kg) and 0.7 kg in the trunk ( $24.9 \pm 3.1$  to  $25.6 \pm 3.0$  kg) and was unchanged in the arm. Total fat mass in the HIIE group was significantly reduced ( $29.8 \pm 7.1$  to  $27.8 \pm 6.9$  kg;  $P < 0.05$ ) by 7%, whereas in the controls fat mass was unchanged ( $31.7 \pm 9.3$  to  $31.8 \pm 9.9$  kg).

**CONCLUSIONS:** Twenty minutes of HIIE, three times a week for 12 weeks, led to a significant decrease in fat mass and a significant increase in FFM in overweight, young males.

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**1225** Board #6 May 30 9:30 AM - 11:00 AM

**A Multidisciplinary Intervention Results in Sustained Improvements in Fitness and Metabolic Profile in Overweight Youth**

Karissa L. Peyer<sup>1</sup>, R Randall Clark<sup>1</sup>, Jens Eickhoff<sup>2</sup>, Aaron L. Carrel<sup>2</sup>. <sup>1</sup>University of Wisconsin Hospital and Clinics, Madison, WI. <sup>2</sup>University of Wisconsin School of Medicine and Public Health, Madison, WI.

(No relationships reported)

**PURPOSE:** To evaluate the impact of a clinical intervention on body composition, aerobic fitness, cholesterol, and insulin sensitivity in a clinic for overweight children.

**METHODS:** 79 children (age  $10.56 \pm 3.24$  years, BMI z-score  $1.15 - 3.48$ ) were followed for 24 months at a Pediatric fitness clinic. All children were seen for initial visit (T0), at 12 months (T12), 24 months (T24), and often for addition follow-up visits between these time points. All children had height, weight, and blood pressure assessed and BMI z-score was computed. DXA and a submaximal treadmill test were used to assess body composition and aerobic fitness. Many children also had carbohydrate and lipid metabolism assessed. Children and parents attended appointments with physicians, registered dietitians, and exercise physiologists to assess lifestyle habits and establish goals for healthy change. Follow-up intervals were set on an individual basis and typically ranged from 6 weeks to 3 months. Changes from baseline were evaluated using the nonparametric Wilcoxon Signed Rank test. Spearman's rank correlations were also performed to assess relationships between variables.

**RESULTS:** At T12, significant changes (mean  $\pm$  SD) were seen in  $\dot{V}O_{2max}$  ( $1.39 \pm 3.25$  ml/kg/min,  $p = 0.001$ ), %fat ( $-2.18 \pm 2.79\%$ ,  $p < 0.001$ ), BMI z-score ( $-0.09 \pm 0.21$ ,  $p < 0.001$ ), and Total Cholesterol ( $-19.72 \pm 44.42$  mg/dL,  $p = 0.01$ ). There were no significant changes in fasting glucose, insulin or blood pressure. There were no significant differences between genders. All improvements remained significant at T24 [ $\dot{V}O_{2max}$  ( $1.32 \pm 3.98$  ml/kg/min,  $p = 0.006$ ), %fat ( $-1.25 \pm 2.87\%$ ,  $p = 0.006$ ), BMI z-score ( $-0.13 \pm 0.28$ ,  $p < 0.001$ ), and Total Cholesterol ( $-11.82 \pm 22.77$  mg/dL,  $0.025$ )]. Correlation analysis revealed a significant negative correlation ( $p < 0.001$ ) between changes in BMI z-score and  $\dot{V}O_{2max}$  levels from baseline to T12 ( $r = -0.67$ ) and T24 ( $r = -0.71$ ).

**CONCLUSIONS:** A personalized, multidisciplinary intervention focusing on lifestyle changes in nutrition and exercise for children yielded significant improvements in cholesterol measures, aerobic fitness, body composition and BMI for 2 years. Children who displayed positive changes in BMI z-score also saw the greatest improvement in  $\dot{V}O_{2max}$ . Further research should evaluate outcomes at longer follow-up intervals.

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1226 Board #7 May 30 9:30 AM - 11:00 AM

**Body Mass Index and Parental Efficacy for Children's Exercise within a Youth Weight Management Program**

David Bellar<sup>1</sup>, Charly L. Bryan<sup>1</sup>, Lisa Broussard<sup>1</sup>, Holly Howat<sup>1</sup>, Lawrence W. Judge<sup>2</sup>. <sup>1</sup>University of Louisiana at Lafayette, Lafayette, LA. <sup>2</sup>Ball State University, Muncie, IN.

(No relationships reported)

Childhood obesity is an alarming trend within the United States and other areas of the world. Greater understanding of the predictors of childhood obesity and overweight are necessary to effectively combat this growing problem.

**PURPOSE:** The present investigation was designed assess the efficacy of parental provision of exercise for children and its relationship to health and fitness in a group of overweight and obese youth.

**METHODS:** Fourteen parents and children (Male n=5, Female n=9, Age: 11.0±2.0yrs, Height 152.5±12.3cm, BMI 34.75±10.3) volunteered to participate in the present investigation. The participants were selected from the population of a local youth weight management program. After consent and assent were collected, the parents were asked to fill out a modified version of the Self Efficacy Scale for Exercise. The youth were tested for cardiovascular fitness via a progressive 20 meter shuttle run, body composition via two site skinfold testing (calf and triceps), body mass index, muscular endurance via curl up and push up tests, and flexibility through back saver sit and reach as well as trunk lift and shoulder flexibility testing.

**RESULTS:** In general the youth in the study were classified in the healthy fitness zone for the flexibility assessments, however, for all body mass or body composition assessments and tests of muscular endurance or aerobic capacity participating youth were below the healthy fitness zone. There was a significant negative correlation between the reported efficacy of provision of exercise by the parents and the body mass index of the children ( $r=-0.522$ ,  $p=0.05$ ).

**CONCLUSIONS:** The results of this study suggest that parental efficacy may be a discriminating factor within a population of overweight and obese, low fitness level youth. As such, parental empowerment may be a key to health related fitness within this population.

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1227 Board #8 May 30 9:30 AM - 11:00 AM

**Effects Of Family-based Behavioral Group Therapy And Exercise Training In Pre-pubertal Obese Children And Their Mother**

Nathalie J. Farpour-Lambert<sup>1</sup>, Albane M. Maggio<sup>1</sup>, Xavier E. Martin<sup>1</sup>, Sophie Bucher Della Torre<sup>2</sup>, Yacine Aggoun<sup>1</sup>, Maurice Beghetti<sup>1</sup>. <sup>1</sup>University Hospital of Geneva, Geneva<sup>14</sup>, Switzerland. <sup>2</sup>School of Dietetics HES, Geneva, Switzerland.

(No relationships reported)

**PURPOSE:** To determine the effects of a family-based behavioral group therapy combined with an exercise training program on body fat and cardio-respiratory fitness in pre-pubertal obese children and their mother.

**METHODS:** This was a 6-month RCT including 50 pre-pubertal obese children (mean age 9.7 years, 95% CI 9.1-10.1) and their mother (40.5 years, 38.2-43.0) were randomly assigned to an Intervention (I, n=25) or a Control group (C, n=25). The intervention consisted of 14 behavioral group therapy sessions (nutrition, physical activity, body image, motivation, positive reinforcement, social and parental skills) once a week for children and mothers separately. In addition, children exercised (swimming, ball games, resistance training) one hour twice a week, and mothers participated to a one-hour Nordic walking session per week. We assessed changes at 6 months in BMI, waist circumference (WC), total body and abdominal fat by dual-energy x-ray absorptiometry (DXA), and cardio-respiratory fitness (VO2max).

**RESULTS:** At baseline, children's characteristics were similar among groups. Mothers in the Intervention group had significantly ( $p<0.05$ ) higher WC, total body and abdominal fat than Controls. At 6 months, using mixed linear regression, we observed significant changes in children's BMI (I-C treatment effect -0.67 g.cm-2), BMI Z-score (-0.15), WC (-1.33 cm), total body fat (-0.94%), abdominal fat (-2.08%), and VO2max (83.7 ml.min-1). In mothers, significant changes in BMI (I-C treatment effect -0.85 kg.cm-2), WC (-9.24 cm), total body fat (-0.61%), and abdominal fat (-1.43%) were shown.Changes in VO2max were not significant in mothers.

**CONCLUSIONS:** Family-based behavioral therapy combined with exercise training significantly reduces BMI and body fat in both pre-pubertal obese children and their mother. This is an interesting public health approach to promote behavioral changes and reduce the degree of adiposity at the family level. This study was funded by the Swiss National Science Foundation (#3200B0-120437) and the Geneva University Hospital Research and Development Fund.

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1228 Board #9 May 30 9:30 AM - 11:00 AM

**Examination of Modifiable Risk Factors for Obesity-Related Disease in African American College Students**

Brenda L. Swearingin<sup>1</sup>, Jamie E. Robbins<sup>2</sup>, Patricia A. Lynch<sup>1</sup>, Wi-Young So<sup>3</sup>, Brandon J. Crooms<sup>1</sup>. <sup>1</sup>North Carolina A&T State University, Greensboro, NC. <sup>2</sup>Winston Salem State University, Winston Salem, NC. <sup>3</sup>Seoul Women's University, Seoul, Korea, Republic of.

(No relationships reported)

The disparity in the prevalence of obesity and concomitant risk for cardiovascular disease in African Americans (AA) is a significant medical concern. Obesity-related chronic disease, associated with modifiable behaviors, is being diagnosed in younger AA populations.

**PURPOSE:** To examine relationships of the following variables in AA college students: 1) social support for healthy behaviors, 2) amount of physical activity (PA), 3) diet, 4) body mass index (BMI), 5) systolic (SBP) and diastolic (DBP) blood pressure, and 6) waist circumference (WC).

**METHODS:** 412 AA students completed a physical exam (BMI, SBP, DBP and WC) and a packet of surveys including the social support survey (SOC), a fruit and vegetable screener (FVS), a fat screener survey (FS), and the Paffenbarger PA questionnaire. Relationships were analyzed using one-way ANOVA, tukey post hoc comparisons and logistical regression.

**RESULTS:** The prevalence of overweight (OVW) and obesity (OB) was 28.3% and 30.3% respectively in males (N= 198, 20±1.5yrs) and 23.0% and 26.7% respectively in females (N=217, 19.8±1.6 yrs). In males, OVW subjects had WC ( $p < 0.01$ ) and SBP ( $p < 0.05$ ) indicating risk for cardiovascular disease (CVD) and low PA for recreational activities ( $p < 0.05$ ). The OB group was classified as increased risk for WC ( $p < 0.001$ ), SBP ( $p < 0.001$ ), and DBP ( $p < 0.001$ ) and lower than normal recreational activities ( $p < 0.05$ ). Female subjects in the OVW group met risk classification criteria for WC ( $p < 0.001$ ) and SBP ( $p < 0.05$ ). Female subjects in the OB group had CVD risk classifications for WC ( $p < 0.001$ ), SBP ( $p < 0.001$ ), and DBP ( $p < 0.001$ ) and lower than normal PA ( $p < 0.05$ ). Logistic regression showed, for both males and females, there was no statistical significance between OVW or OB and SOC, PA, FVS, and FS for males or females. When PA was increased by 1,000 kcal, the prevalence of OB decreased by 9.3% (OR = 0.907, CI = 0.834-0.986,  $p = 0.022$ ) in males and 9.0% (OR = 0.910, CI = 0.839-0.988,  $p = 0.025$ ) in females.

**CONCLUSIONS:** The only significantly different risk factor for obesity in college African Americans is PA. Differences in female PA for normal vs. overweight/obesity existed in total PA; however, males demonstrated significant differences in PA for recreational activities alone. Supported by USDA Grant 0204191.

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1229 Board #10 May 30 9:30 AM - 11:00 AM

**Student Athletes Have A More Favorable Body Composition And Bone Mineral Density Than Non-athletes**

Hattie H. Wright, Chrisna R. Botha, Lize Havemann-Nel. North-West University, Potchefstroom, South Africa.

(No relationships reported)

**PURPOSE** Data on the relative contribution of planned exercise to body composition and BMD of premenopausal black and white African women is scarce.

**METHODS:** Volunteer black and white University female students were recruited into groups according to exercise and race, namely white athletes (WA, n=117) and black athletes (BA, n=50), doing ≥5h/wk of planned weight bearing exercise, as well as white non-athletes (WNA, n=44) and black non-athletes (BNA, n=44) doing ≤1h/wk of planned exercise. Students with a body mass index (BMI) <28.0 and not pregnant were included. Exclusion criteria were use of corticosteroids/thiazides for ≥ 6 months and any known bone disease. Alpine spine (APS), femoral neck (FN), total hip (TH), and whole body (WB) BMD as well as body composition were measured with dual energy X-ray absorptiometry.



**RESULTS:** Mean age, weight, height, and BMI for the total group were 20.3±1.8yrs, 60.7±8.6kg, 1.65±0.1m, and 22.1±2.3kg/m<sup>2</sup>. WA were younger and heavier than both BNA and BA (p<0.05). Height differed significantly between all groups with WA the tallest and BNA the shortest [median = 1.67(1.64-1.72)m vs. 1.59(1.54-1.64)m, p<0.05]. After adjusting for age and weight BMD were similar between WNA and BNA, as well as WA and BA. WNA had lower BMD at all sites compared to WA (p<0.001). BNA had lower BMD at all sites compared to BA [APS= 0.969(0.912-1.028) vs. 1.087(0.991-1.148)g/cm<sup>2</sup>; FN=0.821(0.773-0.904) vs. 0.951(0.888-1.028)g/cm<sup>2</sup>; TH=0.926(0.872-1.012) vs. 1.028(0.959-1.099)g/cm<sup>2</sup>; and WB=1.072(1.003-1.108) vs. 1.129(1.074-1.180)g/cm<sup>2</sup>; p<0.001]. Body fat percentage (BF%) was similar between WNA and BNA as well as WA and BA. WNA had significantly higher BF% than WA, and BNA than BA (p<0.05). Fat-free mass was similar between WNA and BNA, but lower in BNA compared to both WA and BA [38.3(33.5-42.0)kg vs. 46.4(43.3-49.1)kg and 42.3(39.9-46.7)kg, p<0.001]. 36.4% WNA and 31.8% BNA had a Z-score between -1.0 and -2.0 at one or more BMD sites compared to 7.7% WA and 10% BA. Positive correlations were found between fat-free mass and height (r=0.7), weight (r=0.8), APS, FN, TH, and WB BMD (r=0.5 for all, p<0.05).

**CONCLUSIONS:** Exercise seemed to be the main contributing factor towards a higher BMD and a healthier body composition amongst this group of female students; ethnicity did not seem to play a role.

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**1230**    *Board #11*    **May 30**    **9:30 AM - 11:00 AM**

**Effect Of Tai Chi During Dietary Weight Loss On Body Composition In Obese, Postmenopausal Women**

Lynn A. Katkowsk, Marisa C. Benson, Steven Magnanti, Matthew J. Delmonico, Ingrid E. Lofgren, Furong Xu. *University of Rhode Island, Kingston, RI.*

(No relationships reported)

Obesity is a growing problem for the aging population. Obesity, particularly in older women, is associated with increased risk for chronic disease, disability, and loss of physical functioning. Tai Chi, a low impact form of exercise, has been shown to be effective in improving outcomes including strength and balance in older adults. However, there is no published research examining the effect of Tai Chi during dietary weight loss on body composition in obese older women.

**PURPOSE:** To examine the additive effect of Tai Chi during dietary weight loss on body composition in obese, postmenopausal women.

**METHODS:** A 16-week trial was conducted with 27 obese women randomized to a Tai Chi plus weight loss group (TCWL, n=14, age 60.4 ± 5.9 years, BMI = 34.3 ± 5.1 kg/m<sup>2</sup>) or a weight loss only group (WL, n=13, age 62.7 ± 6.0 years, BMI = 34.8 ± 2.9 kg/m<sup>2</sup>). Body mass, height, and waist circumference were assessed using standard techniques. Total body mass, fat mass, and fat free mass were assessed using dual-energy x-ray absorptiometry. Thigh tissue composition was assessed using computed tomography. Both groups received a Dietary Approaches to Stop Hypertension-based weight loss program. The TCWL group also participated in three Tai Chi exercise sessions (~45 min) per week. Between-group comparisons were analyzed using an analysis of covariance adjusting for baseline values.

**RESULTS:** Both groups significantly lost body mass (TCWL, -2.2 ± 0.9 kg; WL, -3.7 ± 0.9 kg; both p < 0.05) with no between-group differences. The TCWL group had a borderline attenuation in fat-free mass change compared to the WL group (-0.2 kg vs. -1.2 kg, p = 0.056). There were significant between group differences in thigh high density muscle (-0.54 kg vs. -1.32 kg, p = 0.0311). There were no significant between group changes in BMI, total fat mass, percent body fat, waist circumference, fat area, normal density muscle, or muscle fat.

**CONCLUSIONS:** Tai Chi appears to aid in preservation of fat free mass but does not have significant additive effect on body fat measures during dietary weight loss in older, postmenopausal women.

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**1231**    *Board #12*    **May 30**    **9:30 AM - 11:00 AM**

**Effect Of Martial Arts Exercise On Body Composition, Bone Biomarkers, And Quality Of Life In Overweight Premenopausal Women**

Ming-Chien Chyu<sup>1</sup>, Raul Y. Dagda<sup>2</sup>, Susan Doctolero<sup>2</sup>, Eugene Chaung<sup>2</sup>, Vera Von Bergen<sup>2</sup>, Yan Zhang<sup>2</sup>, Michael Ragain<sup>2</sup>, Jean-Michel Brismée<sup>2</sup>, Chwan-Li Shen<sup>2</sup>.

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(No relationships reported)

**INTRODUCTION:** Various exercise interventions have been shown to benefit weight control and promote general health, including bone health. Bone mineral density at the spine and hips as well as bone formation markers were found to be significantly associated with the level of physical activity of healthy premenopausal women. However, there is no data on the effects of martial arts exercise (MAE) on body composition, bone biomarkers, and quality of life in overweight/obese premenopausal women.

**PURPOSE:** To evaluate the effects of 12 weeks of MAE intervention on body composition, bone biomarkers and quality of life in overweight/obese premenopausal women.

**METHODS:** After screening, qualified premenopausal women were randomized into two groups: MAE (1 hr/session, 3 sessions/week for 12 weeks) or control group. Body composition (Tanita Body Composition Monitor), serum biomarkers (osteocalcin, C-terminal telopeptide, insulin-like growth factor-I, leptin, and C-reactive protein), and quality of life (SF-36) were assessed at baseline, 6, and 12 weeks. Data were analyzed using paired t-tests.

**RESULTS:** Twenty-three subjects participated in the MAE group (40.2±5.7 yr, BMI: 36.0±5.4 kg/m<sup>2</sup>) and 24 in the control group (40.6±6.9 yr, BMI: 35.8±7.1 kg/m<sup>2</sup>). Fourteen subjects dropped out (7 in MAE, 7 in control) before completing the intervention due to issues such as family, job, personal, and schedule. Compared to the control group, MAE group tended to lose body weight (P=0.09) along with decreased fat-free mass (P=0.007) and muscle mass (P=0.022). The MAE group demonstrated an increase in serum insulin-like growth factor-I concentration (P=0.045), but no change in other serum biomarkers including osteocalcin (bone formation biomarker), C-terminal telopeptide (bone resorption biomarker), leptin and C-reactive protein. The results of SF-36 revealed that subjects in the MAE group reported a significant improvement in general health, vitality, role-emotional, and mental health as compared to those in the control group.

**CONCLUSIONS:** MAE may be a feasible, low-cost, and effective approach to improve body composition and quality of life in overweight/obese premenopausal women. Our study underscores the need for further long-term studies using larger sample size to establish the benefits of MAE in this/other populations.

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**1232**    *Board #13*    **May 30**    **9:30 AM - 11:00 AM**

**Exercise Vital Sign Correlates with Diabetes Control**

Robert Sallis, FACSM<sup>1</sup>, Eunis Ngor<sup>2</sup>, Karen Coleman<sup>2</sup>. <sup>1</sup>Kaiser Permanente Medical Center, Fontana, CA. <sup>2</sup>Southern California Permanente Medical Group, Pasadena, CA.

(No relationships reported)

The Exercise is Medicine campaign calls for physicians to evaluate the exercise habits of their patients and Kaiser Permanente in Southern California (KPSC) was the first major healthcare system to begin using an exercise vital sign to record patient activity levels at every visit. Use of the "Exercise Vital Sign" (EVS) began in October of 2009, with every patient reporting the minutes per week of moderate or greater exercise they typically engage in. In addition, the role of physical activity in both the treatment and prevention of diabetes has been well established. It stands to reason that patients who report doing recommended amounts of regular exercise are likely to have improved control of their diabetes.

**PURPOSE:** To evaluate the correlation between self reported exercise level (using the EVS) and diabetes control as assessed by hemoglobin A1c (HbA1c) levels.

**METHODS:** Data were abstracted from the KPSC electronic medical records of 362,856 adults 18 years and older who had at least one HbA1c value during 4/1/2010 to 3/31/2011. Poisson regression analyses were done to determine the association of the following predictors with HbA1c values >= 7.0: age, gender, race/ethnicity, body mass index (BMI), Charlson comorbidity index, and median exercise min/wk.

**RESULTS:** Independent of all other predictors including BMI and disease burden, adults who were completely sedentary (0 min/wk) had 16% increased risk of HbA1c >= 7.0 as compared to adults who were regularly active (150 min/wk; p < .001).

**CONCLUSIONS:** Based on data from the EVS, we conclude that self reported physical activity is strongly correlated with improved diabetes control. It is well known that improved diabetes control is a major factor in reducing complications and costs associated with diabetes. For this reason, it seems logical that all diabetic patients who report they are not doing any exercise should be targeted with interventions designed to increase their weekly levels of physical activity.

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1233 Board #14 May 30 9:30 AM - 11:00 AM

**Effect Of Exercise Training On Neuromuscular Function Of Arm And Leg Muscles Of Diabetic Patients**

Massimo Sacchetti<sup>1</sup>, Ilenia Bazzucchi<sup>1</sup>, Francesco Felici<sup>1</sup>, Susan Dewhurst<sup>1</sup>, Antonio Sgadani<sup>2</sup>, Giuseppe De Vito<sup>1</sup>. <sup>1</sup>University of Rome Foro Italico, Rome, Italy. <sup>2</sup>Università Cattolica del Sacro Cuore, Rome, Italy. (Sponsor: Carl Foster, FACSM)  
(No relationships reported)

Diabetes is associated to muscle weakness and physical disability. On the other hand, exercise training has the potential of counteracting the diabetes-associated derangement of neuromuscular function.

**PURPOSE:** To investigate the effect of exercise training on neuromuscular function of arm and leg muscles in type 2 diabetic patients.

**METHODS:** Eight type 2 sedentary diabetic patients (D, 61.0±2.3) and eight sedentary healthy matched control subjects (H, 63.9±3.8) underwent a 16-week supervised combined aerobic and resistance exercise training program. Before and after training, maximal isometric (MVC) and isokinetic (15, 30, 60, 120, 180 and 240°/s) muscle strength of the elbow flexors (EF) and knee extensors (KE) were assessed to investigate the torque-velocity relationship. Simultaneously, the EMG activity from the biceps brachii (BB) and the vastus lateralis (VL) muscles was recorded by means of array electrodes, in order to estimate the muscle fibre conduction velocity (MFCV).

**RESULTS:** After the training program, no significant changes in EF maximal torque values were noted in both groups. Differently, KE maximal torque values of D were significantly enhanced (p<0.05) during the MVC (+10.8%) and during isokinetic contractions at 15, 30 and 60 °s<sup>-1</sup> (+17.1% on average). EMG data mirrored what found for torque, with an increase in MFCV in VL in D during MVC and during isokinetic contractions at 15 and 30 °s<sup>-1</sup> (+ 11.2% on average; p<0.01).

**CONCLUSIONS:** Exercise training is more effective in KE than in EF muscles of diabetic patients, as shown by the shift toward higher values of the torque-velocity relationship and the enhancement of MFCV. This is in line with the more pronounced neuromuscular impairment of the lower than the upper extremities in type 2 diabetes.

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1234 Board #15 May 30 9:30 AM - 11:00 AM

**Compliance, Safety And Utility Of Smartphone Indicators During A 52 Week Randomized Trial Of Prescriptive Exercise In Rural Patients With Metabolic Syndrome**

Robert J. Petrella, FACSM<sup>1</sup>, Melanie Stuckey<sup>1</sup>, Kristin Sabourin<sup>1</sup>, Sheree Shapiro<sup>1</sup>, Brittany Izanstadt<sup>2</sup>, John A. Petrella<sup>1</sup>, Claudio Munoz<sup>3</sup>, Robyn Fulkerson<sup>4</sup>. <sup>1</sup>U Western Ontario, London, ON, Canada. <sup>2</sup>U Waterloo, Waterloo, ON, Canada. <sup>3</sup>Gateway Rural Research Institute, Seaforth, ON, Canada. <sup>4</sup>Sykes Assistance Services, London, ON, Canada.  
(No relationships reported)

**PURPOSE:** To determine whether remote clinical monitoring technologies can provide markers of intervention compliance, safety and efficacy outside the clinic setting.

**METHODS:** In a 52 week randomized trial of lifestyle intervention to modify risk factors for metabolic syndrome (Artemis), we used a Smartphone technology- intensive monitoring system linked to a central database in an underserved rural setting. 75 participants were prescribed a lifestyle intervention and provided with Smartphones and Bluetooth-enabled blood pressure (BP) monitors, glucometers and pedometers. Smartphones transmitted pre-determined daily clinical data to a central database (Healthyanywhere™): BP twice daily; blood glucose (BG) twice daily and steps daily. A customized, proprietary decision support system (DSS) detected abnormal clinical data and life style patterns based on pre-determined clinical threshold algorithms. BP was grouped as normal, high-normal, pre-hypertensive, Stage 1, Stage 2; BG as normal, impaired glucose tolerance, diabetic; steps as sedentary, low active, somewhat active, active and highly active.

**RESULTS:** 68 participants (48 women) [56.8 (9.8)] years old completed the study and are reported 0-12, 13-24 and 25-52 weeks. No differences were observed for gender. Compliance with data transmission was high (81-94%) across all measures and did not change over time. Surprisingly, BP and BG were more compliant than daily steps transmission. Most clinical data were in the target therapeutic range over time. BP and BG highest 2 groups showed a decline (p<0.05) over the course of the study. 28-30% of patients achieved the target of 10,000 steps per day at each time point. % of patients in the sedentary, low and somewhat active groups declined with time (p<0.05).

**CONCLUSIONS:** These findings show that clinical data transmission compliance was high and few patients showed clinically relevant alerts during a 52 week lifestyle intervention. High threshold alerts decreased over time while more patients became active. Smartphone monitoring of lifestyle interventions appears to be an important tool for monitoring safety and utility of lifestyle interventions in primary care.

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1235 Board #16 May 30 9:30 AM - 11:00 AM

**The Reliability of Behavioral Modification (Diet and Physical Exercises) on Metabolic Syndrome Primary Care**

Franz H P Burini<sup>1</sup>, Okesley Teixeira<sup>2</sup>, Fernando Moreto<sup>2</sup>, Erick P. de Oliveira<sup>2</sup>, Roberto C. Burini<sup>2</sup>. <sup>1</sup>USP - PRONUT, São Paulo, Brazil. <sup>2</sup>UNESP - Univ Estadual Paulista, Medical School, Botucatu, Brazil.  
(No relationships reported)

There is no curative model for the Metabolic Syndrome (MetS), being the primary prevention, such as the combat of sedentary behavior and food-intake inadequacy (lifestyle changes) the aim of the primary care system.

**PURPOSE:** To evaluate the effects of a protocol including dietary counseling and supervised physical exercises (LSMP) on MetS components.

**METHODS:** The longitudinal study included 131 subjects (55 ± 9 yrs old, 74% female and 68.7% under 60 yrs old) from a community-based sample that fulfilled the ethical and inclusion criteria of attending the 24 weeks LSMP and to all evaluations. The LSMP included a daily (5x/wk) sessions of supervised aerobic exercises (80 min, 65-80% VO2max), weekly dietary counseling and assessments (baseline and end-study) of treadmill cardiorespiratory fitness (CRF, Balke protocol), dietary intake, anthropometry and blood chemistry. The ATP-NCEP (2003) criteria was used for the MetS diagnosis and the Statistica 6.0 software for the analyses of the data (p=0.05).

**RESULTS:** At baseline the MetS group (MSG=50.3%) differed from the non-MS (NMS) by the higher body mass index (BMI) and plasma uric acid (UA) and lower in CRF. Both groups responded to LSMP by increasing CRF, health-eating index, lowering the food-energy intake and plasma high sensitive C-Reactive Protein (CRP-hs). The 24.2% MetS reduction with LSMP were due to waist circumference (WC), blood pressure (BP) and HDL-c normalization whereas the appearance of 10.8% MS in the NMS group during the LSMP was associate with the increased levels of plasma glucose and triglycerides (TG) along with a decreased dietary-fiber intake. The predictive variables for the MetS control with LSMP were the higher increasing of HDL-c and the decreasing of BP whereas the predictive risk factors for the MetS appearance with LSMP were the increasing of BMI, plasma glucose, TG and UA, and the lower consumption of dietary fibre.

**CONCLUSIONS:** These data lead to the conclusion that the MetS treatment by LSMP is primarily due to de lower energy intake (by increasing fibre consumption) and/or lower insulin resistance (by increasing CRF). Supported by CNPq and CAPES

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1236 Board #17 May 30 9:30 AM - 11:00 AM

**Effect Of Regular Exercise Training On Cardiorespiratory Fitness In Diabetes Mellitus: Meta-analysis**

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(No relationships reported)

**PURPOSE:** Cardiorespiratory fitness is the core element of physical health, and it is not only closely related to the incidence but also directly associated with their mortality. Now there are many studies on exercise and Cardiorespiratory fitness in diabetes mellitus, but these studies had relatively small sample sizes and highly variable results. And few literature reviews focus on this. Therefore this article tries to find out the effect of regular exercise training on cardiorespiratory fitness in diabetes mellitus by using meta-analysis.

**METHODS:** Medline (1975 to Sep 2011) and SPORT Discus (1936 to Sep 2011) were searched for randomized, controlled trials evaluating effects of regular exercise interventions(not combined other intervention) of 4 weeks or more on cardiorespiratory fitness in diabetes mellitus. All satisfied trials were assessed by Jadad scales. And related data were extracted by two independent researchers. Then all the data were analyzed via software (Review Manage 5.0).

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**RESULTS:** 1) there were 26 studies searched about exercise intervention on cardiorespiratory fitness in type 2 diabetes mellitus. Regular exercise can increase the VO<sub>2</sub>max about 14.1% in type 2 diabetes mellitus (SWD=1.01SD, p<.05). In the subgroups, Compared to the parallel controlled group, mellitus's VO<sub>2</sub>max was different only in 60-79%VO<sub>2</sub>max intensity exercise group(p<.05) while not occurred in 40-59%VO<sub>2</sub>max or ≥80%VO<sub>2</sub>max intensity exercise group(p>.05). The VO<sub>2</sub>max of type 2 diabetes mellitus both increased in moderate exercise group and moderate plus resistance exercise group, and the former is more effective (p<.05); 2) there were only 4 studies satisfied the criteria in type 1 diabetes mellitus. After regular exercise, VO<sub>2</sub>max increased 8.6%, no significantly (SWD=0.33SD, p>.05).

**CONCLUSIONS:** 1) for type 2 diabetes mellitus, regular exercise is benefit for improving cardiorespiratory fitness, both moderate exercise and moderate plus resistance exercise can, and it's sure about 60-79%VO<sub>2</sub>max intensity exercise can improve the VO<sub>2</sub>max. 2) It's not sure about regular exercise can improve cardiorespiratory fitness in type 1 diabetes mellitus.

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**1237** Board #18 May 30 9:30 AM - 11:00 AM

**Additional Benefits of W-3 Oil Supplements on Metabolic Syndrome Care in Exercise Protocol Intervention**

Erick P. de Oliveira, Lidiana C. Talon, Fernando Moreto, Viviane M R Acerra, Katia C P McLellan, Roberto C. Burini. *UNESP - Univ Estadual Paulista, Medical School, Botucatu, Brazil.*

(No relationships reported)

Metabolic Syndrome (MetS) is a cluster of diseases associated with sedentary and food inadequacy. Lifestyle modification programs (LSMP) including physical activity and nutrition re-education are the aim of the primary care of MetS being the management of body adiposity and plasma lipids one of the goals. Dietary supplements of omega-3 polyunsaturated fatty acid (W-3 PUFA) have those properties.

**PURPOSE:** To compare the additional effect of dietary supplements of W-3 PUFA to a LSMP in treated MetS of free-living adults.

**METHODS:** In a prospective clinical trial, we studied 61 adults (50±13.8 years old), 85% of women, clinically screened to participate in a LSMP. The subjects were randomly assigned in two groups: LSMP (G1, n=26), including daily sessions (5x/wk) of supervised exercises of walking (3x/wk, 60-70% VO<sub>2</sub>max) and strength (2x/wk, 65-80% 1RM) along with a weekly dietary counseling. The other group (G2, n=35) also under LSMP received W-3 PUFA (3g/day). Anthropometric measurements (waist circumference, body mass index, body fat percentage), dietary intake (24-hour recall), cardiorespiratory fitness (Balke protocol in treadmill, CRF), blood pressure (BP), and plasma biomarkers for MetS were performed at baseline (M0), and after 20 weeks (M1) of intervention. For statistical analysis it was used anova-two way, adjusted for gender, age, BMI and total caloric intake, and significance when p<0.05.

**RESULTS:** After 20 weeks both groups increased the CRF, but only G2 showed significantly decrease in waist circumference (1.3%) followed by MetS reduction (29%) mainly due to the normalization of BP (33.3%) and triglycerides (27.3%).

**CONCLUSIONS:** The dietary-supplements of W-3 PUFA potentiated the MetS treatment effects of LSMP by its effects on abdominal fat and some blood markers. Supported by CNPq, CAPES and FUNDAP

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**1238** Board #19 May 30 9:30 AM - 11:00 AM

**Effect Of Exercise Training On The Inflammation Status Among People With Metabolic Syndrome.**

dorthe Stensvold, Ulrik Wisløff, Stig A. Slørdahl. *Department of Circulation and Medical Imaging, Norwegian University of Science and Technology, Trondheim, Norway.*

(No relationships reported)

Metabolic syndrome is associated with chronic low-grade inflammation, a condition thought to play a key role in the pathogenesis of the syndrome. Among a number of pro-inflammatory cytokines, interleukin 18 (IL 18) seem to be the best marker for inflammation among people with metabolic syndrome.

**PURPOSE:** The aim of the study was to examine the effect of aerobic training versus strength training on circulating IL 18 and other pro-inflammatory markers in people with metabolic syndrome.

**METHODS:** Thirty-one inactive men and women (49.8 ± 9.1 years) with metabolic syndrome were randomized to either high intensity interval training (AIT, n=11), strength training (ST, n=10), or to a control group (n=10). Exercise training was carried out 3 times per week for 12 weeks. Serum insulin, high sensitive C-reactive protein (hs-CRP), interleukin 18 (IL 18), interleukin 6 (IL 6), and tumor necrosis factor-alpha (TNF-α) were measured before and after the intervention.

**RESULTS:** Serum IL 18 was reduced by 43% after AIT (p<0.001). Although AIT had no change in TNF-α from baseline, the levels were lower compared to ST (p=0.032) and control group (p=0.039) after the intervention. Total body fat was reduced after AIT (from 33.9 ± 7.3% to 32.2 ± 7.9%, p<0.001) and ST (from 31.2 ± 3.9% to 29.7 ± 3.4%, p=0.025). There were no changes in serum IL 6, insulin, or hs-CRP within or between the groups.

**CONCLUSIONS:** Both strength training and high intensity aerobic exercise reduces fat mass, however, only the latter intervention is associated with a more favourable inflammatory status among people with metabolic syndrome.

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**1239** Board #20 May 30 9:30 AM - 11:00 AM

**Development of a Minimal Exercise Regimen With Maximal Benefits for Type 2 Diabetics**

Kathleen Broomall<sup>1</sup>, Avi Milgrom<sup>1</sup>, Dan Carl<sup>2</sup>. <sup>1</sup>Miami University, Hamilton, OH. <sup>2</sup>University of Cincinnati, Cincinnati, OH.

(No relationships reported)

**PURPOSE:** To examine the effectiveness of a novel, minimal exercise regimen based upon brief, strategically timed bouts of moderate intensity in attenuating postprandial glucose spikes as well its effectiveness in weight management over hours, days and years for type 2 diabetics. The regimen requires no exercise clothing or equipment; thus it can be readily integrated into a busy day in a "built environment" --unlike other brief-interval regimens The underlying premise, documented in the literature, is that muscle contractions can shunt blood glucose from the blood stream into muscle using interval style muscle work.

**METHODS:** Blood glucose levels were mapped over two time scales: hours and years. The short-term studies were to preliminarily explore how the exercise regimen attenuates blood glucose spikes; thus metabolic cart data was gathered in addition to blood glucose. Specifically, the short term studies mapped blood glucose curves as well as fat and carbohydrate utilization from repeated 2 minute bursts of physical activity in three scenarios: no exercise before or after eating (AUC 6095), exercise after eating but with diminished exercise frequency before the meal (AUC 5680), and normal frequency before and after the meal (AUC 1962). The long-term studies tracked daily blood glucose levels and appropriately timed HbA1C's over a 30-month period.

**RESULTS:** Short-term blood glucose attenuation was significantly more effective with the proposed exercise regimen using the third scenario. Additionally, carbohydrate utilization was significantly greater with the proposed regimen. Finally, glucose management yielded significantly improved A1C's as a clinical measure of glycemic control. Inhibition of weight regain with subsequent additive weight loss also seemed a long term trend of this regimen.

**CONCLUSIONS:** An exercise regimen of repeated brief bouts of moderate intensity executed after caloric intake can be effective in managing blood glucose and long term weight management in type 2 diabetics. Proposed research will map HbA1c values against degrees of adherence to the regimen and will identify psychological and physical factors moderating adherence. The ultimate goal is to deliver the regimen to clinicians with guidelines for the selection of viable candidates.

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**1240** Board #21 May 30 9:30 AM - 11:00 AM

**Glucose Tolerance: A Comparison Of Sitting vs. 0.5 Mph Walk On The Active Workstation**

Ronald Cox, Christina Ohlinger. *Miami University, Oxford, OH.*

(No relationships reported)

A growing body of literature suggests that striking differences in metabolic responses to nutritional challenge can be demonstrated when the postural condition of the individual is changed from sitting to standing.

**PURPOSE:**To describe the possible differences in glucose clearance, in young healthy individuals, in response to a glucose tolerance test performed under standard sitting conditions or while using an Active Workstation at very low speeds.

**METHODS:** Nine students, eight females and one male (21±1 yrs) performed a series of glucose tolerance tests. After a minimum of an 8-hour fast a baseline glucose measurement (Accu-Chek®) was obtained. Subjects then ingested 75 gm of glucose solution (TruTol®75) within a ten-minute period. In a counterbalanced manner, subjects either spent the two hours sitting or walking at 0.5 mph on an Active Workstation. During the session, a blood sample (finger stick) was obtained every 30 min for the next two hours.

**RESULTS:** Table 1 shows the means ± SD for blood glucose for each time period under the two conditions. All subjects showed a lower blood glucose curve during walking. The levels at 90 and 120 min were significantly lower ( $p < 0.05$ ) in the walking condition.

**CONCLUSIONS:**These results support the impact of even very low levels of physical activity on metabolic response to glucose ingestion compared to sitting in healthy people. In fact, walking at a speed of 0.5 mph is a near proxy for standing. This result has implications for the standardization of glucose tolerance tests and reaffirms the potentially deleterious effects of sitting while offering support for the benefits of movement in normalizing blood glucose.

| Blood Glucose Levels: Sitting vs. Walk |          |          |          |          |          |
|--|----------|----------|----------|----------|----------|
| Condition                              | Baseline | 30 min   | 60 min   | 90 min   | 120 min  |
| Sitting                                | 85 ± 8   | 149 ± 27 | 156 ± 33 | 139 ± 22 | 124 ± 15 |
| Walk 0.5 mph                           | 86 ± 9   | 132 ± 23 | 116 ± 21 | 102 ± 18 | 106 ± 19 |

**1241** Board #22 May 30 9:30 AM - 11:00 AM

### Dietary-fibre Adequacy Potentiates Physical Exercises In Metabolic Syndrome Management

Livia S. Gonçalves<sup>1</sup>, Marita S. Mecca<sup>1</sup>, Franz H P Burini<sup>2</sup>, Reinaldo C. Dalanesi<sup>1</sup>, Vanessa L. Peresi<sup>1</sup>, Roberto C. Burini<sup>1</sup>. <sup>1</sup>UNESP - Univ Estadual Paulista, Medical School, Botucatu, Brazil. <sup>2</sup>USP - PRONUT, São Paulo, Brazil.  
(No relationships reported)

Lifestyle modification focusing on dietary and exercise behaviors is the preferred first-line treatment for the management of metabolic syndrome (MetS), its components and co morbidities. However attempts to modify diet by reducing food intake are often unsuccessful due to the low compliance. Adequate-to-high fibre intake appears as an alternative for limiting energy intake in a society with high energy-dense food consumption.

**PURPOSE:** To investigate the effects of fibre intake on exercised-MetS patients in a prospective dynamic cohort study.

**METHODS:** The subjects that fulfilled all the inclusion criteria totaled 253 (mostly 35-60 years old and females). They all accomplished a protocol of lifestyle modification program (LSMP) including supervised physical exercise of walking (3 X/wk: 60-70% maximal heart rate) and strength (2 X/wk: 65-80% of one repetition maximal) along with a weekly dietary counseling. A group of 131 subjects was studied on traditional LSMP during 24 weeks (G1), another group of 72 subjects were randomized in either fibre (G2A = 25-30 g fibre/day) and non fibre (G2B) adequacy groups in a 20 weeks-lasting intervention, and the remainders 50 patients also received similar treatment of fibre intervention (G3A) or only LSMP (G3B) but in a shorter (10 weeks) experiment. The statistical analysis (paired Student's t test) were used to compare moments ( $p < 0.05$ ).

**RESULTS:** MetS varied from 40% to 50.4% (NCEP-ATP III, 2003 criteria) at the baseline and the recalled dietary fibre intake averaged  $16.0 \pm 7.1$  g/day. There was a decreasing in MetS with the LSMP alone lasting either 24 wks (-24.2%) or 20 wks (-11.5%) but not after 10 wks (+6%). These decreasing was optimized by dietary fibre interventions from 24% (G3A: 10 wks) to 36.4% (G2A: 20 wks). At the end of the experiment the increase of fibre intake varied from 7.2 g/d (G1) to 14.6 g/d (G2A) and 16.9 g/d (G3A), above the baseline values. The reduced obesity rate varied from 7% to 9% in the fibre-intervened groups.

**CONCLUSIONS:** The present data support the use of fibre adequacy as reducing factor for energy-dense food consumption and consequently body weight loss and then accelerating MetS decrease in a complementary physical exercise protocol. Supported by CNPq and FUNDAP

**1242** Board #23 May 30 9:30 AM - 11:00 AM

### The Impact Of Breaking Sitting Time On Postprandial Response To Three Separate Meal Replacement Beverages.

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(No relationships reported)

**PURPOSE:** The purpose of this study was to compare the effects of breaking continuous sitting with short regular exercise breaks or one continuous bout of exercise on postprandial serum glucose, insulin, and triglyceride responses to three meal replacement beverages.

**METHODS:** Seventy participants (Mean (SD) VO<sub>2</sub>max 42.9 (10.3) ml·kg<sup>-1</sup>·min<sup>-1</sup>, Body mass index 23.6 (4.0)) completed three 9 h interventions. During the prolonged sitting intervention (SIT), participants sat continuously for 9 h; in the exercise intervention (EX) participants sat for 15 min, walked on the treadmill for 30 min, then sat continuously for 8 h and 15 min; in the breaking sitting time intervention (BRK) participants regularly interrupted their sitting with eighteen 1 min 40 s bouts (total of 30 min) of exercise. In each intervention participants were fed a MRB at 60, 240 and 420 min. Each MRB contained 31.4 ± 6.6 g fat, 36.8 ± 7.7 g protein 76.4 ± 16.1 g CHO and 3105 ± 652 kJ energy. Blood samples were obtained at baseline and hourly for 9 h, with additional samples collected 30 and 45 min after each feeding. Postprandial area under the curve (AUC) responses were calculated in response to the three separate MRB. Comparisons between interventions were made using mixed model regression.

**RESULTS:** The triglyceride AUC in BRK was 8% (95% CI 0.5 to 16.0%  $p=0.03$ ) greater compared to SIT in response to the 2nd MRB. There were no differences between conditions in response to the 1st or 3rd MRB. The glucose AUC in BRK was 5.8% (95% CI 2.5 to 9.1%  $p=0.04$ ) less than SIT in response to the 1st MRB. These differences were maintained in response to the 2nd MRB, but were no longer apparent in response to the 3rd MRB. The insulin AUC in BRK was 11.2% (95% CI 1.8 to 20.7%  $p=0.01$ ) less than SIT in response to the 1st MRB. In response to the 2nd MRB BRK was 41.9% (95% CI 15.4 to 68.3%  $p=0.02$ ) less than SIT. The response to the 3rd MRB was similar to the 1st MRB.

**CONCLUSIONS:** Breaking sitting time reduces postprandial insulin responses throughout the day. Health promotion guidelines should promote regular physical activity breaks during periods of prolonged sitting, particular for those at risk of insulin resistance.

**1243** Board #24 May 30 9:30 AM - 11:00 AM

### Chronic Exercise Training Effects on Fatigue in Multiple Sclerosis: A Meta-Analysis

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(No relationships reported)

Fatigue is a common, disabling, and poorly managed symptom of multiple sclerosis (MS). Chronic aerobic exercise training may be an effective behavioral strategy for reducing fatigue in persons with MS.

**PURPOSE:** Provide a quantitative review of research examining the effect of exercise training on fatigue in MS.

**METHODS:** Electronic databases (Web of Science, PubMed, PsycInfo, Medline, Google Scholar, and Current Contents Plus) were searched for articles published up to September 2011 by using the key words exercise, fatigue, tiredness, energy, mood, lassitude, physical activity, rehabilitation, and fitness in conjunction with MS. Manual search of bibliographies of the retrieved papers was also done and study authors were contacted about additional studies. Thirty-five journal articles were located and reviewed, and 25 provided enough data to compute effect sizes (ES) and include in the meta-analysis. The meta-analysis was conducted with Comprehensive Meta Analysis using a random effects model and the overall ES was expressed as Hedge's  $g$ .

**RESULTS:** Twenty-five ESs were retrieved from the 25 studies with 606 MS participants and yielded a weighted mean ES of 0.55 (95% CI = 0.37, 0.78). The weighted mean ES was heterogeneous,  $Q = 50.71$ ,  $df = 24$ ,  $P = 0.001$ , supporting a search for moderator variables.

**CONCLUSIONS:** The cumulative evidence supports that exercise training is associated with a fairly sizable reduction in fatigue among persons with MS.

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1244 Board #25 May 30 9:30 AM - 11:00 AM

**The Effect Of Aerobic Exercise On The Quality Of Life Amongst HIV Positive Persons**

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(No relationships reported)

The positive effects of regular exercise on the physiological well-being of HIV positive (+) persons have been well documented. Although evidence exist for HIV+ persons to retain muscular strength and improving work-related performance through regular exercise without compromising their immune capacities, limited research has been done to assess the effect of exercise on non-physiological parameters such as pain, functional limitations and social functioning which influence overall quality of life (QoL). Aerobic exercise results in several health benefits and consequent QoL improvements in HIV negative populations. However, it is uncertain how aerobic exercise would influence the QoL (self-perceived physical and mental well-being) of HIV+ persons.

**PURPOSE:** To determine the effect of an aerobic exercise intervention on the QoL in HIV+ persons.

**METHODS:** Twenty eight HIV+ persons were randomised into two groups (aerobic intervention and control, n=14 each). The intervention group was exposed to a 12 week supervised aerobic intervention, while the control group was exposed to a supervised stretching program to limit drop-out without inducing physiological adaptation. Participants were assessed for their aerobic capacity, immunological status (CD4 and viral load) and QoL score before and after the intervention. Significance between pre- and post intervention results were set at  $p < 0.05$ .

**RESULTS:** Following the intervention, a significant improvement ( $p = 0.02$ ) in aerobic capacity were seen for the intervention group, while their CD4 counts and viral loads remained unchanged. Interestingly, both groups displayed significant improvements in their self-perceived physical and mental well-being ( $p = 0.003$  and  $p = 0.002$  for the intervention and control group respectively). Based on research in other population groups, the improved QoL in the control group is speculatively attributed to a placebo effect achieved through the personal attention received during exercise supervision.

**CONCLUSIONS:** Aerobic exercise leads to an improved aerobic capacity without compromising the immune capacities of HIV+ persons. Supervised exercise seems to improve QoL for HIV+ persons, irrespective of the type and intensity of the exercise and should therefore be promoted in the holistic disease management of HIV+ persons.

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1245 Board #26 May 30 9:30 AM - 11:00 AM

**Effects of Self-Selected and Imposed Intensity Acute Exercise on Psychological and Cortisol Responses**

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(No relationships reported)

**PURPOSE:** The primary purpose was to examine psychological responses to self-selected and imposed-intensity acute exercise in inactive women with high levels of stress. The secondary purpose was to examine potential psychobiological mechanisms (HPA-axis response and self-efficacy) for changes in psychological states.

**METHODS:** Nineteen participants (age =  $23.58 \pm 5.30$  yr) completed 3 trials of treadmill exercise at self-selected intensity, 10% above and 10% below relative self-selected intensity. Exercise duration was determined to expend 150 kcal. Affective responses and salivary cortisol were measured prior to, during, and following exercise. Self-efficacy was also measured during and post-exercise. Future exercise intention was measured post exercise.

**RESULTS:** Affect and self-efficacy improved significantly over time at all exercise intensity conditions (all variables were  $p < .005$ ). Moreover, positive engagement was higher at self-selected than imposed intensity during and post exercise ( $p < .05$ ). No significant associations were observed between affect, self-efficacy and cortisol levels. However, affect and self-efficacy did significantly predict future exercise intentions.

**CONCLUSIONS:** Acute bouts of exercise at intensities proximal to and lower than ventilatory threshold are associated with positive affective responses during and after exercise in women with high levels of stress. Self-selected intensity may be effective for eliciting more favorable experiences during and following acute bouts of exercise, and promote future intentions for exercise. Findings provide partial support for self-efficacy during exercise as a potential mechanism for positive affective responses, especially at self-selected intensity.

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1246 Board #27 May 30 9:30 AM - 11:00 AM

**Regular Exercise Attenuates Oxidative Stress in Aging Rat Liver : Apoptosis and Fibrosis Signal Pathway Toward Anti-Aging Medicine**

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(No relationships reported)

Regular exercise is known to exhibit various health benefits in reducing risks of age-related diseases such as cardiovascular diseases, type 2 diabetes and cancer. However, there is no report about the protective effects of exercise training on liver senescence.

**PURPOSE:** The purpose of this study was to investigate whether a 12-week swimming exercise training can suppress senescence-oxidative stress markers of liver tissues.

**METHODS:** Twenty-three male Sprague-Dawley rats were divided into the following four groups: (1) vehicle control (n = 6), (2) aging (n = 6), (3) swimming exercise (n = 5), and (4) aging with swimming exercise (n = 6). Rats in groups A and AS were intraperitoneal injection with D-galactose (150 mg/kg/day) for 12 weeks to induce aging. Rats in groups SE and ASE were subjected to swimming exercise for 60 min/day  $\times$  5 days/week for 12 weeks. Body weight, liver weight, epididymal fat mass, histopathological, TUNEL analysis and expressions of Cytochrome C, Bax, Bcl-2, Caspase 9, cleaved Caspase 3, cleaved PARP, MMP2 and MMP9 in liver apoptosis and fibrosis pathway are detected.

**RESULTS:** The results show that apoptosis index cleaved Caspase 3 and cleaved PARP were significantly lower in C and ASE than in A group ( $P < 0.05$ ); apoptosis protective protein Bcl-2 is significantly higher than A group ( $P < 0.05$ ). In ASE group through increasing PI3K-Akt signaling activities and inhibiting apoptosis and fibrosis pathway activities compared with aging group. be a major mechanism of anti-aging.

**CONCLUSIONS:** These results suggest that a 12-week swimming exercise may suppress apoptosis and fibrosis markers in the liver tissues of D-galactose induced aging rats. This study was supported by a research grant from the National Science Council, Taiwan (NSC99-2410-H029-059-MY2)

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1247 Board #28 May 30 9:30 AM - 11:00 AM

**Exercise Training Counterbalances Chronotropic Incompetence and Delayed Heart Rate Recovery in Systemic Lupus Erythematosus**

Fabiana Benatti, Renata Miossi, Ana Lúcia de Sá Pinto, Fernanda Lima, Eduardo Borba, Danilo Prado, Bruno Gualano, Eloísa Bonfá, Hamilton Roschel. *University of São paulo, São Paulo, Brazil.*  
(No relationships reported)

**PURPOSE:** To evaluate the efficacy of a three-month exercise training program in counteracting the chronotropic incompetence and delayed heart rate recovery in patients with systemic lupus erythematosus.

**METHODS:** A 12-wk, randomized trial was conducted. Twenty four inactive SLE patients were randomly assigned into two groups: trained (T, n=14, three-month exercise program) and non-trained (NT, n=10). A gender-, BMI-, and age-matched healthy control group (C, n=8) also underwent the exercise program. Subjects were assessed at baseline (PRE) and 12 weeks after training (POST). Main measurements included the chronotropic reserve (CR) and the heart rate recovery ( $\Delta$ HRR) as defined by the difference between HR at peak exercise and at both first ( $\Delta$ HRR1) and second ( $\Delta$ HRR2) minutes after the exercise test.

**RESULTS:** Neither the non-trained SLE (NT) patients nor the healthy control group (C) presented any change in the chronotropic reserve (NT PRE:  $72.1 \pm 11.1$ , POST:  $75.6 \pm 19.2$  %,  $p=0.96$ ; C PRE:  $93.5 \pm 4.9$ , POST:  $95.9 \pm 10.4$  %;  $p=0.99$ ) or in  $\Delta$ HRR1 (NT PRE:  $26.6 \pm 11.8$ , POST:  $26.7 \pm 10.7$ ,  $p=1.0$ ; C PRE:  $33.8 \pm 6.6$ , POST:  $38.2 \pm 10.0$ ,  $p=0.95$ ) and  $\Delta$ HRR2 (NT PRE:  $38.8 \pm 13.5$ , POST:  $39.5 \pm 15.6$ ,  $p=1.0$ ; C PRE:  $52.0 \pm 5.7$ , POST:  $53.6 \pm 7.6$ ;  $p=0.99$ ). The exercise training program was effective in promoting significant increases in chronotropic reserve (T PRE:  $79.4 \pm 13.5$ , POST:  $95.4 \pm 9.6$  %,  $p=0.003$ ) (POST T vs. NT,  $p=0.0003$ ; ES=1.15), and in  $\Delta$ HRR1 (T PRE:  $23.1 \pm 9.6$ , POST:  $41.0 \pm 10.7$ ,  $p=0.0006$ ) (POST T vs. NT,  $p=0.02$ ; ES=1.12) and  $\Delta$ HRR2 (T PRE:  $39.0 \pm 10.5$ , POST:  $57.3 \pm 12.4$ ,  $p=0.0007$ ) (POST T vs. NT,  $p=0.01$ , ES=1.11) in the SLE trained group (T) when compared with the NT group. Moreover, the heart rate response in SLE patients after training achieved parameters comparable to the healthy control subjects, as evidenced by the ANOVA and by the Z-score analysis ( $p > 0.05$ , T vs. C). SLEDAI scores remained stable throughout the study.

**CONCLUSIONS:** A 3-month exercise training program was safe and capable of reducing the chronotropic incompetence and the delayed heart rate recovery observed in physically inactive SLE patients.

Supported by Fapesp (11/08302-0)

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**1248** Board #29 May 30 9:30 AM - 11:00 AM

**Parasympathetic Tone And Its Adaptation To Aerobic Training (Fitwalking®) In HIV Patients On Anti-Retroviral Therapy**

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(No relationships reported)

Recent evidences showed that in HIV patients Highly Active Antiretroviral Therapy (HAART) and HIV per se may affect parasympathetic tone; this may increase the cardiovascular risk and contribute to HIV associated lipodystrophy. Such impairment may be reversed by a regular physical activity, which is known to increase vagal tone. **PURPOSE:** To evaluate vagal tone and its change after 3 months of aerobic training in HIV patients on HAART.

**METHODS:** 12 non-hypertensive and non-smoker patients (F/M 2/10; 47±5 yrs; 71±14 kg) with HIV infection (H) on HAART were enrolled. A group of 12 control (C) subjects (F/M 3/9; 48±12 yrs; 76±13 kg), matched for gender, age and anthropometric features, was enrolled for baseline comparisons. Heart rate variability (HRV) indexes of parasympathetic tone in time (RMSSD, pNN50) and frequency (High Frequency [HF] in absolute and normalized units [nu]) domains, and a HRV index of sympathovagal balance (LF/HF ratio) were calculated in basal condition in H and C subjects, both in supine and standing position for 5 min each, by a HR monitor. The H group was then trained by walking at 60-70% of maximal HR 3 times/week for 12 weeks, and the HRV measures were repeated thereafter. A 6-min walking test (6MWT) was executed before and after the training.

**RESULTS:** In basal condition, despite similar values in supine position between H and C subjects, HIV patients showed a lower parasympathetic tone during standing, which was significant in the linear indexes (RMSSD: H 16.7±5.1 vs C 25.3±10.5 ms [p<0.05]; pNN50: H 1.4±1.3 vs C 5.4±5.3% [p<0.05]; HF: H 180±207 vs C 196±139 ms<sup>2</sup>; HFnu: H 21.6±23.5 vs C 27.0±16.2), and a higher sympathetic activation (LF/HF: H 9.2±7.0 vs C 4.1±2.7 [p=0.04]) compared to C subjects. Fitwalking® training significantly improved the distance covered by 6MWT (from 667±50 to 802±160 m, p=0.01) and the physical work done (from 451±96 to 538±132 J, p=0.01). However, standing values of HRV indexes did not significantly change after training in H patients (RMSSD 15.2±6.6 ms, pNN50 1.1±1.7%, HF 100±93 ms<sup>2</sup>, HFnu 11.5±6.7, LF/HF 9.7±7.5; p=ns vs pre-training for all comparisons).

**CONCLUSIONS:** 12-weeks aerobic training improved cardiovascular fitness in HIV patients, but did not affect the heart parasympathetic control, which remained reduced compared to healthy subjects.

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**1249** Board #30 May 30 9:30 AM - 11:00 AM

**Oxidative Stress Biomarkers in HIV+ Sedentary Patients And Its Relation to HAART Administration Time**

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<sup>2</sup>Sao Paulo State University (UNESP), Rio Claro-SP, Brazil.

(No relationships reported)

**PURPOSE:** The goal of the present study was to analyze the antioxidant enzymes activities as well as a lipid peroxidation marker in the blood of HIV seropositive (HIV+) sedentary patients.

**METHODS:** This study assessed the effect of different Highly Active Antiretroviral Therapy (HAART) administration times on oxidative stress (OS) biomarkers of HIV+ sedentary patients. Twenty-two HIV+ subjects (Men n=11; 39.42±9.44 years old; Women n=11; 45.00±6.59 years old) were divided into 3 groups, according to the HAART administration time: from 0 to 5 years (0/5y; n=6); from 6 to 10 years (6/10y; n=7); and from 11 to 15 years (11/15y; n=9). The activity of catalase (CAT [U/mg Hbmin]), superoxide dismutase (SOD [U/mg Hbmin]) and glutathione peroxidase (GPx [U/mL]) enzymes as well as a lipid peroxidation marker (thiobarbituric acid reactant substances; TBARS [µmol/L]) were determined in the blood serum of patients by commercial kits (Cayman Chemical, Michigan, USA). The data were analyzed using Kruskal-Wallis test and Dunn *post hoc* test (p value of <0.05).

**RESULTS:** The mean values of SOD (2.67±0.41) and GPx (7.89±0.22) activities were lower in the 0/5y group when compared to 6/10y (SOD: 4.25±0.32; GPx: 9.57±0.66) and 11/15y (SOD: 5.91±0.34; GPx: 13.08±0.33) groups; if compared the 6/10y and 11/15y groups, the means values (SOD and GPx) were statistically different (11/15y > 6/10y). In relation to CAT activities and to TBARS concentrations, it were only observed significant differences when compared 0/5y (CAT: 2.39±0.36; TBARS: 4.14±0.35) and 11/15y (CAT: 4.37±0.24; TBARS: 6.08±0.44) groups. On the other hand, no differences were detected when these groups were compared to 5/6y group (CAT: 3.50±0.48; TBARS: 5.00±0.46).

**CONCLUSIONS:** The findings suggest that increased OS occurs additionally to persistent redox imbalance associated to HIV infection during apparently successfully HAART. In addition, the pro-oxidative responses seem to be related to HAART administration time. Finally, we believe that a physical exercise program would reverse, at least in part, this situation, once that regular physical exercise may protect the organism against the OS caused by the sedentarism condition. Supported by FAPEMAT (Brazilian Foundation; Process number: 512843/2009).

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**1250** Board #31 May 30 9:30 AM - 11:00 AM

**Physical Training and Detraining and the Development of Nonalcoholic Hepatic Steatosis in Rats**

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(No relationships reported)

Nonalcoholic Hepatic Steatosis (NAHS) is a disease caused by fat accumulation in the liver that can lead to organ failure and, consequently, to death. This disease has been increasing alarmingly worldwide and still little is known about the influence of physical exercise training and subsequent detraining on preventing NAHS.

**PURPOSE:** Analyzes body weight, insulin sensitivity, fat tissue accumulation and triglyceride (TG) concentration in the mesenteric adipose tissue and fat accumulation in the liver of rats submitted to physical training and subsequent detraining.

**METHODS:** Thirty weanling Wistar rats were utilized and divided into three groups: Control sedentary rats (C), Trained rats (T) submitted to physical exercise throughout the experiment, and Detrained rats (D) submitted to physical exercise for half of the experimental period and kept sedentary until the end of the study. The training protocol began when the rats were 28 days old and consisted of swimming 1hr per day, 5 days per week, at 80% of their individual anaerobic threshold (LAN), as previously determined by a lactate minimum test. The physical training lasted 16 weeks for the T group and 8 weeks for the D group.

**RESULTS:** An insulin sensitivity test was performed and 48h after this, the animals were sacrificed to analyze total weight and total amount of TG of the mesenteric adipose tissue and liver TG concentration. It was shown that physical exercise performed throughout the experiment increased the sensitivity of insulin (%removal of serum glucose/min) (C: 3.67 ± 0.61; T: 6.36 ± 3.19; D: 4.69 ± 1.20) and decreased the body weight gain (g) (C: 527.13 ± 71.39; T: 453.14 ± 57.37; D: 522.21 ± 78.15), serum insulin concentration (ng/ml) (C: 1.72 ± 0.46; T: 1.39 ± 0.34; D: 1.65 ± 0.49), mesenteric adipose total weight (g) (C: 4.56 ± 1.60; T: 3.40 ± 1.20; D: 5.27 ± 1.94) and total TG amount (mg/total tissue weight-1) (C: 54.26 ± 5.03; T: 41.03 ± 2.27; D: 59.66 ± 3.99) as well as the TG concentration in the liver (mg/100mg) (C: 12.31 ± 3.07; T: 7.82 ± 2.14; CS: 11.94 ± 4.27).

**CONCLUSIONS:** In summary, physical exercise at 80% of LAN, attenuates the disorders that trigger fat accumulation in the liver and, consequently, counteracts NAHS development. Physical exercise cessation neutralizes all the beneficial effects of the physical training.

Supported by: FAPESP (2010/12718-5).

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1251 Board #32 May 30 9:30 AM - 11:00 AM

**Efficacy Of A Multifaceted Intervention Program To Increase Physical Activity In Patients With Parkinson'S Disease; The Parkfit Trial**

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(No relationships reported)

**PURPOSE:** Many patients with Parkinson's disease (PD) lead a sedentary lifestyle. Simply informing patients about the health benefits of physical activity is insufficient to change their sedentary lifestyle. We developed and evaluated a multifaceted behavioural program (ParkFit) aiming to increase the level of physical activity undertaken by patients with PD.

**METHODS:** 586 PD patients were randomly assigned to the ParkFit Program or an active control group (ParkSafe Program). The level of physical activity was measured at baseline and at 6 months using a standardized interview-based 7-day recall (LAPAQ, primary endpoint), an ambulatory activity monitor (secondary endpoint) and an activity diary (secondary endpoint). Results were analysed according to the intention to treat concept.

**RESULTS:** 562 patients (96%) completed both baseline and 6 months assessments. In the ParkFit group, patients increased their time spent to physical activities with 7% as assessed with the LAPAQ; patients in the control group became 1% less active. The difference between both groups was not statistically significant. When we specified the nature of the activities, patients in the ParkFit group increased their 'outdoor and sports activities' (+32%), while their time spent to household activities decreased (-14%). In the control group these differences were less than 4%.

**CONCLUSIONS:** This short term outcome of the ParkFit trial suggests that patients with PD can increase their outdoor activities with a specific multifaceted program. This increase seems to be accompanied by a decrease in time spent to household activities. At the congress we will present the results of the ParkFit trial after 24 months intervention and the potential health consequences of a change in lifestyle. (Funded by ZonMw (The Netherlands Organization for Health Research and Development (75020012)); The Michael J Fox Foundation for Parkinson's research; VGZ; Glaxo Smith Kline; and National Parkinson Foundation; ClinicalTrials.gov number, NCT00748488.)

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1252 Board #33 May 30 9:30 AM - 11:00 AM

**Changes in Sedentary Time and Physical Activity of Livestrong® Cancer Survivor Program Participants**

Sarah Hilgers-Greterman<sup>1</sup>, Nicklaus Redenius<sup>1</sup>, Jeremy Frost<sup>1</sup>, John Schuna, Jr.<sup>1</sup>, Riggs Klika, FACSM<sup>2</sup>, Gary Liguori<sup>1</sup>. <sup>1</sup>North Dakota State University, Fargo, ND. <sup>2</sup>Cancer Survivor Center, Aspen, CO.

(No relationships reported)

**PURPOSE:** The purpose of this investigation was to identify changes in sedentary time (SED) and physical activity (PA) of cancer survivors enrolled in a post-treatment, 12 week, Livestrong® group exercise program.

**METHODS:** Eleven cancer survivors (1 Male and 10 Females; 51.8±9.27 yrs, BMI=26.6±4.1), representing a variety of cancer and treatment backgrounds, volunteered and wore armband activity monitors (BodyMedia® SenseWear) for seven consecutive days. Data collection occurred during the first and sixth week (midpoint) of the Livestrong® Program, and each minute of activity monitor wear time was classified as sedentary (SED), moderate (MOD), or vigorous (VIG). Minutes from MOD and VIG were then combined into a moderate-vigorous (MV) category. Linear mixed model analyses were used to compare weekly time spent in SED, MOD, VIG, and MV between weeks 1 and 6 with an adjustment for activity monitor wear time (time-varying covariate).

**RESULTS:** Across both assessment periods, participants averaged > 15 hr•day-1 of non-sleep activity monitor wear time with a weekly total of (mean ± SD) 6673.6 ± 734.8 min•week-1 (week 1 = 6853.8 ± 572.9, week 2 = 6493.4 ± 856.8). No significant differences were observed in weekly minutes (mean ± SE) from week 1 to week 6 for SED (6484.5 ± 155.6 vs. 6114.6 ± 246.3, respectively), MOD (366.5 ± 67.7 vs. 373.8 ± 51.4, respectively), MV (369.3 ± 68.6 vs. 378.7 ± 51.5, respectively) or VIG (2.7 ± 1.3 vs. 4.9 ± 1.9, respectively).

**CONCLUSIONS:** Results indicated no significant difference in weekly time spent in SED or any PA category between week 1 and week 6. Time spent in both MOD and MV was well above the 150 minutes per week CDC recommendation of PA for adults without chronic conditions. However, VIG activity averaged less than 5 minutes per week. Due to the short time span and small sample, it is difficult to evaluate the overall efficacy of the Livestrong program. However, these preliminary results are promising in that MOD PA is well above the national recommended threshold and SED time appears to be decreasing, though not significantly.

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1253 Board #34 May 30 9:30 AM - 11:00 AM

**The Effects Of Exercise Training From Different Cancer Treatments In Cancer Survivors**

City C. Hsieh<sup>1</sup>, Hsiao-Chuan Wen<sup>2</sup>, Chiuh-Chung Liu<sup>2</sup>, Chun-hong Lin<sup>2</sup>, Ling-Li Wang<sup>1</sup>. <sup>1</sup>Hsinchu University of Education, and Yuanpei University, Hsinchu, Taiwan. <sup>2</sup>Yuanpei University, Hsinchu, Taiwan.

(No relationships reported)

**PURPOSE:** The purpose of this study was to investigate the effects of exercise training on muscular fitness and quality of life in cancer survivors undergoing differing clinical treatments: surgery alone, chemotherapy following surgery, radiotherapy following surgery, or chemotherapy and radiotherapy following surgery.

**METHODS:** This study recruited four groups of female cancer survivors based on the type of clinical treatments they had received: surgery alone (S, n=10), surgery and chemotherapy (SC, n=10), surgery and radiotherapy (SR, n=10), surgery and chemotherapy and radiotherapy (SCR, n=10). The exercise sessions lasted for 60 minutes including a 10-minute warm-up, 40 minutes of aerobic exercise, resistance training, and 10 minutes cool-down, 3 days per week for 6 months. Exercise intensity ranged from 40% to 60% of heart rate reserve depending upon the participant's health status. The assessments and reassessments of muscular fitness (handgrip, peak torque of shoulder, elbow, and knee flexion and extension using Biodex S4 Pro) and quality of life were performed before and after the 6-month exercise training.

**RESULTS:** Cancer survivors in 4 groups following the 6-month exercise intervention showed significant (p < .05) improvements in shoulder flexibility (+22.6~38.0%) and extension (+26.6~35.0%), elbow flexibility (+16.7~43.0%) and extension (+20.7~35.1%), and knee flexibility (+12.2~27.5%) and extension (+8.6~33.0%). In addition, handgrip was improved significantly (p < .05) in SC (+6.3%), SR (+9.8%), and SCR (+7.7%) groups, but not in the S group. Psychologically, all 4 groups showed significant (p < .05) improvements in total (+9.6~18.8%), and in health (+13.8~21.3%), social (+7.9~20.5%), psychological (+9.3~11.3%), and family (+6.9~16.4%) quality of life. Moreover, no significant differences were observed between groups on any of the domains of muscular fitness and quality of life.

**CONCLUSIONS:** The current study suggested that moderate intensity exercise intervention is a safe and efficacious means to augment muscular fitness and improve the quality of life of cancer survivors. Moreover, the muscular fitness and quality of life of cancer survivors improved as a result of the exercise intervention in this study, regardless of the type of treatments.

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1254 Board #35 May 30 9:30 AM - 11:00 AM

**Randomized controlled trial Of Colorectal Cancer Exercise Program for Colorectal Cancer Patient After Surgery**

Ki-yong An<sup>1</sup>, Mi kyung Lee<sup>1</sup>, Dong il Kim<sup>1</sup>, Dong hyun Kim<sup>1</sup>, Ji hee Min<sup>1</sup>, Nam-kyu Kim<sup>2</sup>, Justin Y. Jeon<sup>1</sup>. <sup>1</sup>Yonsei University, Seoul, Korea, Republic of. <sup>2</sup>Yonsei University Severance Hospital, Seoul, Korea, Republic of.

(No relationships reported)

Recently, incidence of colorectal cancer is remarkably increasing in Korea.

Exercise and physical activity have positive effects in colorectal cancer patients and they are revealed in many previous studies. Specially, the patients in recovery after surgery need exercise, so many surgeons recommend to walk for patients after surgery. However, except walking, there is not detail exercise manual. Also, among many previous studies, there is no exercise intervention study has colorectal cancer patients immediately after surgery for subjects.

**PURPOSE:** The purpose of this study are to examine the effect of colorectal cancer exercise program on recovery and physiological and psychological variables in colorectal cancer inpatient after surgery.

**METHODS:** Subjects in exercise group participated supervised exercise program 1–2 times per day on colorectal patients undergoing laparoscopic surgery during hospitalization. Supervised exercise program is mainly composed of stretching, core exercise on the bed and walking. And subjects in conventional group used conventional protocol. Anthropometric measurements and fitness test assessed at pre-surgery, discharge from hospital.

**RESULTS:** The result showed that subjects in exercise group decreased hospital stay during hospitalization. Subjects between both group have no significant difference in anthropometric measurements and fitness level variation.

**CONCLUSIONS:** The finding demonstrated exercise program for colorectal cancer inpatients have a positive effect in recovery variables in colorectal cancer patients after surgery.

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1255 Board #36 May 30 9:30 AM - 11:00 AM

**Effect Of Exercise On Bone Mass Density In Women With Postmenopausal Osteoporosis: A Case-control Study**

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(No relationships reported)

Osteoporosis is a common disease with a spectrum ranging from asymptomatic bone loss to disabling hip fracture. Most guidelines suggest regular weight-bearing exercise, and combined (aerobic and resistance) training to prevent and treat osteoporosis. However, a recent review concluded that physical exercise (PE) slightly improves bone density and does not reduce the risk of having a fracture in postmenopausal women. It has been hypothesized that this paucity of effect may be due to relatively short duration of interventions, poorly standardized exercise protocols and high rate of loss to follow up.

**PURPOSE:** To assess whether a combined exercise program (2 times/week callisthenic exercises plus 3 times/week aerobic and resistance training) influenced BMD in 155 women with postmenopausal osteoporosis.

**METHODS:** Forty-seven women with either lumbar or femoral osteoporosis, exercising at the University Hospital Fitness Facility for at least one year were identified as cases (EXE). One hundred and eight sedentary controls, out from a pool of 5,434 attending the Osteoporosis Outpatient Clinic, were selected according to the following matching criteria: female gender, age  $\pm$  1.5 years, duration of the observation period  $\pm$  3 months, initial BMD value  $\pm$  5% (SED). Main outcome was percent change in BMD. Comorbidities, medications, risk factors for osteoporosis, level of physical activity, dietary intake of macronutrients as well as of Ca, K, P were recorded.

**RESULTS:** Baseline characteristics were similar between EXE and SED groups: mean ( $\pm$ s.d.) age was 64.4 $\pm$ 6.2 vs. 68.8 $\pm$ 6.4 years (n.s.), BMD at femoral neck 0.581 $\pm$ 0.067 vs. 0.598 $\pm$ 0.063 g $\cdot$ cm<sup>-2</sup> (n.s.), and BMD at lumbar spine 0.727 $\pm$ 0.067 vs. 0.732 $\pm$ 0.074 g $\cdot$ cm<sup>-2</sup> (n.s.). After an average follow-up of 36.5 $\pm$ 13.1 months, BMD was increased in the EXE group by 2.23% at the femoral neck and by 3.65% at the spine, while it was decreased in the SED group (2.59% and 0.65%, respectively) (p<0.01 at both sites).

**CONCLUSIONS:** Our results showed that sedentary postmenopausal women had a significant decline in BMD over a 3-year period, while women undergoing a combined PE program do increased their BMD both at the femoral neck and the lumbar level.

1. Howe TE et al. Exercise for preventing and treating osteoporosis in postmenopausal women. Cochrane Database Syst Rev. 2011 Jul 6;(7): CD000333

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1256 Board #37 May 30 9:30 AM - 11:00 AM

**Physical Exercise In Female Fibromyalgia Patients: Effects On Pain, Functional Capacity And Symptomatology.**

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(No relationships reported)

Exercise interventions have been extensively used for the management of fibromyalgia, but it is unclear which mode of exercise is more suitable for this population.

**PURPOSE:** To compare the effects of three different physical interventions (i.e. multidisciplinary, Biodanza and Taichi) on women with fibromyalgia.

**METHODS:** a total of 146 women (51.6 $\pm$ 7.0 years) volunteered to participate in the study and were allocated in 4 groups: control (n=34), multidisciplinary(n=41), Biodanza (n=37) and Taichi (n=34). Multidisciplinary and Taichi interventions were carried out 3 times/week and Biodanza 1 time/week over three months. The following variables were assessed before and after the interventions: tender points, functional capacity (i.e. the handgrip strength, 6 minutes walk, 8 feet up & go, chair sit and reach and chair stand tests) and the fibromyalgia impact questionnaire (FIQ). One-way analysis of covariance (group as fixed factor, change score (posttest-pretest) as dependent factor and pretest score as covariate) was performed.

**RESULTS:** The Taichi group presented greater improvements on the 8 feet up & go test than the multidisciplinary (Change score: -2.1 $\pm$ 0.2 vs. -1.1 $\pm$ 0.2, p=0.005), the Biodanza (-2.1 $\pm$ 0.2 vs. -1.1 $\pm$ 0.2, p=0.006) and the control groups (-2.1 $\pm$ 0.2 vs. -0.5 $\pm$ 0.2, p<0.001). The multidisciplinary and Taichi groups showed greater improvements than the control group on chair sit and reach test (7.4 $\pm$ 2.1 vs. -3.0 $\pm$ 2.2, p=0.005 and 9.9 $\pm$ 2.3 vs. -3.0 $\pm$ 2.2, p=0.001 respectively). The FIQ total score improved in the multidisciplinary (-8.8 $\pm$ 2.3 vs. 4.7 $\pm$ 2.3, p<0.001), the Biodanza (-12.7 $\pm$ 2.5 vs. 4.7 $\pm$ 2.3, p=0.001) and the Taichi (-7.4 $\pm$ 2.5 vs. 4.7 $\pm$ 2.3, p=0.003) groups compared with the control group. The Biodanza group presented a greater decrease on number of tender points than the Taichi group (-1.4 $\pm$ 0.4 vs. 0.1 $\pm$ 0.4, p=0.044).

**CONCLUSIONS:** The multidisciplinary, Biodanza and Taichi interventions improve the symptomatology in female patients. Taichi intervention improves the dynamic balance more than multidisciplinary and Biodanza interventions. Taichi and multidisciplinary interventions improve the lower body flexibility.

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1257 Board #38 May 30 9:30 AM - 11:00 AM

**Heavy, Explosive Strength Training For Postmenopausal Women With Osteoporosis: A Pilot Study**

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(No relationships reported)

Current exercise guidelines recommend weight-bearing activities and strength training for patients with osteoporosis. It is still unclear what type of strength training that is most beneficial for improving physical capacity and bone mass in these patients. **PURPOSE:** The present study investigated the effects of a heavy, explosive strength training programme on physical capacity, bone mineral density (BMD) and content (BMC) in postmenopausal women diagnosed with osteoporosis or osteopenia.

**METHODS:** Twentyone women with osteoporosis or osteopenia (t-score < -1.5 in hip or spine) were randomized to a training group (TG, n=10) or control group (CG, n=11). The TG underwent 12 weeks of supervised strength training in a squat machine, at an intensity of approximately five repetitions maximum, with emphasis on explosive initiation of the concentric part of movement. The CG was encouraged to do non-supervised training in line with current exercise guidelines. Measurements included one repetition maximum (1RM), rate of force development (RFD), serum markers of bone formation (procollagen type I N-terminal propeptide (P1NP)) and bone resorption (fragments of type I collagen C (CTX)), BMD, BMC and bone area measured by Dual X-ray absorptiometry. Nonparametric statistics were used. **RESULTS:** One participant was excluded in the TG and four participants withdrew (one in the TG and three in the CG). 1RM and RFD were significantly improved in the TG with 154 $\pm$ 75% and 52 $\pm$ 46%, respectively (p<0.05). BMC at the lumbar spine and femoral neck increased with 2.9 $\pm$ 2.8% and 4.9 $\pm$ 5.6%, respectively (p<0.05), while bone area increased with 2.4 $\pm$ 2.0% and 5.2 $\pm$ 5.1%, respectively (p<0.05). The 1RM and lumbar spine BMC improvements differed significantly from the CG (p<0.05). There was also a tendency to improved ratio of P1NP/CTX (21%, p=0.09) in the TG. No significant changes were observed in the CG.

**CONCLUSIONS:** Heavy, explosive strength training appears to be safe and give beneficial effects on muscle strength, RFD and BMC in postmenopausal women with osteoporosis. These findings should be further investigated in a larger trial of longer duration.



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1258 Board #39 May 30 9:30 AM - 11:00 AM

**Effective Physical Activity Energy Expenditure Feature For Maintaining Bone Mass In Postmenopausal Women**

Zheng Lu, Zhi-xiong Zhou, Xiao-hong Chen, Xun Li, Yong-Sheng Wang. *Capital University of Physical Education and Sports, Beijing, China.*  
(No relationships reported)

Growing evidence indicates that physical exercise can prevent or improve bone loss. However, the standard of the deficient exercise is lacking.

**PURPOSE:** To observe the change of energy expenditure (EE), body composition (BC), BMD and muscle strength before and after 1y exercise in postmenopausal women, to explore the relationship between the indexes and bone mass, and to determine the best EE maintaining bone mass.

**METHODS:** 62 compliant women, aged 50-60y, with BMD T-score <-1, were divided into exercise group (EG, n=32) and control (CG, n=30). EG exercised 3-4 times weekly for 1y. PA and EE were determined by accelerometer. BMD and BC were measured by DXA. Hip's muscle strength was described by isokinetic peak-torque. Exercise intensity was assessed by portable metabolic test system. Paired and independent sample T tests were used within and between groups.

**RESULTS:** 1. EG were higher than CG in walking, physical activity(PA) and total diary energy expenditure (TDEE) (all p<0.01). And difference was mainly caused by walking EE, which should be considered effective PAEE.

2. PA time of 3-6MET in EG was more than CG (P<0.01). During the exercise, mean heart rate was 117.59±9.41bpm, maximum intensity 5.70±1.97MET, exercise time 50min, and EE 312.07±94.2Kcal. Moderate intensity exercise is adequate stimulus for maintaining EG bone mass.

3. After 1y, EG decreased in weight, BMI and F% (all p<0.01), and increased in LBM% (p<0.01). For both groups, weight, BMI, F%, muscle mass and TDEE was correlated with whole body BMD (r=-0.486, 0.475, 0.434, 0.386, 0.366, all P<0.01), and LBM% was negatively associated with BMD (r=-0.481, P<0.01). The BC optimization was important feature.

4. After 1y, peak-torque values for hip flexion (90°/s, 180°/s) and extension (180°/s) in EG observably elevated (all P<0.01). BMD at main sites in EG were higher than CG (p<0.01-0.05). For EG, 1y exercise effectively increased muscle strength, which was the primary cause of maintaining bone mass.

**CONCLUSIONS:** 1. Exercise can effectively maintain bone mass by improving muscle mass and strength.

2. Exercise of 3-4 times weekly, 50 min/time, and 3-6MET's moderate intensity is suitable for postmenopausal women to maintain bone mass.

3. Lower than 680 kcal PAEE can be considered as standard of deficient exercise for postmenopausal women maintaining bone mass.

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1259 Board #40 May 30 9:30 AM - 11:00 AM

**Effects Of Exercise On Physical, Psychological, And Social Aspects Of Pain In Spinal Cord Injuries**

Carrie J. Yale, Petra B. Schuler, Ludmila Cosio Lima. *University of West Florida, Pensacola, FL.*  
(No relationships reported)

Individuals who suffer a spinal cord injury (SCI) experience pain as a secondary result of the injury. Pain can be difficult to treat as the experience is unique to each individual. If not treated effectively, pain can elevate levels of depression, anxiety, stress, and social isolation.

**PURPOSE:** To determine if exercise helps alleviate aspects of pain associated with SCI.

**METHODS:** Six subjects participated in 8 weeks of twice weekly exercise. Participants were required to complete 12 minutes of wheelchair propulsion and 50 minutes of resistance training. Resting heart rate (HR), blood pressure (BP), cardiorespiratory fitness, muscular strength, pain, depression, anxiety, stress, and perceived social support were assessed. Descriptive statistics were computed to determine changes in resting HR and BP. Subjects performed 6 minutes of arm ergometry and cardiorespiratory fitness was measured by changes in the rate of perceived exertion (RPE) and HR for the same workload. RPE and HR were taken each minute; a dependent t-test was used to determine changes in these variables. During the 12 minute bout, HR, number of completed laps, and the RPE given for each lap around the track were reported; repeated measures of analysis of variance was used to compare any change in these variables. Muscular strength was determined by the subject's one repetition maximum (1-RM). Self report questionnaires were used to measure pain, depression, anxiety, stress, and perceived social support. A dependent t-test was used to determine changes in the measures of the 1-RM and questionnaire scores. For all statistical analyses the confidence interval was set at p<0.05.

**RESULTS:** The group experienced improvement in measures of cardiorespiratory fitness as seen in a decreased resting HR (p = .043), lower RPE at the fifth and sixth minute of arm ergometry (p = .042), lower RPE between each minute of arm ergometry (p = .029), and a lower RPE observed during the 12 minutes of wheelchair propulsion (p = .010). An increase in muscular strength for the chest press (p = .047) and deltoid press (p = .03) was observed. No significant differences were observed in the measures of pain, depression, anxiety, stress, and perceived social support.

**CONCLUSIONS:** Participation in weekly exercise improves physical functioning among individuals with SCI.

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1260 Board #41 May 30 9:30 AM - 11:00 AM

**The Effect of Low Back Strengthening on Balance Performance in Patients with Lumbar Sacralization**

Yen-Ling Li<sup>1</sup>, Guo-Sheng Li<sup>1</sup>, Yu-Tsai Tu<sup>2</sup>, Wei-Han Chang<sup>3</sup>, Cheng-Hsiu Lai<sup>1</sup>, Shih-Wei Chou<sup>3</sup>. <sup>1</sup>Taipei Physical Education College, Taipei, Taiwan. <sup>2</sup>Chang Gung Memorial Hospital, Taipei, Taiwan. <sup>3</sup>Chang Gung Memorial Hospital, taipei, Taiwan. (Sponsor: Chia-Hua Kuo, FACSM)  
(No relationships reported)

Lumbosacral transitional vertebra (LSTV), commonly found between the fifth lumbar vertebra and the first sacral vertebra, of which the transverse processes fuse to different extent. The changes in spinal dynamics of LSTV may result in early disc degeneration, trunk instability and consequent low back pain (LBP). Patients with chronic LBP and lumbar degenerative disease are also characterized by an anterior sagittal imbalance. However, it is unclear whether low back strengthening exercise improve balance performance in LBP patients with LSTV.

**PURPOSE:** To investigate the low back strengthening effects in LBP patients with LSTV on balance performance.

**METHODS:** Thirty LBP patients with LSTV were recruited and divided into two group randomly assigned as Group A, the extensor-flexor group (age, 26.4 ± 11.2 years; body height, 171.9 ± 11.0 cm; body weight, 66.1 ± 13.5 kg) and group B, the flexor-extensor group (age, 26.1 ± 10.2 years; body height, 170.6 ± 8.4 cm; body weight, 66.0 ± 16.7 kg). Two session of the training program were prescribed including the extension session and the flexion session each for 3 weeks, and the order of the two training program was reversed between the two group. The results of the sensory organization test (SOT), Limits of St ability (LOS), and rhythmic weight shifting (RWS), measured by using the Smart Balance Master, lumbar ROM, measured by the microFET3, lumbar isometric strength, measured by the Cybex were compared between the two groups. LBP was evaluate by the visual analogus scale (VAS).

**RESULTS:** Irrespective to training group or modes, ROM, strength and VAS of low back were all improved significantly. Balance performance was in part improved significantly. Extensor training program seemed to be more effective than flexor training program in pain relief.

**CONCLUSIONS:** Low back strengthening for LBP patients with LSTV may improve balance performance in part. It also improves isometric strength, ROM and pain scale of low back. The extensor training session may outweigh flexor training session in pain relief for patients with LSTV.

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1261 Board #42 May 30 9:30 AM - 11:00 AM

**Low Back Strengthening effects on Quadriceps Strength in Lumbago Patient with Lumbar Sacralization**

Yi-chen Lin<sup>1</sup>, Chi-Ping Lai<sup>1</sup>, Yu-Tsai Tu<sup>2</sup>, Yin-Chou Lin<sup>2</sup>, Cheng-Hsiu Lai<sup>1</sup>, Shih-Wei Chou<sup>2</sup>. <sup>1</sup>Taipei Physical Education College, Taipei, Taiwan. <sup>2</sup>Chang Gung Memorial Hospital, Taipei, Taiwan. (Sponsor: Chia-Hua Kuo, FACSM)  
(No relationships reported)

Lumbosacral transitional vertebra (LSTV), commonly found between the fifth lumbar vertebra and the first sacral vertebra, of which the transverse processes fuse to different extent. The changes in spinal dynamics of LSTV may result in early disc degeneration, trunk instability, and consequent low back pain (LBP). The patients with chronic LBP tend to show increased inhibition of quadriceps activity. However, it is unclear whether low back strengthening exercise improve the quadriceps strength in LBP patients with LSTV.

**PURPOSE:** To investigate the low back strengthening effects of the LBP patients with LSTV on quadriceps isokinetic strength.

**METHODS:** Thirty LBP patients with LSTV were recruited and divided into two groups randomly assigned as Group A, the extensor-flexor group (age, 26.4 ± 11.2 years; body height, 171.9 ± 11.0 cm; body weight, 66.1 ± 13.5 kg) and group B, the flexor-extensor group (age, 26.1 ± 10.2 years; body height, 170.6 ± 8.4 cm; body weight, 66.0 ± 16.7 kg). Two sessions of the training program were prescribed including the extension session and the flexion session each for 3 weeks, and the order of the two training program was reversed between the two group. The isokinetic strength of the knee extensor, measured by the Cybex, were compared between the two groups. Pain of low back and knee were evaluate by the visual analogous scale (VAS).

**RESULTS:** Quadriceps strengths were significantly improved in all 3 angular velocities of both right and left legs, particularly after extensor training. Low back extensor training was more efficient than flexor in pain control of the knee pain.

**CONCLUSIONS:** Low back strengthening training for LBP patients with lumbar sacralization may improve quadriceps isokinetic strength and low back/knee pain scale, particularly after extensor strengthening.

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**1262** Board #43 May 30 9:30 AM - 11:00 AM

**Low Normalized Leg Strength in Obesity Predicts Habitual Physical Activity and Endurance in Knee Osteoarthritis**

Kevin R. Vincent, Cindy Montero, Amanda Seay, Heather K. Vincent. *University of Florida, Gainesville, FL.*

(No relationships reported)

Adults with knee osteoarthritis (OA) face multiple challenges with beginning exercise or participating in regular daily physical activity, especially if they are obese. It is unclear how normalized muscle strength relates to endurance time or habitual physical activity.

**PURPOSE:** To determine the associations between muscle strength, endurance time and habitual physical activity in obese and non-obese persons with knee OA.

**METHODS:** Participants with knee OA (68±7 yrs) who sought participation in an exercise program were stratified into obese (n=20; body mass index [BMI] 34±4 kg/m<sup>2</sup>, 49±9% body fat) and non-obese (n=20; BMI 25±3 kg/m<sup>2</sup>, 34±10% body fat). Maximal strength testing of the knee extensors and flexors, and maximal walking endurance tests were performed. Body fat was determined using the BODPOD. The Western Ontario McMaster Osteoarthritis (WOMAC) Index survey was administered to assess knee function with OA pain. Activity monitors were worn for 7 days to record daily activity. Regression analysis determined the contributions of normalized leg strength scores on treadmill endurance time, and average daily steps.

**RESULTS:** Walking endurance time was 31% lower in the obese group (p<0.0001). Average WOMAC knee pain was similar between groups (5.2-5.5 points). Average daily steps taken were 3246±1131 and 4248±1365 steps, in the obese and non-obese groups, respectively (p<0.005). The time spent performing moderate daily activity was 30 minutes less in the obese group (p=0.05). WOMAC scores were not different between groups (33.2 vs 28.8 points). Maximal normalized leg press, leg curl and leg extension strength values were less in the obese group (p<0.05). After accounting for age and sex, normalized leg strength values were contributors to the variance of the models predicting walking endurance time (model R<sup>2</sup>=0.514-0.561, R<sup>2</sup> change range 0.218-0.265) and in habitual physical activity (R<sup>2</sup>=0.198-0.230, change range 0.104-0.136; all p<.001).

**CONCLUSIONS:** Walking endurance and habitual physical activity were consistently predicted by leg strength in knee OA. Targeted resistance exercise may improve muscle strength and foster improvements in endurance and increased habitual physical activity in obese individuals, both of which would facilitate weight loss. Supported by NIH NIAMS RO3AR059786

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**1263** Board #44 May 30 9:30 AM - 11:00 AM

**Efficacy And Effectiveness Of Exercise On Tender Points In Adults With Fibromyalgia: A Meta-analysis**

George A. Kelley, FACSM, Kristi S. Kelley. *West Virginia University, Morgantown, WV.*

(No relationships reported)

**PURPOSE:** Fibromyalgia is a major public health problem affecting an estimated 200 to 400 million people worldwide. The purpose of this study was to determine the efficacy and effectiveness of randomized controlled exercise intervention trials (aerobic, strength training or both) on tender points (TP) in adults with fibromyalgia.

**METHODS:** Meta-analysis using random effects models and 95% confidence intervals (CI) with results partitioned according to per-protocol and intention-to-treat analyses.

**RESULTS:** Statistically significant reductions in TP were observed based on per-protocol analyses (8 studies representing 322 participants) but not intention-to-treat analyses (5 studies representing 338 participants) (per-protocol, g, -0.68, 95% CI, -1.16, -0.20; intention-to-treat, g, -0.24, 95% CI, -0.62, 0.15). Changes were equivalent to relative reductions of 10.9% and 6.9%, respectively, for per-protocol and intention-to-treat analyses.

**CONCLUSIONS:** Exercise is efficacious for reducing TP in women with FM. However, a need exists for additional well-designed and reported studies on this topic.

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**1264** Board #45 May 30 9:30 AM - 11:00 AM

**Case review for 12 Weeks Of High-intensity Interval Training (HIT) in a Spinal Cord Injured Man**

Christopher R. Harnish, Jonathan A. Daniels, Allison F. Keeley, David R. Gater. Hunter Holmes McGuire VAMC, *Richmond, VA.* (Sponsor: Edmond Acevedo, FACSM)

(No relationships reported)

Exercise may play an important role in managing the metabolic health consequences of SCI but little is known about the impact of arm crank ergometer (ACE) HIT or how to adapt it for individuals with SCI.

**PURPOSE:** To review the outcome of 12 weeks of periodized HIT in a man with chronic traumatic SCI.

**METHODS:** One 42 yo man (180 cm tall, 68.4 kg and 30.6% Fat) with C8/T1 AIS A SCI took part in 12 weeks of 3 days/week-1 ACE interval training. A continuous 2 min stage VO<sub>2</sub>Peak test was completed before, 6 and 13 weeks after training. During the first training session and at week 4, 8 and 12 a 30 min time trial (TT30) test was performed on a Monark 881E ACE to assess performance improvement; heart rate (HR) and mean power (W) were determined. Training was conducted on a LODE ACE and consisted of a combination of HIT that included three times 5 min at ~70% Peak Power (WPeak) and 5 min recovery (HIT5); four times 2.5 min at ~85% WPeak and 5 min recovery (HIT2.5); ten times 1 min at ~110% WPeak and 2 min recovery (HIT1). HR zones were set as <75% HRPeak (Z1), 75-89% (Z2), and 90+% (Z3) and HR was measured and stored for all training. HR training impulse (TRIMP) scores were calculated as: Z1 minutes + (Z2 minutes \* 2) + (Z3 minutes \* 3) and used to monitor overall training efficacy. DXA was used to estimate body fat pre and post training.

**RESULTS:** 35 sessions that included 8 HIT5, 10 HIT2.5, and 5 HIT1 sessions were completed. WPeak and VO<sub>2</sub>Peak improved about 45% and 52%, respectively, by week 6 without further improvement at week 12. TT30 wattage improved 32% at week 4, 47% at week 8, and 56% at week 12. HR TRIMP scores decreased in the first 6 weeks as mean session wattage increased before showing a parallel increase for the remaining 6 weeks.

**CONCLUSIONS:** Persons with SCI exhibit widely varying exercise responses, regardless of level of injury. This case report demonstrates that even high-level paraplegics can achieve exceptional training outcomes and that ACE HIT may provide an effective training method for SCI. As with able-bodied persons, maximal performance plateau early, while submaximal performance may show longer term improvement. The latter supports the use of submaximal training assessment important in the long-term training monitoring for SCI. HR TRIMP data provides a useful means for monitoring and periodizing training in paraplegia with a normal HR response.

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**1265** Board #46 May 30 9:30 AM - 11:00 AM

**Comparative Study Of The Effects Of Tai Chi And Strength Training On Osteoarthritis In Older Adults**

Abhinandan Batra, Yong Tai Wang, FACSM, Elisabeth Burgess, Ann Pearman. *Georgia State University, Atlanta, GA.*

(No relationships reported)

**PURPOSE:** Osteoarthritis (OA) is a degenerative joint disorder and one of the leading causes of disability in elderly. Tai Chi is seen to be effective in relieving symptoms of OA knee joint. The main aim of this study was to design a Tai Chi program and/or a strength training program for the older adults with knee OA and to compare the effects of these programs on the range of motion, gait, pain and balance.

**METHODS:** Twenty participants age 55 and over were divided into two groups (Tai Chi and Strength training) based on predetermined criteria (Age, Grade of OA, balance). Both groups received respective form of exercises twice a week for 2 months. Both groups were assessed before and after intervention on WOMAC, Berg balance scale, ROM and Manual muscle testing Independent and paired t test were employed to determine the differences within each group and between two groups with significance level at  $p < .05$ .

**RESULTS:** Mean ages of the participants in both strength training and Tai Chi group were  $82.8 \pm 10.6$  years and  $82 \pm 11.35$  years respectively. Both the groups showed statistical significant improvement in WOMAC scores and balance. WOMAC score decreased for strength training group (52 to 40.5) and Tai Chi group (52.28 to 38.57). Balance score on the Berg balance scale improved for strength training group (36.75 to 46 at  $p < .05$ ) and Tai Chi group (39.14 to 47.42 at  $p < .001$ ). Significant increase in strength of lower limb muscle was seen in strength training group with no change in Tai Chi group. Though significant changes were seen within the group analysis, no such difference was found on comparing strength group to Tai Chi group.

**CONCLUSIONS:** Both groups demonstrated improvement in symptoms related to OA showing that both forms of exercise are effective and safe in improving symptoms related to OA but no evidence was found depicting Tai Chi to be better form of exercise than strength training.

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**1266**    *Board #47*    **May 30**    **9:30 AM - 11:00 AM**  
**Physical Activity, Sedentary Time, and Bone Health In Younger And Older Females**

Saori Ishikawa, Youngdeok Kim, Minsoo Kang, FACSM, Don Morgan, FACSM. *Middle Tennessee State University, Murfreesboro, TN.*  
(No relationships reported)

Recent studies have focused on the contribution of physical activity (PA) and sedentary behavior (SB) on metabolism and cardiovascular health in adults. Little is known, however, regarding the extent to which PA and SB impact bone mineral content (BMC) and bone mineral density (BMD) in females across the lifespan.

**PURPOSE:** To examine the impact of PA and SB on bone health in females from adolescence to old age.

**METHODS:** Data from 2,245 females aged 12 years and older collected as part of the 2007-2008 National Health and Nutrition Examination Survey (NHANES) were included in this analysis. Based on self-report, participants were categorized into three PA categories: sufficient moderate-to-vigorous recreational physical activity (S-MVRPA), insufficient MVRPA (I-MVRPA), and no MVRPA (N-MVRPA). S-MVRPA was defined as  $\geq 150$  minutes per week of moderate recreational PA (RPA) or an equivalent amount of vigorous RPA for adults ( $\geq 19$  years of age) or  $\geq 60$  minutes per day of MVRPA for adolescents (12 to 18 years of age). Values of BMC (g) and BMD (g/cm<sup>2</sup>) of total femur and total spine were measured by dual energy x-ray absorptiometry. Categories of PA and self-reported minutes of SB (i.e., sitting or reclining time, excluding sleeping) were used to predict BMC and BMD of the femoral and spinal regions in four age groups [i.e., adolescents (12-18 years), young adults (19-39 years), middle-aged adults (40-64 years), and older adults (>64 years)] after controlling for nutritional intake and body mass index (BMI). SAS 9.2 SURVEYREG procedures with ESTIMATE statement were used to account for the multistage and complex nature of the NHANES sampling scheme.

**RESULTS:** Female adolescents in the S-MVRPA category displayed significantly greater femoral BMC, femoral BMD, spinal BMC, and spinal BMD compared to those in N-MVRPA category ( $b = 3.01, 0.07, 4.72, \text{ and } 0.04$ , respectively,  $p < .05$ ). In older adults, SB was also a significant predictor of femoral BMC and BMD ( $b = -0.004$  and  $-0.0001$ , respectively,  $p < .05$ ), such that an increase in SB resulted in lower femoral BMC and BMD.

**CONCLUSIONS:** These findings suggest that engaging in S-MVRPA during adolescence and reducing sedentary time in the elderly may contribute to improved bone health in females.

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**1267**    *Board #48*    **May 30**    **9:30 AM - 11:00 AM**  
**Pilates is More Effective than Common Exercise Program for Treatment of Forward Head Posture**

Sun-Myong Lee, Chang-Hyung Lee, Jung Jun Park. *Pusan National University, Busan, Korea, Republic of.*  
(No relationships reported)

**BACKGROUND:** Forward head posture (FHP) is defined as the anterior positioning of the cervical spine, which is one of the most common postural problems in modern society. Recently, Pilates has been reported to be effective exercise for correcting postural problems.

**PURPOSE:** To compare the effects of Pilates and common exercise program on improvements in craniocervical angle (CVA), cervical range of motion (cROM), pain, and muscle fatigue in FHP

**METHODS:** Twenty eight sedentary women with FHP, aged between 20 and 39, participated in this study. They were randomly divided into two groups; Pilates exercise group (PG,  $n = 14$ ) and common exercise group (CG,  $n = 14$ ). Pilates exercise program consisted of modern Pilates focused on FHP-related major muscle group. Common exercise program consisted of stretching and resistance exercise on the same muscle group as Pilates exercise program. Both group performed exercise 50 min/day, 3 days/week, intensity of 11-15 RPE for 10 weeks. CVA, indicating FHP degree, was measured by X-ray. cROM, representing cervical function, was measured by CROM device. Pain levels were assessed by visual analog scale (VAS) and neck disability index (NDI). Muscle fatigue was measured by surface electromyogram (sEMG) at median frequency. Statistical significance was  $p < .05$ .

**RESULTS:** PG significantly increased CVA ( $65.65 \pm 4.53^\circ$  vs.  $70.09 \pm 4.78^\circ$ ,  $p = .002$ ), but CG did not. PG also significantly increased 5 of 6 cROM items: flexion ( $35.11 \pm 6.39^\circ$  vs.  $46.64 \pm 8.83^\circ$ ,  $p = .004$ ), extension ( $50.14 \pm 11.76^\circ$  vs.  $57.05 \pm 9.3^\circ$ ,  $p = .037$ ), R. sideflexion ( $29.58 \pm 3.12^\circ$  vs.  $34.00 \pm 3.78^\circ$ ,  $p = .006$ ), R. rotation ( $51.5 \pm 10.63^\circ$  vs.  $57.81 \pm 5.81^\circ$ ,  $p = .045$ ), L. rotation ( $52.06 \pm 10.1^\circ$  vs.  $57.17 \pm 6.65^\circ$ ,  $p = .033$ ). However, CG did not change in CVA and cROM items. Among sEMG factors, only SCM was significantly increased in PG ( $27.27 \pm 11.26$  Hz vs.  $43.51 \pm 17.29$  Hz,  $p = .009$ ), but not in CG. VAS and NDI were significantly decreased in both groups.

**CONCLUSIONS:** These results indicate that Pilates is more effective to improve CVA, cROM, and, in part, muscle fatigue than common exercise (a combination of stretching and resistance exercise). It suggests that Pilates can be recommended as an appropriate exercise for FHP treatment, and may be extended for other patients with neuromusculoskeletal problems.

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**1268**    *Board #49*    **May 30**    **9:30 AM - 11:00 AM**  
**Low Trunk Strengthening Effects on Patellofemoral Pain Syndrome**

Chiping Lai<sup>1</sup>, Guosheng Li<sup>1</sup>, Chingya Hung<sup>1</sup>, Joupin Li<sup>1</sup>, Chengshiu Lai<sup>1</sup>, Shihwei Chou<sup>2</sup>. <sup>1</sup>Taipei Physical Education College, Taipei, Taiwan. <sup>2</sup>Chang Gung Memorial Hospital, Taoyuan, Taiwan. (Sponsor: Chia-Hua Kuo, FACSM)  
(No relationships reported)

Patellofemoral pain syndrome (PFPS) is a common knee problem. Quadriceps strengthening has been suggested to treat patients with PFPS. The quadriceps muscle was inhibited after lumbar paraspinous fatiguing exercise in the absence of quadriceps fatigue.

**PURPOSE:** To investigate low back strengthening effects on the patients with PFPS in terms of (1) low trunk isometric strength, (2) quadriceps isokinetic strength, and (3) knee pain scale.

**METHODS:** Eighteen knees of sixteen patients with PFPS were randomly divided into two groups, group A (extensor-flexor, 9 knees of 8 patients) and group B (flexor-extensor, 9 knees of 8 patients). In the 1st 3-week session of training group A started low trunk extensors strengthening and group B did flexor and in the 2nd 3-week session, the training programs were shifted between groups. The visual analog scale (VAS) was used to scale knee pain. Cybex NORM was used to measure isometric strength of low back flexor, extensor and isokinetic strength of quadriceps at 60°/sec, 120°/sec and 180°/sec. Two-way ANOVA with repeated measures in the 1st session tested the significance of main and interaction effects between training group factor and pre-post training factor. The training effects in the 2nd session were analyzed by prescription.

**RESULTS:** After the 1st session of training, interaction effects were significant ( $p < .05$ ), indicating extensor training significantly increase low trunk extensor strength and vice versa. No interaction effects occur in isokinetic strength of the quadriceps between two groups at all three angular velocities. The VAS of knee pain appeared to be improved more in group A than B (51.83% vs. 36.07%). After the 2nd session, group B increased low trunk extensor strength and group A increased flexor strength. Isokinetic strength of the quadriceps in group B was improved more than group A at all three angular velocities. Extent of knee pain relief in group B seemed to be more than group A.

**CONCLUSIONS:** Low trunk strengthening training increases specific strength of either extensor or flexor muscles. However, extensor strengthening seemed to be more effective in patellofemoral pain relief and quadriceps strength enhancement.

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## A-30 Free Communication/Poster - Children and Exercise I

MAY 30, 2012 7:30 AM - 12:30 PM  
ROOM: Exhibit Hall

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**1269** Board #50 MAY 30 11:00 AM - 12:30 PM  
**Odds Ratios and Sex Differences in Staying in at-Risk Fitness Categories among Middle School Children**

Traci D. Zillifro, Wenhao Liu, Randall A. Nichols. *Slippery Rock University, Slippery Rock, PA.*  
(No relationships reported)

Fitness tracking statistics such as Pearson or Spearman rank correlations, kappa values, and percentage agreements in percentiles provide little guidance for intervention for adolescents because they just describe the stability of relative rank/position and fail to address the overall change in test scores relative to Fitnessgram Healthy Fitness Zone (HFZ). Fitness tracking studies providing more meaningful information are needed.

**PURPOSE:** To examine odds ratios and sex differences in staying in the at-risk groups among middle school children across a 31-month period.

**METHODS:** Fitnessgram battery was administered to 87 boys (mean age = 11.55 ± .54) and 107 girls (mean age = 11.34 ± .48) at baseline and a follow-up with a 31-month interval to assess percent body fat (%BF), BMI, Progressive Aerobic Cardiovascular Endurance Run (PACER), curl-up, push-up, and sit and reach. Based on sex- and age-specific criteria for Fitnessgram hfz, the participants were categorized into an at-risk group (not in HFZ) and a HFZ group (in HFZ) at the baseline and the follow-up for each fitness measure. Odds ratios and sex differences in staying in the at-risk groups across the 31-month period was examined with crosstabs.

**RESULTS:** Odds ratios of staying in the at-risk groups at the follow-up in fitness measures ranged from 2.6 (95% CI: 1.3-5.1) to 20.4 (95% CI: 7.7-84.7) for those initially in the at-risk groups relative to those who were in the HFZ groups at baseline. Across the 31 months the numbers or percentages of boys in the at-risk groups decreased in %BF (23 vs. 19, -17%), BMI (28 vs. 24, -14.3%), PACER (39 vs. 31, -20.5%), and curl-up (12 vs. 9, -25%); and remained no change in push-up (31 vs. 31, 0%) and sit and reach (15 vs. 15, 0%). In a sharp contrast with boys, the numbers of girls in the at-risk groups increased in %BF (18 vs. 23, +27%), BMI (29 vs. 35, +20.7%), PACER (24 vs. 39, +62.5%), and push-up (38 vs. 51, +34.2%); and decreased in curl-up (24 vs. 11, -54.2%) and sit and reach (47 vs. 29, -38.3%).

**CONCLUSIONS:** Children of roughly 11 years old who are at risk in fitness levels are much more likely to be in the at-risk groups later relative to those who are in the HFZ groups at baseline. In addition, during the middle school period more girls tend to become at risk in fitness levels, whereas numbers of boys in the at-risk groups tend to decrease.

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**1270** Board #51 MAY 30 11:00 AM - 12:30 PM  
**Construction of Delayed Menarche Evaluation in Korean Female Athletes**

Katsunori Fujii, FACSM. *Aichi Institute of Technology, Toyota, Japan.*  
(No relationships reported)

**PURPOSE:** In the present study we conducted a regression analysis of age at menarche against age at maximum peak velocity (MPV) of height in non-athlete Korean girls (control group), and composed 1st to 3rd order regression polynomials to obtain the best regression polynomial. Author then applied the age at menarche and age at MPV of height of athletes to the best polynomial regression evaluation, and investigated the validity of a delayed menarche evaluation system that we constructed.

**Method:** The subjects were 150 second grade female students at a physical education high school in the suburbs of Pusan, South Korea. A questionnaire survey of these girls was conducted, from which their date of birth, age at menarche, and athletic activities in elementary, junior high school, and high school were obtained. In addition, health check records were examined retrospectively, and longitudinal growth data for height were obtained from the 1st grade of elementary school (7 years old) until the second year of high school (17 years old). One hundred twenty-four girls for whom all data were available were selected. Next, the same survey as above was also done for second grade students at a general high school in the same area, as a control group. Three hundred forty-five non-athletes for whom all data were available were selected. In the analysis, first the wavelet interpolation method was applied to the longitudinal height growth data for the athlete and control groups, and age at MPV was determined from the velocity curve.

**RESULTS:** The third order polynomial was found to be most suitable for the regression polynomial. When it was applied to individual female Korean athletes with respect to the regression evaluation, positive scores were obtained for nearly all athletes and an overall delay in menarche was seen. Delayed menarche was not seen, however, in archery athletes. A strong delay in menarche was thus found in Korean athletes.

**CONCLUSION:** it was found that 80% had moderate or greater menstrual pain and a close relation with menstrual abnormalities, suggesting that delayed menarche may be a barometer for menstrual abnormalities. The demonstration of delayed menarche in Korean female athletes from the above suggests the validity of the delayed menarche evaluation.

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**1271** Board #52 MAY 30 11:00 AM - 12:30 PM  
**Cardiovascular Fitness and Bone Health of Adolescent Girls According to Age of Menarche**

Rebecca A. Battista, Lanay M. Mudd. *Appalachian State University, Boone, NC.* (Sponsor: Alan Utter, FACSM)  
(No relationships reported)

The teenage years are one of the most critical stages of bone mineral acquisition. Maturation may also be related to changes in cardiovascular fitness. However, little is known about the relations among menarcheal status, cardiovascular fitness and bone health during this timeframe.

**PURPOSE:** The purpose of this study was to determine relations among menarcheal status and cardiovascular fitness, bone mineral content (BMC) and bone mineral density (BMD) among teenage girls in the National Health and Nutrition Examination Survey (NHANES) 1999-2004.

**METHODS:** Participants included girls with complete dual-energy X-ray absorptiometry (DEXA) measures aged 12 to 18 years who had experienced menarche (N = 1458). Menarcheal status was defined as: early maturers (EM) with menarche < 12 years; average maturers (AM) with menarche 12-14 years (referent); and late maturers (LM) with menarche > 14 years. Self-reported demographics and physical activity (PA), measured height and weight (body mass index calculated), predicted VO<sub>2</sub>max from a cycle ergometer test, and BMC, BMD, and percent fat from a DEXA were obtained. SAS v9.2 used weighted analyses to account for the complex sampling frame of NHANES. Linear regression analyses were used to assess relations among menarcheal status, VO<sub>2</sub>max, BMC, and BMD.

**RESULTS:** EM were significantly (p<0.05) younger (mean ± standard error: 14.7±0.1, 15.4±0.1, 16.6±0.1 years), taller (160.7±0.4, 161.9±0.3, and 163.4±0.5 cm), and larger (24.1±0.4, 23.1±0.3, 22.1±0.5 kg/m<sup>2</sup>; 34.3±0.4, 33.2±0.5, 31.8±0.6 %fat) compared to the AM and LM, respectively. Menarcheal status was not related to VO<sub>2</sub>max in unadjusted or adjusted analyses. After adjustment for age, race and total minutes of PA, EM was significantly related to a higher mean BMC (beta estimate ± standard error: 51.8 ± 24.3 g, p<0.05) and tended to be related to slightly higher BMD (0.015 ± 0.007 g/cm<sup>2</sup>, p=0.054) compared to AM. LM was not related to any changes in BMC or BMD compared to AM.

**CONCLUSIONS:** EM have a larger body size than AM and LM, and slightly higher BMC and BMD. However, despite their larger body size, fitness levels are similar. Additional research is needed to determine if menarcheal status is related to cardiovascular fitness and bone health later in life.

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**1272** Board #53 MAY 30 11:00 AM - 12:30 PM  
**Longitudinal Relationships Between Health-related Physical Fitness Test Item Performances In Elementary-aged Children**

Loran D. Erdmann, Cathy S. McMillan. *Western Illinois University, Macomb, IL.* (Sponsor: Michael P. Godard, FACSM)  
(No relationships reported)

Longitudinal study of health-related physical fitness (HRPF) in children is limited.

**PURPOSE:** To longitudinally examine relationships between HRPF tests in young children.

**METHODS:** HRRPF test data were collected annually from one school district, over an 18-yr period, and included: 1-mile run/walk (MR, in elapsed time); double-leg sit-and-reach (SR); pronated-grip pull-up (PU); and 1-min sit-up (SU). Data were retained from 167 boys and 165 girls who were (a) baseline tested as 5- or 6-yr-old kindergartners, (b) subsequently tested in each of grades 1, 2, 3, 4, and 5; and (c) had complete data at all grades. Pearson's *r* correlations were used to examine relations of MR to SR and SU performances, as well as relations of SR to SU performances. Spearman's *rho* correlations were used to examine relations of PU to MR, SR, and SU performances, as PU data were nonparametric. All analyses were sex-and-grade specific. *P* values < .05\*, .01\*\*, and .001\*\*\* are reported.

**RESULTS:** Correlations between HRRPF test items at grades K, 1, 2, 3, 4, and 5 respectively are as follows: MR/SR: Boys: -.03, -.08, -.13, -.19\*, -.08, -.13; Girls: -.09, .05, -.24\*\*, -.19\*, -.33\*\*\*, -.12; MR/SU: Boys: -.37\*\*\*, -.29\*\*\*, -.29\*\*\*, -.27\*\*\*, -.36\*\*\*, -.43\*\*\*; Girls: -.42\*\*\*, -.29\*\*\*, -.41\*\*\*, -.38\*\*\*, -.45\*\*\*, -.52\*\*\*; SR/SU: Boys: .08, .18\*, .13, .19\*, .30\*\*\*, .19\*; Girls: -.01, .20\*\*, .20\*\*, .15, .26\*\*, .29\*\*\*; Boys: PU/MR: -.28\*\*\*, -.34\*\*\*, -.44\*\*\*, -.29\*\*\*, -.40\*\*\*, -.53\*\*\*; Girls: -.25\*\*, -.28\*\*\*, -.26\*\*, -.27\*\*, -.42\*\*\*, -.39\*\*\*; PU/SR: Boys: .20\*, .21\*\*, .20\*, .11, .17\*, .14; Girls: .26\*\*, .02, .16\*, .21\*\*, .21\*\*, .06; PU/SU: Boys: .30\*\*\*, .38\*\*\*, .31\*\*, .43\*\*\*, .32\*\*\*, .41\*\*\*; Girls: .20\*\*, .27\*\*\*, .49\*\*\*, .35\*\*\*, .34\*\*\*, .32\*\*\*.

**CONCLUSION:** For boys and girls across the elementary grades, there are weak to moderate significant inverse relations of MR times to both SU and PU performances and weak to moderate positive relations of PU to SU performances. Although SR performance is significantly related to other HRRPF test performances at some grades for both genders, the strength of these relations is only very weak to weak. For these HRRPF test item pairs, generally the relational direction remains consistent and the relational strength changes little as young children progress through elementary school.

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1273 Board #54 MAY 30 11:00 AM - 12:30 PM

### Physical Self-Perception and Physical Fitness in Adolescents With and Without Autism Spectrum Disorders

Chien-Yu Pan<sup>1</sup>, Chia-Hua Chu<sup>1</sup>, Chia-Liang Tsai<sup>2</sup>, Kai-Wen Hsieh<sup>1</sup>, Ya-Lin Li<sup>1</sup>, Shih-Tse Huang<sup>1</sup>. <sup>1</sup>National Kaohsiung Normal University, Kaohsiung, Taiwan.

<sup>2</sup>National Cheng Kung University, Tainan, Taiwan.

(No relationships reported)

Physical self-perception (PSP) exerts a crucial role during adolescence. Research has demonstrated that positive associations of PSP with physical fitness (PF) (Carraro, Scarpa, & Ventura, 2010). However, social and behavioral deficits and sometimes motor skill difficulties demonstrated by individuals with autism spectrum disorder (ASD) could limit opportunities for them to successfully participate in physical activity, and therefore, may put them at risk for being physically inactive and unfit.

**PURPOSE:** (a) To compare PSP and PF in adolescents with and without ASD, and (b) to assess the relationship of PSP with PF within each group.

**METHODS:** Thirty-one males with ASD and 36 males without ASD aged 12-18 (14.68±1.55 yrs) participated. The PSP was assessed with a questionnaire originally developed by Whitehead (1995) and translated into Chinese with a high degree of reliability and validity (Hagger, Biddle, Chow, Stambulova, & Kavussanu, 2003). The BROCKPORT Physical Fitness Test was used for PF measures. Independent *t* tests were used to compare group differences in PSP and PF. Pearson product-moment correlation coefficients were calculated to evaluate the relationships of PSP with PF within each group. Significance was set at *p*<0.05.

**RESULTS:** Findings indicate that (a) adolescents with ASD perceived significantly poor scores on physical condition (-2.47, *p*<0.05), sport competence (-2.05, *p*<0.05), and general self-worth (-1.53, *p*<0.05), (b) adolescents with ASD demonstrated significantly poor scores on 20-m PACER (-23.81, *p*<0.01), isometric push-up (-8.62, *p*<0.01), and back-saver sit-and-reach (-8.00, *p*<0.01), (c) for adolescents with ASD, physical condition was associated with 20-m PACER (*r*=0.58, *p*<0.01); sport competence was associated with sit-up (*r*=0.37, *p*<0.05), and (d) for adolescents without ASD, physical condition (*r*=0.51, *p*<0.01) and sport competence (*r*=0.41, *p*<0.05) were associated with 20-m PACER; attractive body was associated with sit-up (*r*=0.35, *p*<0.05); general self-worth was associated with sit-and-reach (*r*=0.39, *p*<0.05).

**CONCLUSION:** Adolescents with ASD perceived less favorable PSP than adolescents without ASD. PSP and PF indicators were related, despite incomplete overlap between the two variables in each group. Supported by Taiwan NSC grants 99-2410-H-017-036-MY2.

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1274 Board #55 MAY 30 11:00 AM - 12:30 PM

### Faster Heart Rate Recovery and Higher Short-term Muscle Power in Physically Active Preschool Children

Leigh Gabel, Nicole A. Proudfoot, Joyce Obeid, Brian W. Timmons. McMaster University, Hamilton, ON, Canada.

(No relationships reported)

Aerobic fitness has a protective effect on metabolic and cardiovascular health and is positively related to physical activity in youth and adults. There is a paucity of literature examining fitness in preschool children (3- to 5-year olds); thus, little is known about the relationships between physical activity and fitness in this young age group.

**PURPOSE:** To investigate the relationships between physical activity patterns and fitness (aerobic and short-term muscle power) in a sample of preschool children.

**METHODS:** Ninety-six preschoolers (4.4 ± 0.9 years; 50 female) participated in the study. Children performed a maximal treadmill assessment (Bruce Protocol) with heart rate (HR) monitored throughout the test and into 1-min of recovery (HR60secpost). Aerobic fitness was assessed by heart rate recovery (HRR = HRmax - HR60secpost). Short-term muscle power was determined by peak power output using a modified 10-sec Wingate cycling protocol. Physical activity patterns were assessed by the duration and frequency of bouts of moderate-to-vigorous physical activity (MVPA) using accelerometry for seven consecutive days with 3-second epochs. Only children who achieved a HRmax of ≥180 bpm on the treadmill test and who wore the accelerometer for ≥3 days for ≥5 hours/day were included in analyses. Pearson correlation coefficients were used to assess the relationships between physical activity and fitness. Both physical activity and short-term muscle power were significantly related to age; thus, partial correlations controlling for age were used.

**RESULTS:** Average HRmax on the treadmill test was 195 ± 7 bpm with a HRR of 63 ± 14 bpm. HRR was positively related to the frequency of bouts of MVPA (*r*=0.29, *p*<0.01). Average peak power on the modified Wingate test was 4.6 ± 1.5 Watts/kg and was positively related to the duration of bouts of MVPA (*r*=0.23, *p*=0.03).

**CONCLUSIONS:** Preschool children who engage in more frequent bouts and longer duration of bouts of MVPA have faster HRR and higher short-term muscle power, respectively, compared to preschoolers who engage in less frequent and shorter duration of bouts of MVPA.

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1275 Board #56 MAY 30 11:00 AM - 12:30 PM

### Characteristics of Physical Fitness According to the Level of Obesity Index among Young Children

Kosho Kasuga<sup>1</sup>, Takahiro Nakano<sup>2</sup>, Kazuo Oguri<sup>3</sup>, Keisuke Fukutomi<sup>4</sup>. <sup>1</sup>Gifu University, Gifu, Japan. <sup>2</sup>Nagoya Gakuin University, Seto, Japan. <sup>3</sup>Shizuoka Sangyo University, Iwata, Japan. <sup>4</sup>Gifu Sports Science Training Center, Gifu, Japan. (Sponsor: Kiyoji Tanaka, FACSM)

(No relationships reported)

Many reports have shown that the prevalence of obesity in Japanese children, including infants, has been increasing. The number of children diagnosed with infant metabolic syndrome is also on a rise. Moreover, in recent years, there has been an increase in the number of lean children in Japan.

**PURPOSE:** The purpose of this study is to examine the characteristic of physical fitness according to level of obesity index among young children (age, 3-6 years) by using a large dataset.

**METHODS:** This study included 5640 young children (2840 boys and 2800 girls). We administered physical fitness tests comprising 7 exercises to gauge the physical fitness status of these children. A T-score was calculated on the basis of the mean and standard deviation according to sex and age; this score was used as an individual score of physical fitness. The children were divided into 7 groups based on their obesity index. Further, the extent of differences among children with different obesity index was examined for each type of exercise. To conduct a statistical analysis of the data, one-way ANOVA and multiple comparisons (Tukey's HSD test) were employed.

**RESULTS:** Statistical analysis showed a significant difference among the groups for all the exercises. The children in the "+20% or more" group had the lowest scores in 25-m run, standing long jump, and upright hand standing time. The children in the "-15% or less" group had the lowest scores in softball throw, sitting trunk flexion, side-step, grip strength, and overall physical fitness.

**CONCLUSIONS:** The physical fitness of obese (+20% or more) and lean (-15% or less) children was found to be poor. The poor physical fitness in lean children may be due to low muscle mass and underdevelopment because of the lack of any physical activity. Moreover, their low energy expenditure may result in a low appetite, which can lead to poor nutrition. In contrast, the severely obese children (+20% or more) may be underdeveloped due to the lack of any physical activity and consumption of an excessive and unbalanced diet. However, the mildly obese (up to +15%) are not physically underdeveloped at infancy, and do not need extreme obesity prevention measures. It is important for them to adopt a "play a lot, eat a lot" lifestyle.

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1276 Board #57 MAY 30 11:00 AM - 12:30 PM

**The Relationship Between The Development Of Physical Fitness And Lifestyle Behavior In Young Children**

Takahiro Nakano<sup>1</sup>, Kosho Kasuga<sup>2</sup>, Kazuo Oguri<sup>3</sup>. <sup>1</sup>Nagoya Gakuin University, Aichi, Japan. <sup>2</sup>Gifu University, Gifu, Japan. <sup>3</sup>Shizuoka Sangyo University, Shizuoka, Japan. (Sponsor: Kiyoji Tanaka, FACSM)  
(No relationships reported)

Recently, the decline in children's physical fitness has become a big problem in Japan for not only older children but also young children. Childhood is very important period for acquisition of basic lifestyle behavior. Many studies have shown a relationship between physical fitness and lifestyle behavior. However, few studies have examined the relationship between the development of physical fitness and lifestyle behavior. Such studies have been particularly rare in young children.

**PURPOSE:** The purpose of this study was to examine the relationship between the development of physical fitness and lifestyle behavior in young children using longitudinal data.

**METHODS:** The subjects of this study were 311 young children. We measured seven parameters related to physical fitness: grip strength, upright hand standing time, sitting trunk flexion, 25-meter run, standing long jump, side step, and softball throw. As well, we administered a questionnaire about daily lifestyle behavior. We calculated the development of physical fitness using two-years longitudinal data for the same young children, and calculated the correlation coefficient between the amount of development and daily lifestyle behavior. Further, we examined differences in lifestyle behavior between groups whose physical fitness developed well or did not, using a chi-square test and independent t-test.

**RESULTS:** The lifestyle behaviors related to several physical fitness items were "Bedtime," "TV viewing time," "video-game playing time," "active play with body movement" and "active play with family". Significant differences were confirmed between the high-development group and the low-development groups in 7 items, including "TV viewing time," "video-game playing time," "number of friends usually playing together," and "keeping a regular lifestyle".

**CONCLUSION:** Relationships between young children's physical fitness and several lifestyle behaviors were confirmed. It is suggested that physical fitness is easy to develop in children who have a regular lifestyle and a lot of friends to play with. In addition, it is suggested that the development of young children's physical fitness is promoted by improving lifestyle behaviors such as TV viewing time and video-game playing time.

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1277 Board #58 MAY 30 11:00 AM - 12:30 PM

**Use Of Exergaming For Obtaining Moderate And Vigorous Physical Activity In Children**

Magdalene Horton, Larry Kennard, Scott E. Crouter, FACSM. *University of Massachusetts Boston, Boston, MA.*  
(No relationships reported)

There are a growing number of PA programs that now include interactive video games (exergames) as part of an activity routine; however, it is unclear, if these games are a viable alternative for children obtain moderate and vigorous PA (MVPA).

**PURPOSE:** The purpose of this study was to examine the energy cost of children playing exergames. A secondary purpose was to see how the energy cost of exergames compares to other commonly performed activities.

**METHODS:** Fifty-three boys and 50 girls (mean±SD; age 11.5±1.7 yrs; BMI%ile, 68.6±28.4 %) performed 30-min of lying rest. Each participant was then randomly assigned to perform one of three activity routines consisting of six activities. Participants were familiarized with all activities prior to testing. Exergames included were: Nintendo Wii, Floor-based LightSpace, Wall-based LightSpace, Dance Dance Revolution, SportWall, and Cybex Trazer. Oxygen consumption was measured using a Cosmed K4b<sup>2</sup>. Measured METs (measured activity VO<sub>2</sub>/measured resting VO<sub>2</sub>) were calculated for each activity. Data were also examined for differences between genders, age groups (8-9, 10-11, and 12-15 yrs) and BMI [normal weight (<85<sup>th</sup>% for age and sex), overweight (85<sup>th</sup>-95<sup>th</sup>% for age and sex), and obese (≥95<sup>th</sup>% for age and sex)].

**RESULTS:** On average, the mean METs for playing the Nintendo Wii were 2.5 METs. All other exergames had a mean MET value of at least moderate intensity (range; 3.4-5.3 METs). In general, there were no differences by gender, age, or BMI categories, except for; Nintendo Wii (overweight, 3.6 METs vs. normal weight and obese, 2.6 METs), Cybex Trazer (9 yrs, 2.5 METs vs. 10-11 yrs 3.9 METs vs. ≥12 yrs 5.0 METs) and SportWall (8-9 yrs, 2.7 METs vs. 10-11 yrs 4.5 METs vs. ≥12 yrs 6.9 METs). Playing exergames resulted in similar MET values as other commonly performed PA in children (e.g., slow and brisk track walking, track running, playing catch, and soccer).

**CONCLUSION:** The results of this study show that, in general, the energy cost to play exergames is at a moderate intensity or greater. Exergames could be an alternative way for children to obtain MVPA in addition to the use of more traditional activities. However, there may issues related to age and BMI that need to be further investigated as not all activities work equally well for all individuals.

Study supported by NIH grant 5R21HL093407-02

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1278 Board #59 MAY 30 11:00 AM - 12:30 PM

**Compliance with Physical Activity Recommendations and Blood Pressure In Preschool Children**

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(No relationships reported)

**PURPOSE:** Research suggests that moderate levels of PA are predictors of lower values of systolic and diastolic blood pressure (SBP and DBP). However, few studies addressed this issue in pre-school children. The purpose of this study was to analyse the associations between compliance of PA recommendations and SBP preschool children.

**METHODS:** The sample comprised 593 preschool children (48% female) with mean age of 5.3 years. Physical activity was assessed during 7 consecutive days by accelerometer (Actigraph GTM1). We analyzed the recommendation of at least one hour daily of moderate-vigorous PA (MVPA). Blood pressure was measured using the Colin monitor. The measurements were performed with each subject seated and rested for at least five minutes before the test. Percentage of fat (% MG) was calculated using the equation of Westraat and Durenberg. (1990).

**RESULTS:** The prevalence of BP above the 90th percentile (P90) was 7.8% and 1.3% respectively for SBP and DBP. We found that about 16.5% of the girls and 8.2% of the boys did not accomplish the recommended daily MVPA. Girls who did not meet the daily recommendations of MVPA were twice as much more likely to have SBP values above the P90 compared to those who meet the daily recommendations (OR: 2.6; CI 95%:1.0-6.6; p<0.05), even after adjustment to fat mass.

**CONCLUSION:** We found an association between the accomplishment of daily PA recommendations and SBP in pre-school children in girls.

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1279 Board #60 MAY 30 11:00 AM - 12:30 PM

**After-School Exercise Increases Endothelial Progenitor Cells in Overweight and Obese Children**

Jong-Hwan Park<sup>1</sup>, Masashi Miyashita<sup>1</sup>, Yoshio Nakamura<sup>1</sup>, Hyun-Tae Park<sup>2</sup>, Yoo-Chan Kwon<sup>3</sup>, Eun-Hee Kim<sup>3</sup>, Jin-Kee Park<sup>3</sup>, Ki-Beam Park<sup>3</sup>, Sang-Kab Park<sup>3</sup>. <sup>1</sup>Waseda University, Saitama, Japan. <sup>2</sup>National Center for Geriatrics and Gerontology, Aichi, Japan. <sup>3</sup>Dong-A University, Busan, Korea, Republic of.  
(No relationships reported)

Obese children who are home alone after school have limited time to be active outdoors and unlimited access to junk food, video games and electronic devices which can lead to a more sedentary lifestyle. The role of bone marrow-derived circulating endothelial progenitor cells is to maintain endothelial function and organ perfusion. Endothelial dysfunction is associated with the childhood obesity and is closely linked to the amount and function of endothelial progenitor cells. However, it remains unclear whether endothelial progenitor cells increase with after-school exercise in overweight and obese children.

**PURPOSE:** The purpose of this study was to investigate the effects of an after-school exercise programme on endothelial progenitor cells in overweight and obese children.

**METHODS:** Total of 29 overweight/obese children were randomly divided into the control (i.e., no after-school exercise, n = 14) or after-school exercise (n = 15) groups. The 12-week after-school exercise intervention consisted of 3 days of combined aerobic and resistance exercise per week. Each 80-minute exercise programme included 10 minutes of warm-up and 10 minutes of cool-down after school. CD34+ (a cell surface marker on hematopoietic stem cells), CD133+ (a cell surface marker on hematopoietic progenitor cells) and CD34+/CD133+ (considered as endothelial progenitor cells) were measured at baseline and after 12 weeks using flow cytometry.

**RESULTS:** Increased percentages of CD34+, CD133+ and CD34+/CD133+ were observed in the after-school exercise group ( $p = 0.018$ ;  $p = 0.001$ ;  $p = 0.002$ , respectively) compared with the control group. Carotid intima-media thickness decreased after 12 weeks in the after-school exercise group ( $p = 0.020$ ) compared with the control group. Circulating concentrations of vascular endothelial growth factor and nitric oxide were increased in the after-school exercise group ( $p = 0.013$ ;  $p = 0.005$ , respectively) compared the control group.

**CONCLUSIONS:** This study provides preliminary evidence that an after-school exercise programme may represent an effective intervention strategy for improving vascular repair and endothelial function, leading to improved cardiovascular health in overweight and obese children.

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**1280** Board #61 MAY 30 11:00 AM - 12:30 PM  
**Physical Activity, Focused Education and Endothelial Function in an Obese Teen: A Case Study**

Anna Gabbard, Nabil Boutagy, Elise Maniguet, Alison Peters, Shannon Isom, John W. Wygand, Robert M. Otto, FACSM. *Adelphi University, Garden City, NY.*  
(No relationships reported)

Endothelial function plays a significant role in vascular health. Normal endothelial function includes release of vasoactive substances and growth factors to maintain vascular homeostasis. Endothelial dysfunction (Reactive Hyperemia Index [RHI] < 1.67) can be defined as a loss of balance between vasoconstrictors vs vasodilators and other inflammatory factors. Endothelial dysfunction is precursor to atherosclerosis and is implicated in obesity, diabetes and hypertension. EndoPAT noninvasively assesses endothelial function by reactive hyperemia- pulse amplitude tonometry (RH-PAT). Endothelial function is calculated by measuring blood vessel diameter relative to resting, occluded and hyperemic conditions.

**PURPOSE:** To determine whether a combined education and physical activity program has an effect on endothelial function in an obese female (age 18 yr, wt 108 kg, ht 170 cm, BMI 37.4 m/kg<sup>2</sup>).

**METHODS:** EndoPAT was performed in a thermo-neutral environment with the subject supine and both index fingers in the EndoPAT probe. A blood pressure cuff (BPC) was placed on the subject's non-dominant arm. Baseline data were collected for 5 minutes. The BPC was inflated to  $\geq 200$  mmHg for complete occlusion for 5 minutes, rapidly released and post-occlusion data were collected. Body composition was measured by skinfolds & waist to hip (W/H) with Gulick tape. The intervention was a 12 week program of nutrition and physical activity education combined with twice weekly exercise sessions designed to reduce obesity and modify the participant's obesogenic environment. Each 60 minute exercise session, consisted of 20-35 minutes of aerobic interval cross training on 4-7 exercise machines at 65-85% HRR for 5 min. each. A circuit of resistance training was performed on 12 Nautilus resistance machines to an intensity of momentary muscular fatigue.

**RESULTS:** The subject reduced body mass 10.8%, BMI 10.9%, body fat 7.3%, W/H 2.5%, and improved muscular strength 79% (10 RM leg press). RHI improved from dysfunction of 1.46 at baseline to normal function of 2.61 following intervention.

**CONCLUSION:** A cardiovascular and resistance training intervention improved endothelial function, body composition and muscular strength in an obese teen and attenuated cardiovascular risk.

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**1281** Board #62 MAY 30 11:00 AM - 12:30 PM  
**Comparison Between Individual And Averaged Methodologies For Anaerobic Threshold Assessment Of Age-group Swimmers**

Marisa Sousa, João Paulo Vilas-Boas, Ricardo Fernandes. *University of Porto, Faculty of Sports, Porto, Portugal.* (Sponsor: Carlo Baldari, FACSM)  
(No relationships reported)

The assessment of the velocity corresponding to anaerobic threshold ( $v_{AnT}$ ) is frequently part of elite swimmers training program in order to diagnosis their aerobic performance. However, the velocity corresponding to blood lactate concentration ( $[La^-]$ ) of 4 mmol/l ( $v_4$ ), an averaged value proposed for standard more than 30 years ago, is often used in detriment of individualized protocols; in addition, rarely swimmers of young ages are involved in training control.

**PURPOSE:** To compare the  $v_{AnT}$  of 10-11 years old swimmers assessed by individualized protocols (step and critical velocity tests) and by the traditional  $v_4$  value.

**METHODS:** Fifteen age-group swimmers ( $10.7 \pm 0.70$  years) performed a 5x200 m front crawl step test (increments of 0.05 m/s per step, and 1 min rest intervals), being capillary blood samples for  $[La^-]$  analysis collected from the earlobe at rest, after each step and at the end of the test, which allowed the assessment of the  $v_{AnTStep}$  through  $[La^-]$ /velocity curve modeling method, and  $v_4$  by linear interpolation. Critical velocity (CV) was obtained through the slope of the linear relationship of time versus distance based on the times of the 100 and 400m competitive events. Mean and SD were computed, as well as repeated measurements ANOVA (with Bonferroni post hoc test) and Pearson correlation coefficient ( $p \leq 0.05$ ).

**RESULTS:** Mean  $\pm$  SD values of  $v_{AnTStep}$ , CV and  $v_4$  were  $1.03 \pm 0.05$ ,  $1.03 \pm 0.07$  and  $1.08 \pm 0.06$  m/s, respectively, being the two former velocities significantly lower than  $v_4$ ; these differences corresponds to a 5 s gap in a 100m front crawl effort. The  $[La^-]$  corresponding to  $AnT$  obtained in the step test was  $2.3 \pm 0.59$  mmol/l.

**CONCLUSIONS:**  $v_4$  does not represent the individual  $v_{AnT}$  in children involved in competitive swimming, and both a 200 m step incremental protocol, with the later determination of the precise point of the rise in  $[La^-]$ , and CV, seems to be advised for individual anaerobic threshold assessment in young swimmers.

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**1282** Board #63 MAY 30 11:00 AM - 12:30 PM  
**Validity of an Alternate Knee Raise Test for Assessing Aerobic Fitness of Adolescents**

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(No relationships reported)

**PURPOSE:** Simple but valid home-based aerobic fitness test that can be self-administered with minimal equipment is lacking. The purpose of this study was to examine the validity of an alternate knee raise test (AKR) for assessing aerobic fitness of adolescents.

**METHODS:** With informed consent form completed, 30 male adolescents age 12 to 18 yrs-old ( $14.63 \pm 1.56$  yrs-old) volunteered to participate in an AKR test and a grade maximal treadmill exercise (GXT) test. In the AKR test, participants were asked to perform alternate knee raise movement in place following a cadence of 96 beats/min for 3 mins continuously. In each knee raise motion the participants were required to lift up their leg until their thigh touched their palm which was placed in front of their waist at the same level of iliac crest and above their thigh. The movement was similar to a platform step test but no platform was required. At the end of the 3 min AKR test, the post-exercise heart rate (PHR) at 20 seconds after the test was recorded by a Polar heart rate monitor. For GXT test, criterion measure of  $VO_{2max}$  was examined by a portable COSMED K4b2 metabolic analyzing system. To evaluate the predictive validity of AKR test, independent variables of age, body weight, skinfolds, body mass index, resting heart rate, post-exercise heart rate were entered into stepwise regression procedures for predicting dependable variable of measured  $VO_{2max}$ .

**RESULTS:** Regression analysis revealed that the AKR test produced good predictive validity and acceptable standard error of estimates. Only two independent variables were needed which were age and PHR. The suggested equation was  $VO_{2max} \text{ (ml/kg/min)} = 52.168 - 0.25 \text{ (PHR)} + 1.568 \text{ (Age)}$ ,  $R=0.71$ ,  $SEE=5.17$  ml/kg/min.

**CONCLUSIONS:** The AKR Test was found to be a valid submaximal field test for assessing aerobic fitness of adolescents. It is a practical test due to its' simple procedure and can be self-administered at home with minimal equipment.

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**1283** Board #64 MAY 30 11:00 AM - 12:30 PM  
**Body Perception: Parents' Poorly Perceive Children's Fitness Characteristics**

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(No relationships reported)

At least 155 million school-age children worldwide are overweight or obese. Body Mass Index (BMI) as a measurement of parental recognition of child's overweight status ranges from 6-73%. When examining overweight children, less than 50% of parents identify their child as such.

**PURPOSE:** The purpose of this study was to examine parental ability to appropriately identify their child's BMI status and also measures of physical fitness (body composition, muscular strength, flexibility and aerobic fitness).

**METHODS:** Subjects consisted of 133 males (10.8±2.1 years), 110 females (11.4±2.4 years) and their maternal parent. Males and females scores were compared to maternal perception of score: BMI, body composition, and fitness characteristics (muscular strength, aerobic fitness and flexibility) were categorized according to normative rankings. The maternal perception questionnaire was administered while subject's fitness characteristics were evaluated. Data associations were examined using descriptive statistics and bivariate correlation.

**RESULTS:** BMI, body fat and fitness characteristics ranged categorically from poor to excellent. Maternal parents ability to correctly identify fitness characteristics by categorical selection were: BMI (72.8%), body composition (49.4%), flexibility (26.3%), muscular strength (32.5%) and aerobic fitness (39.5%). The relationship between subjects scores and parental perception of scores was considered weak to moderate, as determined by Pearson correlation (BMI:  $r=.618$ , body composition:  $r=.693$ , muscular strength:  $r=.268$ , aerobic fitness:  $r=.406$  and flexibility  $r=.435$ ).

**CONCLUSION:** In children ranging from under-weight to obese, parent's ability to predict characteristics relative to weight and body composition is substantially better than their ability to predict fitness characteristics. Parents have a strong influence on children's behavior and physical activity levels. Primary prevention is key in fighting the obesity epidemic, thus adult's awareness of their child's fitness status is imperative. As such, professional or school-based screening could be suggested as a necessary tool to identify children's fitness characteristics for parental informative purposes.

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**1284 Board #65 MAY 30 11:00 AM - 12:30 PM**  
**Prevalence Of Obesity In Japanese Children Aged 3.5 Through 6.5 Years Old**

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(No relationships reported)

The prevalence of childhood obesity has risen progressively worldwide. It is said that obesity onsets in early childhood; however, factors not yet clarified include: age of obesity onset, and age when gender difference in obesity prevalence becomes apparent.

**PURPOSE:** The purpose of this study was to examine the prevalence of obesity and its development trends, such as differences with age and gender, in Japanese young children.

**METHODS:** This cross-sectional study analyzed height, weight and age data of 6,235 children (3,147 boys and 3,088 girls) aged 3.5 to 6.5 years old. Subjects were categorized into age groups in increments of 0.5 years, and prevalence of obesity was compared between gender and among groups. Obesity was defined according to the National Health and Nutrition Survey of Japan as 115% of the standard weight for an individual's height and gender. The chi-square test was used to compare differences in prevalence of obesity. Where appropriate, p values of the chi-square test were corrected according to Bonferroni inequalities.

**RESULTS:** Prevalence of obesity plateaued at 6.4 % to 6.7 % both in boys and girls, aged between 3.5 years and 4.5 years. However, it significantly decreased to 3.1 % and 3.0 % in boys and girls respectively, at age 5.0 years old ( $p<0.001$ ). Prevalence of obesity in boys and girls aged 5.5 years increased to 8.0 % and 6.8 % respectively, which was significantly higher than that in boys and girls at 5.0 years old, and the rate gradually increased with age thereafter ( $p<0.001$ ). No significant difference in prevalence of obesity was found between boys and girls in each group for ages 3.5 years to 6.0 years. However, the prevalence was significantly higher in boys than in girls at age 6.5 years ( $p<0.05$ ).

**CONCLUSIONS:** Our data suggest that prevalence of obesity temporarily decreases at age 5.0 years old, however, it markedly increases from age 5.5 years old. Prevalence of obesity among boys significantly increases relative to that among girls at age 6.5 years. These findings indicate that prevention and treatment of young childhood obesity is important for pediatric healthcare.

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**1285 Board #66 MAY 30 11:00 AM - 12:30 PM**  
**Relationship of Body Mass Index to Exercise Participation and Adherence in Overweight Children and Adolescents**

Amanda Gier, Christopher Kist, Wayne A. Mays, Robert Siegel, Shelley Kirk. Cincinnati Children's Hospital Medical Center, Cincinnati, OH.  
(No relationships reported)

**PURPOSE:** To determine if body mass index (BMI) in overweight and obese children and adolescents is a barrier to participation in and adherence to an organized group exercise program.

**METHODS:** During medical visits for a clinical pediatric weight management program, height and weight was obtained on 603 overweight children and adolescents and used to calculate BMI. Patients were given information about the group exercise sessions available to them through the program. Group classes were offered five evenings per week, and participants could attend at their discretion. Classes were 1-hour long and consisted of strength training, cardiovascular activity and active games in a fun, non-competitive environment. Class attendance was tracked and duration of active participation was determined. Data was analyzed to determine if BMI was related to class attendance.

**RESULTS:** Active class attendance ranged from 0 to 182 weeks. There was no correlation between BMI ( $34.9 \pm 7.5$  kg/m<sup>2</sup>) and weeks attended ( $10.7 \pm 22.4$  weeks) ( $r = -0.054$ , NS) when looking at all participants. Within the group of participants that attended group exercise sessions,  $N=355$ , there was no correlation between BMI ( $34.4 \pm 7.8$  kg/m<sup>2</sup>) and total weeks of exercise class attendance ( $18.1 \pm 26.8$  weeks) ( $r = -0.03$ , NS). However, when comparing the participants that attended classes to those who did not attend any classes, the children who did attend classes had a significantly lower BMI ( $34.4 \pm 7.8$  vs  $35.6 \pm 7.1$  kg/m<sup>2</sup>) ( $p<0.05$ ), but were also significantly younger ( $11.2 \pm 3.3$  vs  $12.0 \pm 3.3$  years) ( $p<0.005$ ).

**CONCLUSION:** BMI was not related to the length of time that children actively participated in group exercise sessions. However, BMI and age were significantly lower in the group that attended classes. Younger children may have a lower BMI but still be in a higher BMI percentile for age than older children with a similar BMI. Therefore, BMI alone may not be helpful in determining which patients will participate in an exercise program. Future research should focus on a multivariate analysis of BMI percentile and age as indicators of participation in exercise classes. Further research into these variables could give healthcare providers insight into which patients may need additional support and encouragement when beginning structured exercise.

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**1286 Board #67 MAY 30 11:00 AM - 12:30 PM**  
**Relationship between Health Status and Motor Ability among Young Children**

Keisuke Fukutomi<sup>1</sup>, Kosho Kasuga<sup>2</sup>, Katsunori Fujii<sup>3</sup>, Tohru Isigaki<sup>4</sup>. <sup>1</sup>Gifu Sports Science Training Center, Gifu, Japan. <sup>2</sup>Gifu University, Gifu, Japan. <sup>3</sup>Aichi Institute of Technology, Toyota, Japan. <sup>4</sup>Aichi Prefectural University of Fine Arts and Music, Nagakute, Japan. (Sponsor: Kiyoji Tanaka, FACSM)  
(No relationships reported)

It has been suspected that people with low motor ability are liable to have bad health status. However, less research has been performed on the motor ability of young children by using a large dataset.

**PURPOSE:** The purpose of this study is to examine the relationship between health status and motor ability among young children.

**METHODS:** The study included 2,431 young children (1,241 boys and 1,190 girls; age range: 4-6 years) and their parent. We administered motor ability tests comprising 10 exercises to gauge the motor ability status of these children. To obtain the overall motor ability parameter, the measurement items were summarized by using principal component analysis. And we concluded that the first principal component represented the overall motor ability. Further, the principal component score of the first principal component was divided by the number of subjects of each sex and 0.5 years to obtain the individual T-scores. These individual T-scores indicated the motor ability scores. Questionnaires comprising 13 items on health status\_frequent loose bowels, frequently catching cold, having a nosebleed, having eczema and suppuration, having car sickness, having no notable symptoms, allergy constitution, asthma, atopy, nasal catarrh, food allergy, drug allergy, and conjunctivitis\_were administered to their parent. Student's t-test was performed to determine the statistical differences in the motor ability scores between children who answered 'True' and those who answered 'False'. The level of significance was set at  $p < 0.05$ . The data were collected in 2009.

**RESULTS:** With respect to the health status, the motor ability scores of the group that answered 'True' were significantly lower than those of the group that answered 'False' for items under the category 'having no notable symptoms' (True: 50.7, False: 49.3) and 'frequently catching cold' (True: 47.9, False: 50.3). Particular attention was paid to allergy symptoms. Statistical analysis showed that there was no significant difference in the motor ability scores of young children who answered 'True' and those who answered 'False'.

**CONCLUSIONS:** The young children who caught cold frequently had low motor abilities. Moreover, 38% of the subjects had allergy constitution; however, presence of an allergy did not have any correlation with motor ability.

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1287 Board #68 MAY 30 11:00 AM - 12:30 PM

**Relations between Sedentary Behavior and FITNESSGRAM® Healthy Fitness Zone Achievement and Physical Activity**

Jacob S. Tucker, Scott B. Martin, Allen W. Jackson, FACSM, James R. Morrow, FACSM, Christy A. Greenleaf, Trent A. Petrie. *University of North Texas, Denton, TX.*

(No relationships reported)

Sedentary behaviors such as television viewing and video game playing increase the relative risk of morbidity and mortality independent of physical activity levels. Due to the direct relations between these sedentary behaviors and health risk, the American Academy of Pediatrics recommends no more than two hours of daily screen time for youth.

**PURPOSE:** To investigate the relations between sedentary behaviors and health-related physical fitness (PF) achievement and physical activity (PA) behaviors in middle school students.

**METHODS:** Students (N=1515) in grades 6-8 completed the FITNESSGRAM® PF items, and FITNESSGRAM PA questions in addition to Youth Risk Behavior Survey sedentary behavior questions as part of school activities.

**RESULTS:** Using logistic regression and controlling for gender, age, ethnicity, and economic status, we calculated odd ratios (OR) for all components of health-related fitness, aerobic capacity (OR=1.70, 95%CI = 1.30-2.34), muscular strength and endurance (OR = 1.87, 95%CI = 1.30-2.68), flexibility (OR = 1.54, 95%CI = 1.20-2.00), and body composition (OR = 1.71, 95%CI = 1.27-2.30). The odds of achieving the FITNESSGRAM Healthy Fitness Zone were higher when students reported  $\leq 2$  hours of sedentary behaviors per day. Similarly, the odds of achieving physical activity guidelines for aerobic (OR = 1.42, 95%CI = 1.09-1.84), muscular strengthening (OR = 1.77, 95%CI = 1.22-2.57), and flexibility (OR = 1.47, 95%CI = 1.15-1.88) activity were higher when students reported  $\leq 2$  hours per day of sedentary behaviors.

**CONCLUSION:** Results illustrate the importance of keeping sedentary behaviors to  $\leq 2$  hours per day in middle school students, thus increasing the odds that students will achieve sufficient health-related fitness for health benefits. Less screen time is related to achieving national physical activity guidelines.

Grant support from the National Association for Sport and Physical Education.

1288 Board #69 MAY 30 11:00 AM - 12:30 PM

**Associations Among Body Fat %, BMI, And Fitness Test Performance In School-Aged Children**

Ryan D. Burns<sup>1</sup>, James C. Hannon<sup>1</sup>, Brett Allen<sup>1</sup>, Pedro F. Saint-Maurice<sup>2</sup>, Gregory J. Welk, FACSM<sup>2</sup>. <sup>1</sup>University of Utah, Salt Lake City, UT. <sup>2</sup>Iowa State University, Ames, IA.

(No relationships reported)

**PURPOSE:** The purpose of this study was to examine associations among body fat % (BF%), BMI, and various fitness tests in school-aged children.

**METHODS:** The participants included male and female 4<sup>th</sup> through 10<sup>th</sup> grade students (n=376) recruited from three private schools from a metropolitan area in the southwestern United States. Participants completed assessments of body composition, aerobic fitness and muscular fitness on 4 separate testing days with at least 48 hours between sessions. On day 1 participants completed the BMI, BF% and PACER aerobic fitness test. On day 2 participants completed DYNAMIC CURL UPS and ROMAN CHAIR STATIC extension tests. On day 3 participants completed PLANKS, LATERAL STRENGTH, and ROMAN CHAIR DYNAMIC extensions. On day 4 participants completed any test that they may have missed on previous days. Pearson-Product Moment (PPM) correlations were used to assess the degree of association between body composition and fitness variables. Alpha level of 0.05 was set to determine significance for statistical analyses.

**RESULTS:** The BMI and BF% values were moderately correlated with each other ( $r=.51, p<.001$ ). BF% had higher correlations with the fitness variables than BMI (PACER:  $r=-.407$  vs.  $-.094$ ; CURL-UP:  $r=-.197$  vs.  $.108$ ; PLANK:  $r=-.311$  vs.  $-.06$ ; LATERAL STRENGTH:  $r=-.239$  vs.  $-.078$ ; ROMAN CHAIR DYNAMIC:  $r=-.142$  vs.  $-.128$ ; ROMAN CHAIR STATIC:  $r=-.149$  vs.  $-.133$ ). BF% correlations were significant among all fitness tests ( $p<.001$ ) while BMI correlations were only significant for both ROMAN CHAIR extensions ( $p<.05$ ).

**CONCLUSION:** The results suggest that BF% is negatively correlated with indicators of aerobic fitness and muscular fitness in youth. The moderate correlations between BF% and BMI and the weaker associations between BMI and fitness performance tests indicate that BMI may provide a less useful indicator of body composition for use in school health related fitness testing.

1289 Board #70 MAY 30 11:00 AM - 12:30 PM

**A Comparative Cross-cultural Comparison Of Posture, Core Strength, Height, Age And Body Mass Index**

Ulrike H. Mitchell, A Wayne Johnson, Barbara Simmons. *Brigham Young University, Provo, UT.*

(No relationships reported)

**PURPOSE:** High income countries around the world have experienced dramatic increases in obesity and sedentary behaviors in both genders, all income levels, ethnic groups, and all ages. We hypothesized that the lack of multiple TV channels or computers would have a positive impact on posture and fitness. This project was conducted in the rural villages outside of Irapuato, Mexico. The data were compared to similar studies conducted in Ghana, Australia and the United States.

**METHODS:** Intervention: 29 children, ages 10-12, performed 5 exercises indicative of core strength (plank, left and right bridge, left and right stork); the times of how long they were able to hold the positions were documented. With reflective markers placed on bony landmarks, the children had posture assessment photographs taken of their normal standing posture from a lateral view. A software program was used to mark and measure postural angles.

**RESULTS:** Height and weight (and their SD) were greater in Mexico (139.7cm SD9.6 and 35.1kg SD11.9) than in Australia (138.8cm SD5.8 and 32.4kg SD3.8). The gaze angle was greater in the Hispanic children (14.10 deg SD8.48) compared to the Australian's (10.3 deg SD7.6); this indicates a greater propensity towards a forward head posture.

The head on neck angle was greater in the Australian children (55.7deg SD8.7) compared to the Hispanics (50.3deg SD6.1); however, we believe that this is the result of a protruding C7 marker rather than an actual postural dysfunction.

Core strength: There were differences in exercise times for the side bridges and stork exercises between the children tested in Mexico and Utah County and for the left side bridge and stork exercises between the children tested in Mexico and Ghana (all with p-values  $<.05$ ); there was no difference in exercise times between children tested in Ghana and Utah County.

**CONCLUSIONS:** Our hypothesis was not supported by this study. While life in Irapuato, Mexico, is less influenced by computers and TV, it doesn't seem to have any impact on better posture or fitness. Reasons for this include widespread poverty which encourages consumption of cheaper high-calorie processed foods, culturally anchored sedentary lifestyle habits, lack of physical and health education and exercise-prohibitive living conditions.

1290 Board #71 MAY 30 11:00 AM - 12:30 PM

**Influence of BMI on Aerobic Fitness and Academic Performance in Middle School Students**

Guoyuan Huang<sup>1</sup>, Xiangrong Shi, FACSM<sup>2</sup>, Audra Offutt<sup>3</sup>. <sup>1</sup>University of Southern Indiana, Evansville, IN. <sup>2</sup>University of North Texas Health Science Center., Fort Worth, TX. <sup>3</sup>Thompson Middle School of EVSC, Evansville, IN.

(No relationships reported)

**PURPOSE:** Obesity is one of the most pressing health concerns for children. Could positive results presenting an academic advantage be due to children more fit in BMI? The current study was to explore if middle school students who are BMI fit are likely to have better aerobic fitness and stronger academic performance.

**METHODS:** The study sample included 146 middle school students (mean age: 11.9 $\pm$ 0.4 yrs). Subjects were administered physical fitness tests after first signing the informed consent. The study used standard physical fitness tests and was conducted in a controlled manner by the trained professionals. The academic performance information was collected, including previous and current semester GPA (P-GPA; C-GPA), and final GPA for the academic year (F-GPA). Only those students with complete sets of scores for both variables were included in the statistic analysis. SPSS for Windows 17.0 was used for statistical analysis.

**RESULTS:** The results showed a significant mean difference of aerobic fitness in terms of 1-mile running time (min) between normal-BMI and overweight-obese-BMI students (mean $\pm$ SD, 9.99 $\pm$ 2.67 vs. 13.51 $\pm$ 2.61;  $p<0.0001$ ), and between underweight-BMI and overweight-obese-BMI students (10.38 $\pm$ 2.52 vs. 13.51 $\pm$ 2.61;  $p<0.0001$ ). Students with normal-BMI tended having better academic performance than that of the overweight-obese-BMI students in terms of percentile rank for F-GPA (58.97 $\pm$ 26.47 vs. 46.27 $\pm$ 28.01;  $p=0.022$ ) and C-GPA (59.02 $\pm$ 26.05 vs.

47.56±26.91; p=0.041). Better GPAs were also found in normal-BMI students, compared to the underweight-BMI, in P-GPA (58.25±26.13 vs. 41.43±24.16; p=0.009), C-GPA (59.02±26.05 vs. 38.13±26.67; p=0.001), and F-GPA (58.97±26.47 vs. 40.50±26.09; p=0.004).

**CONCLUSIONS:** This study suggests that normal-BMI students are likely to have high level of cardiorespiratory fitness, compared to those students with underweight-BMI and overweight-obese-BMI. Students with healthy BMI tend to have higher GPAs, showing better academic performance.

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**1291** Board #72 MAY 30 11:00 AM - 12:30 PM

**Relationship Of Exercise Class Participation and BMI Change In Pediatric Obesity Patients**

Christopher Kist, Amanda Gier, Wayne Mays, Bob Siegel, Shelley Kirk. *Cincinnati Children's Hospital, Cincinnati, OH.*

(No relationships reported)

**PURPOSE:** To evaluate the relationship of participation in a pediatric weight management program inclusive of exercise classes and family-oriented dietary counseling to body mass index (BMI) change pre and post participation.

**METHODS:** We evaluated 269 pediatric obesity patients (mean age 11.2 ± 3.0 years, 106 males) with a 400 meter walk test pre and post participation in the pediatric weight management program. There were 178 patients that participated in exercise classes (EC) and 91 patients that completed the program without participation in the exercise classes (NC). Heart rate difference (HRDiff) was calculated by subtracting the pre 400 meter walk heart rate (HR) from the post 400 meter walk HR.

**RESULTS:** For the total group, there was a significant correlation between the change in BMI (0.12 ± 2.13 kg) and the percentage of exercise classes attended (12.3 ± 16.2%, r=0.21, p<0.0005). Additionally, the initial BMI (34.7 ± 7.7 kg/m<sup>2</sup>) correlated with the pre and post HR Diff (30 ± 13 and 29 ± 13 BPM) (r=0.15, p<0.01 and r=0.16, p<0.01) Also, the post BMI was significantly correlated with the post HRDiff (r=0.14, p<0.05). The NC group showed no correlations with pre or post HRDiff. However, the EC group showed significant correlation between the change in BMI (0.43 ± 2.46 kg) and the percentage of exercise classes attended (18.6 ± 16.7%, r=0.25, p<0.0005). Additionally, the initial BMI (34.8 ± 7.9 kg/m<sup>2</sup>) correlated with the pre and post HR Diff (29 ± 13 and 28 ± 13 BPM) (r=0.20, p<0.005 and r=0.20, p<0.005) Also, the post BMI was significantly correlated with the post HRDiff (r=0.17, p<0.005). **DISCUSSION:** There was a significant correlation between the change in BMI pre and post exercise participation and the percentage of classes attended. This relationship was strengthened when patients that did not attend classes were removed from the analysis. Additionally, BMI was significantly correlated with HR difference from the 400 meter walk test indicating BMI relationship to the difficulty of the walk test.

**CONCLUSION:** There was a significant but weak correlation of BMI change to attendance to exercise classes in a pediatric weight management program. Further multivariate analysis may illuminate the relationship between attendance and BMI.

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**1292** Board #73 MAY 30 11:00 AM - 12:30 PM

**Influence Of BMI On The New FITNESSGRAM® Aerobic Capacity Criteria Standards In Sixth-grade Children.**

Tinker D. Murray, FACSM<sup>1</sup>, John Walker, FACSM<sup>1</sup>, Pete Silvius<sup>2</sup>, Erik Silvius<sup>2</sup>, James Eldridge<sup>3</sup>, William G. Squires, Jr., FACSM<sup>4</sup>. <sup>1</sup>Texas State University, San Marcos, TX. <sup>2</sup>Seguin ISD, Seguin, TX. <sup>3</sup>University of Texas of the Permian Basin, Odessa, TX. <sup>4</sup>Texas Lutheran University, Seguin, TX.

(No relationships reported)

New criterion standards for percent body fat, body mass index (BMI), and aerobic capacity have been developed for the FITNESSGRAM®. Aerobic capacity is calculated based on 1-mile run, PACER, or 1-mile walk performances, as well as BMI values. Criterion standards for aerobic capacity include a healthy fitness zone (HFZ) and a categories for Needs Improvement - Some Risk (NI-SR) and Needs Improvement - High Risk (NI-HR).

**PURPOSE:** The purpose of this study was to examine the influence BMI has on the new FITNESSGRAM® criterion standards for aerobic capacity compared to the previous standards for one-mile run and PACER tests in sixth-grade children.

**METHODS:** Subjects were 439 sixth-grade boys and girls (61.3% Hispanic; 7.1% African-American) who completed each of the FITNESSGRAM® test components of their yearly physical education assessment. While, 60% of students met the previous FITNESSGRAM® age and gender criterion standards for BMI, only 43% met the new HFZ standards, and only 2% were in the very lean category. For the remaining students, 13% were classified as NI-SR, while 42% were classified as NI-HR.

**RESULTS:** The percent of these students meeting the previous criterion standards were 48% for the one-mile run, and 44% for the PACER test. The percent of these students meeting the new FITNESSGRAM® age and gender aerobic capacity standards calculated from one-mile run times were 55% for the HFZ, 19% for NI-SR, leaving 26% in the NI-HR category. The percent meeting the new aerobic capacity standards calculated from PACER performance were 50% for the HFZ, 19% for NI-SR, leaving 31% in the NI-HR category. Logistic regression revealed that compared to students who failed to meet the new HFZ standard for BMI, students who met the new HFZ standards for BMI were 42.6 times more likely to meet the aerobic capacity HFZ standard determined from one-mile times, and 57.1 times more likely to meet the aerobic capacity HFZ standard determined by PACER performance.

**CONCLUSIONS:** A decrease in BMI of one unit (based on weight loss only, -2.38 kilograms) would increase the probability of meeting HFZ criterion standards for aerobic capacity determined from the one-mile run by 45% and for aerobic capacity determined from PACER performance by 71%. This achievable (and safe) goal in similar youth populations remains to be tested in fitness interventions.

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**1293** Board #74 MAY 30 11:00 AM - 12:30 PM

**The Effect of Waist Circumference on FITNESSGRAM® BMI and Aerobic Capacity Criterion Standards in Sixth-Grade Children.**

John L. Walker, FACSM<sup>1</sup>, Tinker D. Murray, FACSM<sup>1</sup>, James Eldridge<sup>2</sup>, Pete Silvius<sup>3</sup>, Erik Silvius<sup>3</sup>, William G. Squires, Jr., FACSM<sup>4</sup>. <sup>1</sup>Texas State University - San Marcos, San Marcos, TX. <sup>2</sup>University of the Permian Basin, Odessa, TX. <sup>3</sup>Seguin Independent School District, Seguin, TX. <sup>4</sup>Texas Lutheran University, Seguin, TX.

(No relationships reported)

Waist circumference has been identified as an indicator of metabolic syndrome. New FITNESSGRAM® health fitness zone (HFZ) standards for body composition and body mass index (BMI) have been established to identify students most at risk for metabolic syndrome. New HFZ standards have also been established for aerobic capacity (AC).

**PURPOSE:** The purpose of this study was to determine the effect of waist circumference (WC) on the new FITNESSGRAM® BMI and AC HFZ standards in sixth-grade children.

**METHODS:** Subjects were 528 sixth-grade boys and girls who completed each of the FITNESSGRAM® test components as a part of their yearly physical education assessment. AC was determined from one-mile run times. In addition to height and weight, subjects were also measured for WC. The percent of these students meeting the FITNESSGRAM® age and gender HFZ standards were 49% for BMI, and 59% for AC, compared to passing rates of 60% for BMI, and 35% for the one-mile run based on the previous FITNESSGRAM® standards.

**RESULTS:** The correlation between BMI and AC was .74. The correlation between WC and AC was .71. The correlation between BMI and WC was .94. Multiple regression indicated that BMI and gender accounted for 62% of the variation in AC. WC and gender accounted for 61% of the variation in AC. Logistic regression revealed that students who met the HFZ standards for BMI were 76.7 times more likely to meet the HFZ standards for AC than students who failed to meet the HFZ standards for BMI. A decrease in BMI by one unit would increase the probability of meeting the HFZ standards for AC by 41%. A decrease in WC by one inch would increase the probability of meeting the HFZ standards for AC by 37%.

**CONCLUSIONS:** The influence of BMI on AC is similar to that of WC. Receiver Operating Characteristic (ROC) analysis indicated that a waist circumference of 29 inches is the optimal cut-off score for determining successful completion for either BMI (AUC = .97) or AC (AUC = .93). These data suggest that interventions targeting a reduction in waist circumference or weight loss have the potential to improve performance on health-related fitness tests of aerobic capacity. Recent reports indicating an increase in overweight and obesity among children and adolescents make the development of such interventions even more meaningful for appropriate health-related fitness in youth.

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**1294** Board #75 MAY 30 11:00 AM - 12:30 PM

**School Physical Education Programs And Children's Cardiovascular Fitness Tracking**

Randall A. Nichols, Traci D. Zillifro, Wenhao Liu. *Slippery Rock University, Slippery Rock, PA.*

(No relationships reported)

**PURPOSE:** To compare cardiovascular fitness tracking between children from two different PE programs.

**METHODS:** Participants were 176 children (85 girls) in a PE4life Academy middle school (S1), which was known for its high level of moderate and vigorous physical activity (MVPA) in the PE class, and 118 children (63 girls) in a same-area middle school with a traditional PE program (S2). Two schools were similar in socioeconomic status, race composition (white > 93%), and weekly PE class time (approximately 90 minutes per week). Progressive Aerobic Cardiovascular Endurance Run (PACER) was administered to the cohort at the beginning and end of their middle school period. Spearman rank correlation was used to examine stability of cardiovascular fitness. Further, based on the criteria of FITNESSGRAM Healthy Fitness Zone (HFZ), the cohort was categorized into either an at-risk group or HFZ group, and Chi-square test was used to examine differences in distribution changes in at risk and HFZ between S1 and S2 across the three years. Children's MVPA in the PE class were coded for 25 lessons in each school with System for Observing Fitness Instruction Time and analyzed with one-way MANOVA.

**RESULTS:** PACER correlations were .64 for S1 and .73 for S2 for boys, and were .77 for S1 and .49 for S2 for girls. Chi-square results for boys indicated similar distribution pattern in the two groups between S1 (49.1% in the at-risk group and 50.9% in the HFZ) and S2 (57.1% and 42.9%) at baseline. At the follow-up, however, the patterns became different between S1 (24.5% in the at-risk group and 75.5% in the HFZ) and S2 (81.0% and 19.0%), with  $\chi^2 = 19.86$  and  $p < .001$  in favor of S1. Results for girls were similar. At baseline S1 had 21.6% in the at-risk group and 78.4% in the HFZ, and S2 had 33.3% and 66.7%, respectively. At the follow-up S1 had 29.4% in the at-risk group and 70.6% in the HFZ, and S2 had 61.5% and 38.5%, respectively, with  $\chi^2 = 9.23$  and  $p < .01$  in favor of S1. Further, MANOVA results indicated that children in S1 had significantly larger percentage of PE class time in MVPA than those in S2 ( $p < .001$ ), with  $66.42 \pm 6.50$  vs.  $44.12 \pm 8.79$ .

**CONCLUSIONS:** The PE4life program has much more positive tracking results in children's cardiovascular fitness than traditional PE programs. But Spearman rank correlation alone could not identify or explain the differences.

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**1295** Board #76 MAY 30 11:00 AM - 12:30 PM  
**Physical Activity Incorporated Within Head Start Curriculum Improves Early Literacy In African American Children**

Stacie M. Kirk, Erik P. Kirk. *Southern Illinois University Edwardsville, Edwardsville, IL.*  
(No relationships reported)

**PURPOSE:** To determine the effects of a low cost, teacher directed, minimal intervention program that delivered existing academic lessons taught through physical activity (PA) in Head Start preschools serving African American (AA) children.

**METHODS:** Seventy-two African American children (mean $\pm$ SE, age 3.8 $\pm$ 0.1y) from a low socioeconomic urban Head Start were randomized to Control (CON, n=3 classrooms, n=21, F, n=9 F, M, n=12) or PA (n=4 classrooms, n=51 F, n=29, M, n=22) groups for 6 mo. The PA program was designed to promote 150 min/wk of moderate to vigorous PA academic lessons (3.0-6.0 METS, ~15 min each, 2 lessons/day). Intensity of classroom PA was measured by a SOFIT. Height and weight to determine BMI were obtained using a stadiometer and digital scale. The Get It, Got It, Go Individual Growth and Development Indicators for children ages 3-5y was administered to assess early literacy and phonological awareness in the areas of alliteration and picture naming. All measures were assessed at baseline, 3 and 6 mo.

**RESULTS:** The PA protocol resulted in significantly ( $p < 0.05$ ) greater levels of PA in the classroom during free play at 3 (PA, 8.1 $\pm$ 2.1% vs. CON, -2.2 $\pm$ 2.1%) and 6 (PA, 20.1 $\pm$ 2.1% vs. C, -7.1 $\pm$ 2.1%) mo than children in the CON, resulting in between group differences at 3 and 6 mo,  $p < 0.01$ . The 6 mo change in BMI for the PA group was 2.0 $\pm$ 1.1% and CON 0.8 $\pm$ 0.9%, respectively (NS). Alliteration (letters sounds/two min) significantly ( $p < 0.01$ ) improved in the PA group from baseline (0.4 $\pm$ 0.1) to 3 mo (1.0 $\pm$ 0.4) and was maintained at 6 mo (1.0 $\pm$ 0.4) compared to no change in CON at 3 (0.1 $\pm$ 0.3) and 6 (0.2 $\pm$ 0.4) mo compared to baseline,  $p > 0.05$ , resulting in between group differences at 3 and 6 mo,  $p < 0.01$ . Picture naming (picture per minute) significantly ( $p < 0.01$ ) improved in the PA group from baseline (17.2 $\pm$ 3.5) to 3 (21.7 $\pm$ 5.0) and 6 (24.8 $\pm$ 5.4) mo compared to no improvement in the CON, resulting in between group differences at 3 and 6 mo,  $p < 0.01$ . Higher scores for alliteration and picture naming indicate greater early literacy skills and phonological awareness.

**CONCLUSION:** A low cost, teacher directed, minimal intervention program incorporating PA within Head Start curriculum promotes daily PA, increases early literacy, and attenuate increases in BMI in AA preschool children, a group at an increased risk for poor literacy development and obesity.

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**1296** Board #77 MAY 30 11:00 AM - 12:30 PM  
**Effect of Exercise Training in the Cold on Regional Body Composition in Obese Boys**

Boguslaw Wilk, FACSM, Joyce Obeid, Raymond Trott, Oded Bar-Or, Brian W. Timmons. *McMaster University, Hamilton, ON, Canada.*  
(No relationships reported)

Exercise training in the cold reduces whole body fat mass in obese adolescent boys (Wilk et al 2006).

**PURPOSE:** To determine the effect of exercise training in the cold on regional body composition, substrate utilization, respiratory heat loss (RHL), and energy expenditure (EE) in obese adolescents.

**METHODS:** Twenty obese (>30% body fat) adolescent boys, ages 12 to 16 years, participated in a 6-week (3 times per week) exercise training program. Boys were randomly allocated to train in the cold (COLD; 5 °C, n=10) or a thermoneutral environment (NEUT; 24.5 °C, n=10). Each training session consisted of 3 x 20 min exercise bouts interspersed with 5 min rest performed in a climate chamber. The boys alternated between treadmill walking and cycling (both at 60 % VO<sub>2max</sub>) within each session. Regional body composition was measured before and after the 6-week training program using DXA. Volume, O<sub>2</sub>, CO<sub>2</sub>, and temperature of expired air were measured during exercise at the first (T1) and last (T18) training sessions to assess EE, substrate utilization (fat oxidation (FATox) and carbohydrate oxidation (CHOox)), and RHL. Two-way ANOVAs with between (COLD vs. NEUT) and within (pre- vs. post-training) factors were used ( $p < 0.05$ ).

**RESULTS:** Significant post-training %fat changes were observed for trunk (-1.6 %,  $P = 0.05$ ) and legs (-1.0%,  $P = 0.001$ ) in COLD and for arms in NEUT (-1.2%,  $P = 0.04$ ). Leg lean mass increased 4.6% ( $P = 0.001$ ) in COLD only. FATox was higher and CHOox lower at T18 compared with T1 ( $P < 0.05$ ), with no differences between groups. RHL were higher ( $P = 0.001$ ) in COLD at T1 (1.08 kcal/kg) and T18 (1.04 kcal/kg) compared with NEUT (0.61 and 0.57 kcal/kg at T1 and T18, respectively). Although EE was ~10% higher in COLD compared with NEUT at both T1 and T18, this difference was not statistically significant.

**CONCLUSIONS:** Six weeks of exercise training in the cold induces desirable changes in regional body composition, particularly central adiposity, of obese boys.

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**1297** Board #78 MAY 30 11:00 AM - 12:30 PM  
**Examining Elementary School Students' Motor Skills, Physical Activity, and Health-related Physical Fitness**

Tao Zhang<sup>1</sup>, Ping Xiang<sup>2</sup>. <sup>1</sup>University of North Texas, Denton, TX. <sup>2</sup>Texas A & M University, College Station, TX.  
(No relationships reported)

Promoting motor skills, physical activity (PA), and health-related physical fitness are all critical to our effort to help school-aged students live physically active lifestyles. Therefore, understanding their interrelationships is considered a research priority. While considerable research has examined PA in relation to students' health-related physical fitness, research on the relationships among students' motor skills, in-class PA and physical fitness has been scarce.

**PURPOSE:** The purpose of this study was to investigate the relationships among motor skills, in-class PA, and health-related physical fitness among elementary school students in physical education (PE).

**METHODS:** Participants were 104 fourth and fifth grade students (45 girls and 59 boys; M age = 11.0). They completed motor skills in basketball, overhand throwing, and striking assessed by PE Metrics TM (NASPE, 2010). Students' PA across three PE lessons was measured by Actical accelerometers (Mini-Mitter Co., Inc., Bend, OR). Health-related physical fitness was assessed by FITNESSGRAM® (Cooper Institute, 2007), including Progressive Aerobic Cardiovascular Endurance Run, curl-ups, push-ups, height and weight (calculating BMI), trunk lift, and sit-and-reach tests. The total number of fitness tests in which students achieved the Healthy Fitness Zone was calculated and used as an overall measure of physical fitness.

**RESULTS:** There were positive relationships among basketball, overhand throwing, and striking. Basketball was positively associated with in-class PA. Health-related physical fitness was positively correlated with basketball, striking, and in-class PA. Two regression analyses indicated basketball and overhand throwing were significant predictors of students' in-class PA ( $R^2 = 6.3\%$ ;  $\beta = .22, -.24$ , respectively, all  $p < 0.05$ ). The basketball skill emerged as a significant predictor of students' physical fitness ( $R^2 = 4.7\%$ ;  $\beta = .22, p < 0.05$ ).

**CONCLUSION:** These results provided empirical evidence on relationships among students' motor skills, PA, and health-related physical fitness. Given the small predictive strength of motor skills in this study, additional investigation is needed to further examine the dynamic relationships among motor skills, PA, and health-related physical fitness.

## A-31 Free Communication/Poster - Clinical Exercise Physiology Cardiovascular (Clinical Exercise Physiology Association)

MAY 30, 2012 7:30 AM - 12:30 PM  
ROOM: Exhibit Hall

1298 Board #79 MAY 30 9:30 AM - 11:00 AM

### Blind Reading Of Anaerobic Threshold (AT) To Detect Changes In Exercise Tolerance

Kazuo Kondou<sup>1</sup>, Hirotaka Nishijima<sup>1</sup>, Namiko Horigome<sup>1</sup>, Oukusa Takanori<sup>1</sup>, Kazuya Yonezawa<sup>2</sup>, Masayuki Sakurai<sup>1</sup>. <sup>1</sup>Hokko Memorial Hospital, Sapporo, Japan. <sup>2</sup>National Hospital Organization Hakodate Hospital, Hakodate, Japan.  
(No relationships reported)

**PURPOSE:** Although AT is a useful measure of exercise tolerance (ET), it has a drawback of requiring an evaluator, a source of subjectivity. This study was done to assess the AT by blind reading to detect changes in ET.

**METHODS:** The records of 166 patients who underwent cardiopulmonary exercise testing (CPX) during cardiac rehabilitation (CR) were retrospectively reviewed. CR was hospital (the mean of 3.1/mo) and home based. The mean time elapsed between the 1st and 2nd tests was 135(SD:29) days. The mean age was 64(11), with 143 males and 23 females. The underlying heart disease was mainly ischemic: post myocardial infarction in 95 and angina in 39. CPX was done using an upright bicycle with a breath-by-breath apparatus. The exercise was submaximal, which was mostly terminated with an appearance of AT or target heart rate. CPX records were erased of their ID's and coded by the controller. AT was read by 2 independent experienced investigators(A,B) based on the Wasserman's criteria.

**RESULTS:** The table below shows the mean(SD).

| CR   | Wt(kg)     | HR(b/min) at highest workload | Borg scale (/20) | VO2 at highest workload (ml/min/kg) | AT(ml/min, VO2) by A | AT(ml/min, VO2) by B |
|------|------------|-------------------------------|------------------|-------------------------------------|----------------------|----------------------|
| Pre  | 66.1(10.9) | 111(22)                       | 13.2(1.6)        | 14.6(3.5)                           | 670(217)             | 706(194)             |
| Post | 66.7(10.9) | 117(18)                       | 13.6(1.7)        | 17.0(4.1)                           | 721(251)             | 752(204)             |
| p    | 0.006      | 0.958                         | 0.012            | <0.0001                             | 0.0004               | 0.0001               |

The investigator A did not detect AT in 21.7% and B in 14.5%. About 2/3 of these cases had a R<1.0 at the highest workload, suggesting a workload below AT. Although the pre-and post-CR AT values read by the investigators A and B were clearly different (p<0.001), the mean pre-post difference in AT detected by each was remarkably similar (51(161) vs 46(140) ml/min in VO2, ns). We speculated that since the entire portion of the v-slope would shift to the right with training, any identifiable deflection point on it would equally shift in parallel

**CONCLUSIONS:** Despite differing AT readings at pre-and post-rehabilitation by the 2 independent investigators, the mean absolute difference (improvement) did not differ between the 2.

1299 Board #80 MAY 30 9:30 AM - 11:00 AM

### Effect Of An Exercise-based Cardiac Rehabilitation Program On Arterial Stiffness In Post Myocardial Infarction Patients

Norton Luis Oliveira<sup>1</sup>, Fernando Ribeiro<sup>2</sup>, Alberto Jorge Alves<sup>1</sup>, Fátima Miranda<sup>3</sup>, Marlene Fonseca<sup>3</sup>, Lilibeth Campos<sup>3</sup>, Madalena Teixeira<sup>3</sup>, José Oliveira<sup>1</sup>. <sup>1</sup>University of Porto, Faculty of Sport, Porto, Portugal. <sup>2</sup>CESPU, Polytechnic Health Institute of the North, Gandra PRD, Portugal. <sup>3</sup>Centro Hospitalar de Gaia/Espinho, Vila Nova de Gaia, Portugal.  
(No relationships reported)

The arterial stiffness, assessed by pulse wave velocity (PWV), has been showed to be an independent cardiovascular risk marker in several clinical conditions. Exercise seems to be an effective intervention in decreasing PWV in several chronic diseases, although few studies exist in post myocardial infarction (MI) patients

**PURPOSE:** To determine the effect of an exercise-based cardiac rehabilitation program on PWV in post MI patients.

**METHODS:** Twenty-four male and 2 female patients, mean (±SD) age 60.1 ± 10.5 years, after an acute myocardial infarction were randomized to either an 8-week exercise-based cardiac rehabilitation program (EG) or to a control group, which underwent only usual medical care (CG). Complete randomization was performed by choosing one of two sealed envelopes. The EG participated in an 8-week programme comprising 3 exercise sessions per week. Each exercise session included 10 minutes of warm-up, 35 minutes of aerobic exercise on a cycloergometer or treadmill, and 10 minutes of cool-down. The exercise intensity was calculated as 65-75% of maximal heart rate achieved in the exercise test. Outcome measures included changes in PWV, evaluated by applanation tonometry, and peak oxygen consumption (VO2). Group comparisons were made using two-way ANOVA with repeated measures.

**RESULTS:** Age (EG - 63 ± 9.4 vs. CG - 57 ± 11.2 years), PWV (EG - 9.2 ± 2.3 vs. CG - 8.2 ± 2.5 m/s) and VO2 (EG - 26.4 ± 6.6 vs. CG - 28.2 ± 5.4 ml/kg/min) were not significant different at baseline (p>0.05). Moreover, patients did not change their medication in the study period. The main effect of cardiac rehabilitation for PWV was significant (F 1.24 = 5.4) indicating a decrease in EG (8.2 ± 2.0 m/s, p0.05). The main effect was also significant for VO2 (F 1.24 = 6.6) with an average increase of 3.4 ml/kg/min in EG (29.8 ± 8.1 ml/kg/min, p<0.05) and no significant change in CG (28.5 ± 6.1 ml/kg/min).

**CONCLUSIONS:** Exercise-based cardiac rehabilitation decreases systemic arterial stiffness in post MI patients. Therefore, this could be one of the mechanisms associated with the positive outcome (i.e., mortality rates) on post MI patients who undergo rehabilitation.

ClinicalTrials.gov Identifier: NCT01432639

Supported by the following grants from The Portuguese Fundação para a Ciência e a Tecnologia (FCT): SFRH/BD/48875/2008 and PTDC/DES/113753/2009

1300 Board #81 MAY 30 9:30 AM - 11:00 AM

### Double Product Based on Heart Sounds as a Marker of Catecholamines During Exercise

Takuro Matsuda<sup>1</sup>, Yasuki Higaki<sup>1</sup>, Akira Kiyonaga<sup>1</sup>, Shigeru Obara<sup>2</sup>, Hiroaki Tanaka<sup>1</sup>. <sup>1</sup>Fukuoka University, Fukuoka, Japan. <sup>2</sup>The University of Tokushima, Tokushima, Japan.  
(No relationships reported)

**PURPOSE:** It is well documented that exercise-induced adrenergic stimulation enhances myocardial contractility in healthy humans. The break-point of the double product of heart rate (HR) and systolic blood pressure, which is a marker of cardiac oxygen demands, is strongly correlated with the epinephrine (Ep) threshold. The amplitude of the first sound (HS1) is a marker of cardiac contractility, which is a major determinant of cardiac oxygen demand and is easy to determine continuously during exercise. This study investigated the relationship between the double product (DP) based on heart sounds and Ep level.

**METHODS:** Twelve subjects, with a mean±SD age of 22±3 years and a mean±SD BMI of 23.1±3.5 kg/m<sup>2</sup>, underwent graded cycle ergometer testing. The work rate started at 15 watts and then increased at 15 watts every 2 min until the heart rate reached 85% of its maximum expected for their age. The heart sounds were collected in a personal computer via an A/D converter throughout the exercise test. Blood from the antecubital vein was sampled and Ep levels were measured every 2 min during the test. Values of the DP were calculated by the formula HR×HS1. The break-point of DP (DPBP) and Ep threshold were determined based on a visual inspection three separate times and the mean value was calculated.

**RESULTS:** The DP was significantly correlated with Ep levels in all subjects during incremental exercise (r=0.97 to 0.99, p<0.001). A clear DPBP and Ep threshold were obtained in all subjects (DPBP: 84.6±13.9 watts; Ep threshold: 83.5 ±19.5 watts) and they were not statistically significant from each other (p=0.877).

**CONCLUSIONS:** The DP from heart sounds is a valid marker of the sympathetic nerve system during exercise stress. Monitoring heart sounds appears to provide valuable information related to the level of exercise stress. This information may be useful when determining an appropriate exercise prescription.

This work was supported by the Ministry of Education, Culture, Sports, Science, and Technology, Japan (No. 22300240 and Strategic Research Infrastructure No. 0801083), a grant from GFP at Fukuoka University.

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**1301** Board #82 MAY 30 9:30 AM - 11:00 AM

**Is Cardiorespiratory Fitness, Muscular Fitness or Physical Activity Related to Diabetes Risk in Postmenopausal Women?**

Judith A. Flohr, Elizabeth S. Edwards, Layne E. Eidemiller, Christine M. Nicewonger, Christopher J. Womack, FACSM. *James Madison University, Harrisonburg, VA.*

*(No relationships reported)*

**PURPOSE:** The purpose of this study was to examine the independent and joint associations of upper and lower body muscular strength (MS), cardiorespiratory fitness (CRF), and physical activity (PA) with the prevalence of Type 2 diabetes mellitus (T2DM) in a group of sedentary healthy postmenopausal women.

**METHODS:** Thirty-five postmenopausal (age  $57.9 \pm 4.7$  yrs.) women completed a graded exercise test on a treadmill to determine maximum relative oxygen consumption ( $VO_{2max}$ ) and the International Physical Activity Questionnaire (IPAQ) to estimate MET minutes/week of PA. Waist circumference (WC), body fat via DXA (BF), height, weight, 5RM leg press and chest press were measured and used to estimate 1RM. These 1RM values were then divided by body weight, yielding ratios for leg press (LP) and chest press (CP). All participants had blood drawn and analyzed for HbA1c (A1c). Bivariate Pearson's correlations were used to identify variables that were associated with A1c. Stepwise regression was then used to identify variables that significantly predicted A1c.

**RESULTS:** The average A1c was 5.9%. Both LP ( $r = -0.344, p = .043$ ) and CP ( $r = -0.414, p = .013$ ) were significantly associated with A1c, but neither  $VO_{2max}$  nor IPAQ were significantly correlated with A1c. In the regression model, only LP significantly predicted A1c,  $b = -0.57, t(33) = -2.61, p = .013$ . LP explained a significant proportion of the variance in A1c,  $R^2 = 0.17, F(1, 33) = 6.84, p = .013$ .

**CONCLUSIONS:** Previous studies have reported an inverse relationship among CRF, PA, MS and T2DM in men. There is limited data available describing the relationship between MS and A1c in postmenopausal women. However, recent reports suggest that muscle mass may play a significant role in glycemic control. The results of the present study indicate that muscular strength as measured by LP and CP were related to A1c. Therefore, efforts to increase muscle strength in postmenopausal women in an attempt to lower diabetes risk appear to be warranted.

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**1302** Board #83 MAY 30 9:30 AM - 11:00 AM

**The Effects Of Aerobic Training In The Patients With Heart Failure**

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*(No relationships reported)*

**PURPOSE:** Aerobic training can improve not only aerobic capacity but also symptoms and survival rate in patients with heart failure (CHF). The purposes of our study will test the effects of exercise training on aerobic capacity, heart rate, blood pressure, cardioutput, body composition, serum lipid and NT-proBNP (aminoterminal fragment brain natriuretic peptide prohormone) in CHF patients, and examine the potential benefit of changes over time.

**METHODS:** The samples consisted of 13 eligible cases with heart failure. Seven of them completed 12-week exercise program (30 minutes a day, 3 days a week, at 60% peak oxygen uptake ( $VO_{2peak}$ )). Every 4 weeks training, heart rate, blood pressure, body composition, serum lipid and NT-proBNP were measured after an overnight fast. Besides,  $VO_{2peak}$  and cardioutput were measured at pre-training and post-training.

**RESULTS:** After 12-week exercise training program, seven cases completed the process. The results indicate that the parameters of cardiopulmonary capacity were all significant improved. The  $VO_{2peak}$  was improved from  $20.30 \pm 5.30$  to  $22.49 \pm 4.36$  ml/kg/min ( $p = .002$ ). The maximal metabolic equivalent (MET) was improved from  $5.76 \pm 1.55$  to  $6.37 \pm 1.31$  METs ( $p = .0001$ ). The maximal work load was improved from  $220.43 \pm 76.39$  to  $276.57 \pm 75.91$  Watt (W) ( $p = .029$ ). Although it was not significant, diastolic pressure and systolic pressure were improved over training time. Meanwhile, after 12-week training, static cardioutput was not significant changed, but dynamic cardioutput was significant improved (increased  $2.37$  ml/min  $p = .015$ ). However, total cholesterol and NT-proBNP did not decreased significantly. But the more time of exercise training they received, the more they improved.

**CONCLUSION:** It is concluded that aerobic exercise training could improve cardiopulmonary capacity, static heart rate, blood pressure, cardioutput, body composition, serum lipid and NT-proBNP in heart failure patients. The results also proved the effects of aerobic exercise for heart failure patients could be accumulated over time. Therefore, provide precise exercise prescriptions and educate them how to do the adequate aerobic exercise training are very important to patients with heart failure.

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**1303** Board #84 MAY 30 9:30 AM - 11:00 AM

**Heart Rate Variability is Reduced at Peak Exercise in Individuals at Risk for Sleep Apnea**

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*(No relationships reported)*

Obstructive sleep apnea (OSA) is a sleep disorder that significantly increases risk for hypertension, cardiovascular disease (CVD) and diabetes, among others. OSA leads to dysfunction in the autonomic regulation of the cardiovascular system, a primary mediating factor in the increased risk for chronic disease. Heart rate variability (HRV) has been widely used for assessing autonomic function, and has been shown to be predictive of CVD and all-cause mortality at rest and during exercise. HRV has been shown to be reduced in OSA at rest, but to date, no studies have examined exercise HRV in individuals diagnosed with, or at high risk for, OSA.

**PURPOSE:** To examine the HRV responses during exercise in individuals identified as high risk for OSA.

**METHODS:** Nine (6 male, 3 female) obese subjects (BMI: Mean SD =  $33.3 \pm 6.4$  kg/m<sup>2</sup>; age =  $47.4 \pm 8.2$  yr) at risk for OSA (OSA) and 16 (6 male, 9 female) obese subjects (BMI =  $32.5 \pm 4.9$ ; age =  $28.7 \pm 10.3$ ) at low risk for OSA (Control) performed maximal cycle ergometer exercise tests utilizing a 20 watts/min ramp protocol. HRV was assessed at rest, during exercise and immediately post-exercise. Measures of time and frequency domain HRV were obtained. HRV variables were log transformed and converted into normalized units for statistical analysis. Risk for OSA was established through a screening result from an at-home sleep assessment device (Embletta).

**RESULTS:** The OSA group was significantly older than the control group ( $P < 0.001$ ). Body mass index, blood pressure, resting heart rate, and  $VO_{2peak}$  did not differ between groups. After controlling for age and gender, peak exercise (last two minutes of exercise) log total power ( $0.74 \pm 0.2$  vs.  $1.5 \pm 0.2$  ms<sup>2</sup>), log low frequency ( $-0.47 \pm 0.3$  vs.  $0.31 \pm 0.2$ ), log high frequency ( $-0.92 \pm 0.3$  vs.  $0.27 \pm 0.2$ ), normalized low frequency ( $1.03 \pm 0.5$  vs.  $3.03 \pm 0.4$ ), and normalized high-frequency ( $0.60 \pm 0.5$  vs.  $3.00 \pm 0.4$ ) were reduced in the OSA group ( $P < 0.05$ ). No differences were noted in time domain variables at peak exercise. Resting, submaximal exercise or recovery HRV variables (time or frequency domain) did not differ.

**CONCLUSION:** Results suggest that individuals at high risk for probable OSA display abnormal autonomic modulation of heart rate during peak exercise. Exercise HRV may be a useful tool for improving risk assessment in OSA, but needs further examination.

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**1304** Board #85 MAY 30 9:30 AM - 11:00 AM

**Early Oxygen Uptake Response to Constant Work Exercise and Mortality in Men**

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*(No relationships reported)*

The blunted pulmonary oxygen uptake ( $VO_2$ ) response to constant work exercise is associated with a poor prognosis in congestive heart failure patients but no previous study has addressed this issue in asymptomatic subjects.

**PURPOSE:** To study the association between a blunted VO<sub>2</sub> increase during the first 30 s of the constant work exercise in cycle ergometer and the risk of cardiovascular death in cardiovascularly healthy middle-aged men.

**METHODS:** The subjects were 484 men, 54-56 years of age, from eastern Finland without cardiovascular disease or cancer at baseline. VO<sub>2</sub> response to constant work exercise at 50 Watts in cycle ergometer was quantified by calculating the average net VO<sub>2</sub> during the first 30 s of exercise (VO<sub>2</sub>30) in proportion to the average net VO<sub>2</sub> at steady state (VO<sub>2</sub>ss, the average net VO<sub>2</sub> during the third minute of exercise). The association of VO<sub>2</sub> response with the risk of cardiovascular death was examined with multivariable Cox proportional hazards' regression model. A total of 52 cardiovascular deaths were observed during an average follow-up of 19.8 years.

**RESULTS:** The average net VO<sub>2</sub> during the first 30 s of exercise in proportion to the average net VO<sub>2</sub> at steady state was not related to the risk of cardiovascular death. In Cox-multivariable model, the risk of death increased 8% (95% CI -19-43, p=0.58) for a 1-SD (0.19) increment in VO<sub>2</sub>30/VO<sub>2</sub>ss after adjustment for myocardial ischaemia during exercise test, cigarette smoking, systolic blood pressure at rest, and body mass index.

**CONCLUSION:** An attenuated early VO<sub>2</sub> response during the first 30 s of constant work exercise does not predict cardiovascular death in cardiovascularly healthy middle-aged men. While submaximal testing itself offers certain advantages, the early VO<sub>2</sub> response can not be utilized for prognostic assessment in healthy men.

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**1305** Board #86 MAY 30 9:30 AM - 11:00 AM

**Blood Flow Restriction Increases Angiogenic Gene Expression in Skeletal Muscle following Acute Resistance Exercise**

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(No relationships reported)

Blood flow restriction (BFR) potentiates the effects of low-intensity resistance exercise on skeletal muscle size and strength. However, evidence is sparse regarding the effects of BFR exercise on vascular adaptations within the skeletal muscle.

**PURPOSE:** To evaluate the effects of BFR on post-exercise expression of angiogenesis-related mRNAs.

**METHODS:** Using a randomized cross-over design, six healthy young adults (n=3 men, n=3 women, 22±1 years) performed on separate occasions low-intensity exercise with and without BFR. Each exercise bout entailed 120 repetitions of single-limb knee extensor exercise at 40% of 1RM maximum. The BFR condition was performed with an external pressure cuff inflated to 220 mm Hg. Near-infrared spectroscopy (NIRS) was utilized to measure oxygenation of the vastus lateralis during exercise. Skeletal muscle samples were collected via percutaneous biopsy prior to, 4 hours following, and 24 hours following exercise. Skeletal muscle mRNA expression was determined using standard Q-PCR techniques and normalized to GAPDH. NIRS data were analyzed using paired Student's *t*-tests and Q-PCR data were analyzed using the Wilcoxon's test.

**RESULTS:** BFR (45.3±2.4%) decreased tissue oxygenation during the exercise bout compared to control exercise (59.7±2.9%, p=0.028). This was reflected in a significant increase in total Hb (14.4±2 vs. 0.9±2, p=0.010) that was driven largely by an increase in deoxygenated Hb. BFR increased (p<0.05) mRNA expression of vascular endothelial growth factor (VEGF), VEGF-R2, hypoxia inducible factor alpha (HIF1α), inducible nitric oxide synthase (NOS), and neuronal NOS. The most notable change in response to BFR was an increase in VEGF mRNA expression at 4 hours post-exercise (4.1±0.6 vs. 0.6±0.2 fold change, p=0.028). Muscle mRNA expression of endothelial NOS was not altered in response to BFR (p>0.05).

**CONCLUSIONS:** Acute BFR increases post-exercise expression of mRNA related to skeletal muscle angiogenesis.

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**1306** Board #87 MAY 30 9:30 AM - 11:00 AM

**Effect Of Training With Blood Flow Restriction Of The Thigh Muscles In Men**

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(No relationships reported)

Training with vascular restriction lately receives more attention since less percentage of 1 RPM seems necessary for gaining strength.

**PURPOSE:** The aim of this study was to find out whether training with 40 % of 1 RPM leads to more strength with blood flow restriction than without.

**METHODS:** 14 men aged 27 ± 2.8 years and a BMI of 26 kg/m<sup>2</sup> took part in this study. Initially, the strength of the quadriceps and the hamstrings was measured on an isokinetic system isometrically in 60° and 30° positions respectively, isokinetic strength at 60°/s and strength endurance at 120°/s with 25 maximal intensity movements.

Training was conducted for 8 weeks, twice a week for 35 minutes according to the endurance method with 3 sets and 20 repetitions. The right side was always trained under vascular occlusion and both sides at 40 % of 1 RPM. Each leg was trained separately in an alternating mode.

**RESULTS:** Maximal isometric force of flexion rose from 60 ± 26 to 70 ± 35 Nm (p < 0.001), while it remained constant in the control leg with 58 ± 27 and 57 ± 23 Nm. The extension rose from 82 ± 20 to 94 ± 19 Nm (p<0.001) and dropped in the control leg from 79 ± 21 to 78 ± 24 Nm. During isokinetic flexion, an increase from 106 ± 22 to 124 ± 24 Nm (p<0.01) occurred and in the control leg from 98 ± 22 to 114 ± 24 Nm. During isometric flexion an increase from 198 ± 27 to 219 ± 34 Nm (p < 0.001) and also in the control leg from 201 ± 30 to 210 ± 24 Nm (p < 0.005). The endurance measurement resulted in no increase. The compliance was 83 %.

**CONCLUSION:** Training with vascular restriction is especially effective for increasing the isometric maximal strength to a lesser degree for the isokinetic maximal strength and without an effect on the endurance of the quadriceps and the hamstrin

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**1307** Board #88 MAY 30 9:30 AM - 11:00 AM

**Heart Rate Index Prediction Of Maximal Oxygen Consumption In Pediatrics During The James Cycle Protocol**

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(No relationships reported)

**PURPOSE:** To evaluate the utility of two versions of heart rate index (HRindex) based on supine and sitting resting heart rates as predictors of maximal oxygen consumption in pediatric patients with structurally normal hearts.

**METHODS:** We evaluated 637 pediatric patients (mean age 13.8 ± 3.2 years, 354 males) with maximal graded exercise testing utilizing the James cycle ergometer protocol. Two versions of HRindex were calculated by dividing the maximal heart rate by the heart rate (HR) in the resting supine (SupHRindex) and sitting (SitHRindex) positions. Predicted maximal METS (EstMMETS) was generated by the line equation of 6 times the maximal HRindex minus 5 using both the supine HR(SupEstMMETS) and the sitting HR (SitEstMMETS) .

**RESULTS:** Both SupHRindex and SitHRindex were significantly correlated to maximal oxygen consumption (MVO<sub>2</sub>) (r=0.45 and r=0.43, p<0.0005), maximal indexed oxygen consumption (MIVO<sub>2</sub>) (r=0.25 and r=0.31, p<0.0005) and maximal metabolic equivalents (MaxMETs) (r=0.25 and r=0.31, p<0.0005). There was a significant correlation between MaxMETs and SupEstMMETS and SitEstMMETS (10.4 ± 2.2 vs 11.1 ± 3.0 r=0.25, p<0.0005 and 10.4 ± 2.2 vs 9.3 ± 2.6 r=0.31, p<0.0005, respectively). However, the absolute values of MaxMETs versus SupEstMMETS and MaxMETs versus SitEstMMETS were significantly different (p<0.0005).

**DISCUSSION:** There was a significant correlation between HR index calculated using either the supine or sitting resting heart rate and MVO<sub>2</sub>, MIVO<sub>2</sub> and MaxMETs. However, the correlation was weak and provided little predictive value for MVO<sub>2</sub>, MIVO<sub>2</sub> and MaxMETs. This lack of predictive robustness was demonstrated by the significant difference seen in absolute values for MaxMETs compared to both SupEstMMETS and SitEstMMETS.

**CONCLUSION:** The predictive power of the heart rate index utilizing either the supine or sitting resting heart rate for the calculation is limited in pediatric patients. Future research should focus on a multivariable predictive model that identifies the sources of variability in the correlational relationship of heart rate index and maximal oxygen consumption.

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1308 Board #89 MAY 30 9:30 AM - 11:00 AM

### Ventilatory Efficiency Is Not Associated With Acsm Heart Disease Risk Factors In Asymptomatic Obese Adults

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(No relationships reported)

Graded exercise tests (GXT) are administered to symptomatic heart failure patients as a diagnostic and prognostic assessment of mortality. GXT's provide an assessment of functional capacity ( $VO_{2peak}$ ) and ventilatory efficiency ( $V_E/VCO_2$  slope) and both outcomes are predictive of patient mortality. However, the  $V_E/VCO_2$  slope has been shown to be a stronger predictor than  $VO_{2peak}$  for heart disease severity. The American College of Sports Medicine (ACSM) has established several cardiovascular disease risk factors for determining the risk for cardiac disease in asymptomatic adults.

**PURPOSE:** This study evaluated the relationship between the  $V_E/VCO_2$  slope,  $VO_{2peak}$ , and the total ACSM heart disease risk factors in asymptomatic obese adults.

**METHODS:** 29 obese adults free of heart disease (Mean  $\pm$  SE; Age  $46.5 \pm 2.6$  years; BMI  $35.9 \pm 1.1$  kg/m<sup>2</sup>) were stratified into low (LR <2 risk factor) or moderate risk (MR  $\geq 2$  risk factors) using ACSM's Logic Model from self reported health history questionnaires. Each subject performed a treadmill GXT at a constant speed of 3.5 mph with 2.5% grade increase every 2 minutes. LR exercised to volitional fatigue and MR until achieving 6 METS, or 76% predicted heart rate maximum.  $V_E/VCO_2$  slope was determined as the rise in  $V_E$  (L·min<sup>-1</sup>·BTSP) to the increase in  $VCO_2$  (L·min<sup>-1</sup>·STPD) throughout the entire exercise session.

**RESULTS:** There were no significant differences in ventilatory efficiency between risk groups (LR  $30.9 \pm 0.9$ , MR  $28.6 \pm 1.4$   $V_E/VCO_2$  slope). There were group differences in  $VO_{2peak}$  (LR  $33.9 \pm 3.4$ , MR  $19.7 \pm 0.9$  ml·kg<sup>-1</sup>·min<sup>-1</sup>) and total risk factors (LR  $1.0 \pm 0.0$ , MR  $3.0 \pm 0.25$ ).  $V_E/VCO_2$  slope was not associated with total risk factors ( $p = 0.12$ ,  $r = -0.288$ ) or final risk category ( $p = 0.17$ ,  $r = -0.258$ ).  $VO_{2peak}$  was associated with total risk factors ( $p = 0.00$ ,  $r = -0.614$ ) and final risk category ( $p = 0.00$ ,  $r = -0.665$ ). Exercise test and exercise duration were not associated with  $V_E/VCO_2$  slope.

**CONCLUSIONS:** Ventilatory efficiency, which has been shown to predict severity of heart disease in symptomatic adults, was not associated with total ACSM heart disease risk factors in this group of asymptomatic obese adults. Our results suggest that  $VO_{2peak}$  is inversely related to heart disease risk in asymptomatic obese adults.

1309 Board #90 MAY 30 9:30 AM - 11:00 AM

### Classical End-criteria With Impact On Maximal Oxygen Uptake In A Population

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(No relationships reported)

During a maximal exercise test, the subjects' motivation and effort are important requirements to ensure valid and reliable results. Classical end criteria are a plateau in  $VO_2$ , high RER, HR, [blood lactate] and ratings of perceived exertion. However, there is currently no consensus for the assessment of maximal effort and different end criteria may have an impact of the results.

**PURPOSE:** to describe classical end criteria during a maximal progressive exercise test in a random sample of 20 - 85 year old population, and to explore if changes in end criteria have an impact on  $VO_{2max}$ .

**METHODS:** A sample of 839 individuals (412 women), with a mean age of 51.0 (SD  $\pm 14.8$ ) performed a progressive exercise test on a treadmill to voluntary exhaustion. Gas exchange, heart rate, [blood lactate] and BORG scale<sub>6,20</sub> was measured. A plateau in  $VO_2$  was defined by levelling off despite increase in ventilation at maximal power. Different end criteria were used to study the impact on  $VO_{2max}$ , such as RER  $\geq 1.15$  and [blood lactate]  $\geq 8$  mmol·L<sup>-1</sup>.

**RESULTS:** There were no sex related differences in HR<sub>max</sub>, RER or BORG scale, while the [blood lactate] was significantly lower in women. When using RER  $\geq 1.15$  and [blood lactate]  $\geq 8.0$  mmol·L<sup>-1</sup>,  $VO_{2max}$  increased on average by 4.5 % and 11 %, respectively, compared to using only voluntary exhaustion. Furthermore, a [blood lactate]  $\geq 8.0$  mmol·L<sup>-1</sup> excluded 65 % of the participants in the 50 - 85 year cohort (424 vs 148 respectively).

**CONCLUSIONS:** A range of typically end criteria are presented in a healthy population. Choice of end criteria during exercise testing will have an impact on  $VO_{2max}$ . This shows the importance of maximal effort to ensure valid and reliable results.

| End criteria variables after voluntary exhaustion in healthy men and women age 20-85 years |            |            |            |            |            |            |
|--|------------|------------|------------|------------|------------|------------|
|  | Age (year) |            |            |            |            |            |
|  | 20-29      | 30-39      | 40-49      | 50-59      | 60-69      | 70-85      |
| Number   | 76         | 143        | 197        | 180        | 161        | 83         |
| $VO_{2max}$ (ml/kg/min)  | 44.9 (9.9) | 41.8 (9.2) | 37.7 (9.3) | 33.7 (7.0) | 30.3 (6.8) | 25.8 (6.5) |
| $VO_2$ leveling off (n)  | 29 (38%)   | 48 (34%)   | 75 (38%)   | 72 (40%)   | 55 (34%)   | 18 (22%)   |
| HR <sub>max</sub> (beat·min <sup>-1</sup> )  | 191 (7.9)  | 187 (8.8)  | 180 (12.5) | 171 (13.0) | 162 (14.7) | 152 (15.9) |
| RER ( $vCO_2/vO_2$ )   | 1.22 (0.1) | 1.22 (0.1) | 1.19 (0.1) | 1.17 (0.1) | 1.15 (0.1) | 1.10 (0.1) |
| [BLa] (mmol·L <sup>-1</sup> )  | 10.9 (2.6) | 11.3 (2.9) | 10.0 (3.1) | 8.4 (2.8)  | 7.0 (2.6)  | 5.7 (2.4)  |
| BORG scale   | 17.8 (1.3) | 17.8 (1.3) | 17.3 (1.6) | 17.3 (1.4) | 17.1 (1.6) | 17.1 (1.4) |

1310 Board #91 MAY 30 9:30 AM - 11:00 AM

### Maximal Strength Training Enhances Functional Performance in Chronic Stroke Patients

Tor Ivar Gjellesvik<sup>1</sup>, Tessa R. Hill<sup>2</sup>, Per Marius R. Moen<sup>2</sup>, Tom Tørhaug<sup>2</sup>, Marius S. Fimland<sup>2</sup>, Jan Helgerud<sup>2</sup>, Jan Hoff<sup>2</sup>. <sup>1</sup>St.Olav University Hospital, Trondheim, Norway. <sup>2</sup>Norwegian University of Science and Technology, Trondheim, Norway.  
(No relationships reported)

Physical impairment after stroke has been shown to have an immense impact on the reintegration of patients into society and can affect their quality of life. Muscle strength has been shown to be a significant contributor to physical disability (more than the loss of dexterity) after stroke. It is therefore assumed that by increasing a patient's muscle strength, functional everyday tasks will become easier.

**PURPOSE:** This study aimed to demonstrate that maximal strength training improves muscle strength, and to assess the effect on functional measures and walking economy amongst chronic stroke survivors.

**METHODS:** Baseline control trial. 10 patients acted as their own controls for 4 weeks, prior to an 8-week training intervention. Patients trained 3 days/week, 4 sets of 4 repetitions at 85-95% one repetition maximum in unilateral leg press and plantarflexion with an emphasis on maximal mobilization of force in the concentric phase.

**RESULTS:** Post training, leg press strength improved by 30.6kg (75%) and 17.8kg (86%), and plantarflexion strength by 35.5kg (89%) and 28.5kg (223%) for the unaffected and affected limbs respectively (all  $p=0.005$ ). The 6-minute walk test improved by 13.9m ( $p=0.007$ ) and the Timed Up and Go test time by 0.6 seconds ( $p=0.028$ ). No changes were observed in the control period. There were no significant changes in walking economy, peak aerobic capacity, Four square step test or health related quality of life post training.

**CONCLUSIONS:** Chronic stroke patients could benefit from maximal strength training as it generates large increases in strength and some improvements in functional measures.

1311 Board #92 MAY 30 9:30 AM - 11:00 AM

**Enhanced External Counter Pulsation Improves Endothelial Function in Patients With Left Ventricular Dysfunction**

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(No relationships reported)

**PURPOSE:** Enhanced external counterpulsation (EECP) improves arterial function, exercise tolerance, and angina symptoms in patients with coronary artery disease (CAD) and normal LV function. To date, however, studies have not elucidated the mechanism of action and the overall effects of EECP therapy in patients with LV dysfunction. The purpose of this study was to investigate the effects of EECP on endothelial function in peripheral muscular conduit arteries in patients with LV dysfunction.

**METHODS:** Patients with ischemic etiology of LV dysfunction (EF < 40%; n = 9), and age-matched patients with symptomatic CAD and normal LV function (n = 13), were studied after 35 1-hr sessions of EECP. Flow-mediated dilation of the brachial (bFMD) and femoral (fFMD) arteries was performed using high-resolution ultrasound imaging.

**RESULTS:** EECP treatment improved comparably (p > 0.05 between groups) the following FMD parameters in both the CAD and LV dysfunction groups, respectively: absolute bFMD (0.213 to 0.325 and 0.226 to 0.385 mm); relative bFMD (4.12 to 6.16 and 4.18 to 7.26 %); bFMD normalized for shear during the first 10 sec after cuff release (0.185 to 0.313 and 0.191 to 0.307 mm); absolute fFMD (0.198 to 0.264 and 0.194 to 0.226 mm); relative fFMD (2.77 to 3.66 and 2.73 to 3.19 %); fFMD normalized for shear (0.198 to 0.264 and 0.194 to 0.226 mm). EECP treatment also improved comparably (p > 0.05 between groups) plasma levels of the stable nitric oxide metabolites nitrate and nitrite (NOx) in both the CAD (19.4 to 30.1 μmol/L) and LV dysfunction (22.0 to 28.2 μmol/L) groups.

**CONCLUSIONS:** EECP treatment improves brachial and femoral artery endothelial function, and NOx levels similarly in patients with CAD possessing normal LV function and in patients with LV dysfunction. Our data suggest that peripheral vascular adaptations may be the specific mechanisms responsible for the beneficial clinical effects of EECP in patients with LV dysfunction.

1312 Board #93 MAY 30 9:30 AM - 11:00 AM

**Evidence Of Reverse Left Ventricular Remodelling Following Exercise Training In Post-Myocardial Infarction Patients.**

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(No relationships reported)

Raised serum NT-proBNP concentration is indicative of hemodynamic compromise following myocardial infarction (MI) and also in chronic heart failure (CHF). A reduction in NT-proBNP is evidence of successful treatment and may also indicate reverse left ventricular (LV) remodelling. Cardiac rehabilitation exercise training has been shown to reduce NT-proBNP in CHF, however, the effect of exercise training on resting and peak exercise NT-proBNP is less well characterised in post MI patients.

**PURPOSE:** To determine the effect of exercise training on resting and peak exercise NT-proBNP in post MI patients following successful percutaneous coronary intervention (PCI).

**METHODS:** Cardiopulmonary exercise testing (CPET) was undertaken in 31 male (56±10 yrs) clinically stable post MI (33±7 days) patients prior to (CPET1) and following (CPET 2) 10 weeks of exercise training. NT-proBNP measurements were determined from serum samples obtained at rest and at peak exercise via a peripheral venous cannula. Mixed modality (treadmill, cycle, rower, cross-trainer) supervised exercise training was conducted for 30-40 minutes twice weekly at 60-80% of VO<sub>2</sub> peak.

**RESULTS:** VO<sub>2</sub> peak significantly improved (3.1±2.6 ml.kg<sup>-1</sup>.min<sup>-1</sup>, P<0.0001) following 10 weeks of exercise training. Resting and peak NT-proBNP were significantly reduced by 178±419 ng/L (P<0.01) and 202±384 ng/L (P<0.001) respectively. NT-proBNP increased significantly (49±97 ng/L, P<0.001) from rest to peak exercise on CPET 1 but not on CPET 2 (25±77 ng/L, P>0.05) despite a greater exercise stimulus (147±26 vs 171±28 Watts, P<0.0001).

**CONCLUSION:** Consistent with findings in the HF population, exercise training improves VO<sub>2</sub> peak and lowers resting plasma NT-proBNP concentration in post MI patients. Furthermore, peak exercise NT-proBNP concentration is reduced. These reductions may potentially indicate reverse LV remodelling secondary to exercise training. However confirmation of this is required.

1313 Board #94 MAY 30 9:30 AM - 11:00 AM

**Improvement in Exercise Capacity after Cardiac Rehabilitation is Independent of Ejection Fraction in Patients With Coronary Heart Disease**

Aashish S. Contractor, Shraddha M. Khialani, Hetal D. Poptani, Anjali S. Zende, Priyanka M. Mehta. *Asian Heart Institute, Mumbai, India.*  
(No relationships reported)

**PURPOSE:** A low ejection fraction (EF- <35%) risk stratifies an individual in the high risk category for cardiac events. It is a wide spread belief that these patients should not engage in intense physical activity. The objective of this study is to determine safety and efficacy of exercise training in coronary heart disease patients (CHD) with low EF, and to evaluate whether cardiac rehabilitation (CR) outcomes differ in patients with normal or reduced EF.

**METHODS:** 454 patients who were diagnosed to have CHD and enrolled for a 4 week CR program at the Asian Heart Institute; Mumbai formed a part of this study. Based on the EF at enrolment patients were divided into three groups: EF (>55%- 240 patients), EF (35%-54% -154 patients) and EF <35%-60 patients. Exercise capacity was determined using the 6 minute walk test at baseline. Patients exercised under telemetry supervision for 13 sessions over 4 weeks. Exercise was prescribed at 60%- 80% of predicted maximum heart rate and a rating of perceived exertion of 11-13 on Borg's Scale. After 4 weeks the 6 minute walk test was repeated.

**RESULTS:** During the training period there were no adverse events reported. The results are tabulated as follows:

| EF      | 6 Minute    | Walk        | Distance    | (meters) | p value |
|---------|-------------|-------------|-------------|----------|---------|
|         | Pre-CR      | Post-CR     | Change      | %Change  |         |
| <35%    | 316.4±/58   | 401±/59.7   | 83±/32.3    | 20.7     | 0.0005  |
| 35%-55% | 306.2±/70.2 | 394.4±/76   | 87±/37.2    | 22.1     | 0.0005  |
| >55%    | 320.6±/75   | 405.2±/70.7 | 84.52±/48.5 | 21       | 0.0005  |

On comparing the change in the distance covered, no significant difference (p=0.694) was found between the three groups, indicating that improvement in the exercise capacity is independent of the EF.

**CONCLUSIONS:** Low EF patients with CHD can safely participate in a medically supervised exercise program and experience significant gains in exercise capacity equivalent to those with normal EF.

1314 Board #95 MAY 30 9:30 AM - 11:00 AM

**Enhanced External Counter Pulsation Improves Exercise Capacity in Patients With Left Ventricular Dysfunction**

Joseph C. Avery, Darren T. Beck, Darren P. Casey, C R. Conti, Wilmer W. Nichols, Calvin Y. Choi, Matheen A. Khuddus, Randy W. Braith, FACSM. *University of Florida, Gainesville, FL.*  
(No relationships reported)

**PURPOSE:** Enhanced external counterpulsation (EECP) improves peak oxygen uptake (VO<sub>2peak</sub>) and exercise time to angina symptoms in patients with coronary artery disease (CAD) and normal LV function. However, the efficacy of EECP in patients with LV dysfunction remains controversial. The purpose of this study was to investigate the effects of EECP on VO<sub>2peak</sub> and exercise time to angina symptoms in patients with LV dysfunction.



**METHODS:** Patients with ischemic etiology of LV dysfunction (EF < 40%; n = 9), and age-matched patients with symptomatic CAD and normal LV function (n = 13), performed symptom-limited treadmill tests using a modified Naughton protocol and metabolic cart to determine VO<sub>2peak</sub> before and after 35 1-hr sessions of EECP.

**RESULTS:** EECP treatment improved comparably (p > 0.05 between groups) the following exercise parameters in both the CAD and LV dysfunction groups, respectively: VO<sub>2peak</sub> (17.0 to 19.8 and 13.9 to 16.3 ml/kg/min); total exercise time (615 to 813 and 493 to 659 sec); exercise time to angina (421 to 686 and 345 to 528 sec); peak heart rate (112 to 116 and 113 to 118 beats per min); peak subjective angina rating (2.8 to 1.7 and 1.8 to 1.5). EECP treatment also improved comparably (p > 0.05 between groups) the Canadian Cardiovascular Society (CCS) angina classifications in both the CAD (3.17 to 1.17) and LV dysfunction (3.14 to 1.29) groups.

**CONCLUSIONS:** EECP treatment improves VO<sub>2peak</sub>, total exercise time, exercise time to angina, and CCS angina classification to the same magnitude in patients with CAD possessing normal LV function and in patients with LV dysfunction. Our data indicate that EECP serves as 'passive exercise' and may be a useful intervention in individual patients with LV dysfunction who are poor candidates for aerobic exercise training.

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1315 Board #96 MAY 30 9:30 AM - 11:00 AM

**Field versus Laboratory Tests: Exercise Capacity Estimates in Elderly Patients with Coronary Artery Disease**

Sandra Mandic<sup>1</sup>, Rob Walker<sup>1</sup>, Emily Stevens<sup>1</sup>, Bridget McIlraith<sup>1</sup>, Sarah Featherston<sup>1</sup>, Edwin R. Nye<sup>1</sup>, Dianne Body<sup>2</sup>, Leanne Barclay<sup>2</sup>, Michael J A Williams<sup>1</sup>.

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(No relationships reported)

Compared to conventional laboratory exercise tests, timed walking tests are cheaper and a more simple alternative for an assessment of exercise capacity in cardiac rehabilitation participants. It remains unknown whether these tests provide an adequate estimate of peak oxygen consumption (VO<sub>2peak</sub>) in elderly individuals with coronary artery disease (CAD).

**PURPOSE:** To compare measured VO<sub>2peak</sub> during symptom-limited exercise testing versus estimated VO<sub>2peak</sub> derived from 6-minute walk test and incremental shuttle walk test in elderly CAD patients.

**METHODS:** Fifty-one elderly individuals with CAD (age: 73±6 years (range: 60 to 89), 16 (31%) women) completed the following assessments: 1) symptom-limited graded exercise test with expired gas analysis on a cycle ergometer using a ramp protocol; 2) incremental 10-meter shuttle walk test and 3) two 6-minute walk tests. VO<sub>2peak</sub> was estimated based on maximal walking speed (shuttle walk test) and distance, age, height, weight and rate pressure product (6-minute walk test) using published equations. Data were analysed using Pearson Product Moment correlation and paired t-test.

**RESULTS:** Measured VO<sub>2peak</sub> obtained during symptom-limited exercise test was significantly related to distance covered during 6-minute walk test (r=0.71, p<0.001) and duration of the incremental shuttle walk test (r=0.75, p<0.001). Estimated VO<sub>2peak</sub> based on 6-minute walk test data (16.0±4.4 ml/kg/min) and maximum walking speed achieved during shuttle walk test (14.7±1.9 ml/kg/min) were significantly lower compared to VO<sub>2peak</sub> measured during a symptom-limited exercise test (19.9±0.7 ml/kg/min; p<0.001 for both comparisons).

**CONCLUSIONS:** Distance covered during 6-minute walk test and duration of incremental shuttle walk test can be used for an assessment of functional capacity and monitoring of cardiac rehabilitation progress in elderly CAD patients. Estimation of VO<sub>2peak</sub> based on these tests underestimates exercise capacity in elderly CAD patients.

Supported by University of Otago Research Grant

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1316 Board #97 MAY 30 9:30 AM - 11:00 AM

**Coronary CT In Asymptomatic Subjects With Ventricular Repolarization Abnormalities During Maximal Exercise Test**

Andrea Ermolao, Fausto Roman, Andrea Gasperetti, Maurizio Varnier, Eleonora Zanella, Marco Zaccaria. *Università di Padova, Padova, Italy.*

(No relationships reported)

Specific data are still lacking about the significance of repolarization abnormalities observed during exercise test in physically active asymptomatic subjects. Coronary CT is a highly sensitive diagnostic procedure able to confirm or exclude a significant coronary artery disease (CAD).

**PURPOSE:** To evaluate if the occurrence in asymptomatic subjects of ECG repolarization abnormalities potentially suggesting a CAD, is confirmed by coronary CT. Further, clarify if the likelihood of detecting CAD or coronary anomalies was related to the degree of the ECG abnormalities and to the prevalence of cardiovascular risk factors.

**METHODS:** Among 940 athletes performing a maximal exercise test for sport eligibility (age 30-60yrs), 44 asymptomatic subjects (4,7%, 39 men and 5 females, 45,2±7,1yrs) demonstrated repolarization abnormalities requiring the completion of a coronary CT. The exercise tests were classified into two categories: suspicious and positive for CAD.

**RESULTS:** The average maximal heart rate at exhaustion was 170,4±11,9. Risk factors evaluation demonstrated 10 subjects with hypertension, 23 subjects with hypercholesterolemia, 5 smokers. Among the 44 subjects 23 had a suspicious while 21 had a positive exercise test. The coronary CT demonstrated 6 subjects (13,6%) with a clinically significant CAD, 8 non-significant CAD, while 7 showed various coronary abnormalities. Considering the coronary CT as "gold standard", the positive predictive value (PPV) of the exercise test for any coronary anomaly was 61,9% for positive exercise tests (47,7% including suspicious tests), while the PPV of positive tests for CAD was 47,6% (31,8% including suspicious tests). The association of late recovery abnormalities and cardiovascular risk factors improved the likelihood of CAD.

**CONCLUSION:** Our data suggest the clinical importance of slight repolarization abnormalities occurring at the peak of the exercise in asymptomatic middle-aged athletes, particularly when associated with the presence of cardiovascular risk factors. They also support the importance of a prolonged ECG monitoring during the late recovery phase. The PPV of a maximal exercise test in asymptomatic athletes appears lower than what observed in symptomatic subjects, however, about half of these subjects demonstrated some coronary anomalies.

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1317 Board #98 MAY 30 9:30 AM - 11:00 AM

**Effects of Exercise Training on Objectively Measured Physical Activity Levels in Heart Failure Patients**

Daniel Clevenger, Peter H. Brubaker, FACSM, Joel Eggebeen, Dalane W. Kitzman. *Wake Forest University, Winston-Salem, NC.*

(No relationships reported)

Physical activity (PA) levels have not been quantified in the heart failure population, particularly heart failure patients with a preserved ejection fraction (HFpEF).

**PURPOSE:** To objectively measure PA in HFpEF patients and evaluate changes in levels after structured exercise training and weight loss interventions.

**METHODS:** Participants of this investigation were assessed at baseline and follow-up to an RCT of exercise and/or weight loss in HFpEF patients. Participants were randomized to one of four intervention groups for 20 weeks: Exercise Only (EO), Diet Only (DO), Exercise plus Diet (E+D), or Attention Control (AC). Participants were asked to wear an accelerometer for 7 continuous days at baseline and then again during the final week of the intervention. The data was included if the participant wore the accelerometer for > 10 hours, of which included activity > 80% of the wear time, and had > 3 days of activity recorded. Each participant's average steps/day, daily physical activity energy expenditure (PAEE) in kcal/min, minutes of light physical activity (LPA), and minutes of moderate/vigorous physical activity (MVPA) were analyzed.

**RESULTS:** Thirty-five subjects (77% female) with average age of 68.5±5.9 were included in the analysis. There were a significantly more steps per day in the E+D group compared to the AC group (6761 ± 2174 vs. 4052 ± 1083, respectively). There was a significant difference between the E+D, EO, DO, and AC, at follow-up for minutes of MVPA (31.0 ± 11.1, 11.6 ± 10.7, 14.2 ± 8.4, 9.9 ± 5.1, min/day respectively). There was also a significant difference for PAEE between the E+D and DO groups (280 ± 95 vs. 151 ± 52 kcal/day, respectively).

**CONCLUSIONS:** HFpEF patients randomized to the E+D group had significantly more minutes of MVPA compared to all of the other intervention groups and significantly greater number of steps/day than AC and more PAEE than DO. It appears that the weight loss, secondary to E+D, results in greater amounts of PA than EO and DO interventions for older HFpEF patients.

**1318** Board #99 MAY 30 9:30 AM - 11:00 AM  
**Safety Of Cardiopulmonary Stress Testing In Patients With A Broad Range Of Cardiovascular Disorders**

Erin West, Lora Raines, Daniel Forman, MD. *Brigham & Women's Hospital, Boston, MA.*  
(No relationships reported)

**PURPOSE:** While cardiopulmonary stress testing (CPX) has been well evaluated in heart failure patients, the utility and safety of these tests are not as well defined in other high-risk cardiovascular populations. The purpose of this study was to identify the rate of adverse outcomes during symptom limited CPX tests in a population of cardiovascular patients with a broad range of diagnoses.

**METHODS:** A retrospective data review was performed for CPX tests performed between July 2007 and July 2009. Patients with known cardiovascular disorders at the time of testing were included in the analysis. Peak functional capacity ( $\text{VO}_2$ ), peak respiratory exchange ratio (RER), and reason for test termination were collected. Adverse outcomes included significant hemodynamic abnormalities, arrhythmias, or ischemic changes.

**RESULTS:** The study population consisted of 815 patients (68% male) with the following cardiovascular diagnoses: dilated cardiomyopathy (41.8%), prior cardiac transplantation (25.2%), ischemic cardiomyopathy (12.3%), congenital/structural heart disease (3.9%), prior pulmonary embolism (3.4%), heart failure with preserved ejection fraction (2.9%), hypertrophic cardiomyopathy (1.8%), restrictive cardiomyopathy (1.7%), valvular disease (1.8%), and other cardiovascular disorders (5%). Mean peak  $\text{VO}_2$  was 15.9 ml/kg/min at a mean peak RER of 1.16. Eighty-three percent of patients achieved a peak RER  $\geq 1.05$ . Thirty-seven tests were terminated prematurely by the supervising exercise physiologist for the following reasons: hypotensive response (1.7%), hypertensive response (1.2%), and significant arrhythmia (1.6%). No myocardial infarctions, cardiac arrests, or deaths occurred.

**CONCLUSIONS:** Even amongst a population of patients with significant cardiovascular disorders, symptom limited CPX tests can be performed in a safe and effective manner with proper screening and test supervision.

**1319** Board #100 MAY 30 9:30 AM - 11:00 AM  
**Differences In Using The Same Supramaximal Verification Test Protocol For Treadmill And Cycle Ergometry**

Christoph Otto<sup>1</sup>, Friederike Scharhag-Rosenberger<sup>2</sup>, Anja Carlssohn<sup>1</sup>, Jürgen Scharhag, FACSM<sup>3</sup>, Frank Mayer<sup>1</sup>. <sup>1</sup>Potsdam University, Potsdam, Germany. <sup>2</sup>University of Applied Science for Prevention and Health Management, Saarbrücken, Germany. <sup>3</sup>University Hospital, Heidelberg, Germany.  
(No relationships reported)

Verification testing to validate maximum oxygen uptake ( $\text{VO}_{2\text{max}}$ ) is used increasingly in performance testing. Different verification test protocols are applied at different points of time after incremental tests.

**PURPOSE:** The aim of this study was to examine whether there are substantial differences in using the same verification test protocol for treadmill and cycle ergometry. Furthermore, verification tests subsequent to incremental tests and on separate days should be compared.

**METHODS:** 10 recreational runners ( $f=4$ ,  $m=6$ ,  $29 \pm 6$  y,  $1.74 \pm 0.06$  m,  $66 \pm 7$  kg,  $\text{VO}_{2\text{max}}$ :  $62 \pm 6$  ml/min/kg) and 10 male recreational cyclists ( $31 \pm 5$  y,  $1.82 \pm 0.05$  m,  $75 \pm 9$  kg,  $\text{VO}_{2\text{max}}$ :  $62 \pm 5$  ml/min/kg) underwent an incremental exercise test to exhaustion (E) either on the treadmill or the bicycle ergometer. After 10 min of rest a first verification test at 110% of  $\text{V}_{\text{max}}$  or  $\text{P}_{\text{max}}$  ( $\text{V}_1$ ) was performed to exhaustion. 24h later a second verification test ( $\text{V}_2$ ) similar to  $\text{V}_1$  followed. Breath by breath gas exchange data were measured continuously. Capillary blood samples were collected at the end of each stage and at the point of exhaustion. Differences in E,  $\text{V}_1$  and  $\text{V}_2$  were tested by using ANOVA for repeated measures.

**RESULTS:** Runners'  $\text{VO}_{2\text{max}}$  (E:  $62 \pm 6$  ml/min/kg,  $\text{V}_1$ :  $61 \pm 7$  ml/min/kg,  $\text{V}_2$ :  $60 \pm 6$  ml/min/kg) was not significantly different between E and  $\text{V}_1$ , while  $\text{V}_2$  was significantly lower than E ( $p<0.01$ ). There was no statistically significant difference in the runners' time to exhaustion (TTE;  $\text{V}_1$ :  $01:55 \pm 00:15$  min,  $\text{V}_2$ :  $02:05 \pm 00:30$  min). Cyclists'  $\text{VO}_{2\text{max}}$  (E:  $62 \pm 5$  ml/min/kg,  $\text{V}_1$ :  $61 \pm 6$  ml/min/kg,  $\text{V}_2$ :  $63 \pm 4$  ml/min/kg) was significantly lower in  $\text{V}_1$  than in E ( $p<0.05$ ) but there was no difference between E and  $\text{V}_2$ . Cyclists' TTE was significantly longer in  $\text{V}_2$  than in  $\text{V}_1$  ( $\text{V}_1$ :  $02:24 \pm 00:20$  min,  $\text{V}_2$ :  $03:23 \pm 00:25$  min,  $p<0.01$ ). TTE was significantly longer in cyclists than in runners in  $\text{V}_1$  and  $\text{V}_2$  ( $p<0.01$ ).

**CONCLUSION:** For recreational athletes, the time of verification testing seems less important since the observed differences in  $\text{VO}_{2\text{max}}$  were irrelevantly small. Therefore, verification tests can be performed directly after incremental tests to ensure validity of maximum values. Due to the longer TTE in cyclists it seems needful to examine different test protocols for different exercise modes.

**A-32** Free Communication/Poster - Diet and Exercise Interventions: Impact on Energy Balance

MAY 30, 2012 7:30 AM - 12:30 PM  
ROOM: Exhibit Hall

**1320** Board #101 MAY 30 11:00 AM - 12:30 PM  
**The Effect Of 2 Weeks Of Night Eating Restriction: A Randomized And Counter-balanced Study**

Ed Christensen, Bruce W. Bailey, Larry A. Tucker, FACSM, James D. LeCheminant, FACSM. *Brigham Young University, Provo, UT.*  
(No relationships reported)

**PURPOSE:** This study examined the effects of two weeks of night eating restriction on energy intake and body weight in young adult men.

**METHODS:** Eleven college-aged men were randomized to two weeks of normal eating (NE) and two weeks of night eating restriction (NER) in a counter-balanced fashion. There was a one week wash-out period between conditions. During NE, participants were asked to consume their normal diet, ad libitum. During NER, participants were asked to avoid all eating or kcal consumption from 7pm-6am but there were no restrictions on type or amount of food/beverage consumed. To assess diet, participants were asked to complete three randomly assigned dietary recalls during each week of the study. The National Cancer Institute's Automated Self-administered 24-hour Dietary Recall (ASA24) was used to collect and analyze energy and macronutrient intake. Body weight was measured using a digital scale before and after each condition (NE and NER). All participants were screened and excluded for Night Eating Syndrome.

**RESULTS:** During NE, participants consumed  $2,497 \pm 514$  kcal/d and during NER  $2,115 \pm 269$  kcal/d ( $F=7.89$ ;  $P=0.019$ ). Dietary fat intake during NE was  $105 \pm 27$  g/d and during NER was  $86 \pm 15$  g/d ( $F=7.05$ ;  $P=0.024$ ). Carbohydrate intake during NE was  $299 \pm 67$  g/d and during NER was  $258 \pm 64$  g/d ( $F=7.05$ ;  $P=0.024$ ). There were no differences between the two conditions in protein, alcohol, or fiber intake ( $P>0.05$ ). Body weight change during NE was  $0.81 \pm 0.87$  and during NER was  $-0.53 \pm 0.120$  ( $F=13.09$ ;  $P=0.005$ ). Additional data collection is ongoing.

**CONCLUSIONS:** Restricting energy intake after 7pm may result in lower energy intake and potentially better short-term weight management than not limiting night eating. The difference in energy intake resulted from lower fat and carbohydrate intake during NER.

**1321** Board #102 MAY 30 11:00 AM - 12:30 PM  
**Short Term Energy-Restricted Diets Improve Weight and Fat Loss Compared to Resistance Training**

Elizabeth J. Sussman, Carol S. Johnston, Pamela D. Swan, FACSM. *Arizona State University, Phoenix, AZ.* (Sponsor: Pamela D. Swan, FACSM)  
(No relationships reported)

Both energy expenditure and energy restriction are recommended for weight loss in obese populations.

**PURPOSE** This study examined the effects of energy restrictive diets (either high protein/low carbohydrate or high carbohydrate/low fat) or a resistance exercise training regimen on body weight, fat percentage and fasting resting metabolic rate (RMR) over a six week intervention.

**METHODS** Healthy adults ( $n = 25$ ), stratified by age (mean =  $37 \pm 11.5$  y), gender (4 M), and BMI (mean =  $29.6 \pm 5.6$  kg/m<sup>2</sup>), were randomly assigned to one of three groups: high protein (30% energy), low fat diet (PRO); high carbohydrate (60% energy), low fat diet (CHO); or resistance exercise training (EX). All foods consumed by the diet groups were prepared in a metabolic

kitchen and designed to achieve a 1-2 pound weight loss per week. The EX group followed their usual diet but attended three supervised weight training sessions per week. EX was comprised of eight exercises over 45 minutes designed to achieve similar calorie deficit as that computed for the diet groups. Body composition was assessed by bioelectrical impedance and RMR was measured during 40 minutes of supine rest in a fasted state following 24 hours of no exercise. Changes in body weight, RMR and %fat between groups were analyzed using ANOVA.

**RESULTS** There were no differences between groups at baseline. Change in body weight and %fat was significantly improved ( $p < 0.001$ ) for the PRO and CHO groups as compared to EX (Wt: -5.9%, -6.2%, -0.5%; Fat: -3.5%, -5.3%, + 1.2% respectively). There were no significant changes in RMR for any group.

**CONCLUSION** An energy-restricted caloric deficit produces greater weight loss and greater body fat loss in six weeks when compared to a resistance training exercise program inducing the same caloric deficit. It is possible that the EX group increased caloric intake during the intervention. Follow up is necessary to establish the long-term efficacy of these programs.

Supported by ASU Foundation.

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**1322** Board #103 MAY 30 11:00 AM - 12:30 PM

**Optimizing Fat Oxidation in Untrained Women: The Competing Indices of Fitness versus Fat Loss**

Harold C. Mayer, Deborah A. Beihl. *Southern Adventist University, Collegedale, TN.*

(No relationships reported)

Arresting the obesity epidemic is a high priority public health issue. This study explores factors affecting fat oxidation and resting metabolism in untrained overweight/obese women.

**PURPOSE:** The objective of this research was to explore the effects of a high fiber diet (*The Full Plate Diet* [FPD]) and exercise on resting metabolism, weight loss, and percent body fat loss.

**METHODS:** Overweight/obese (BMI between 25 -39), sedentary women (n=20) were recruited with a fiber intake <30g/day. Participants were randomized into three groups and followed for 8 weeks: FPD alone (FPD); FPD + continuous heart rate exercise (FPD+conEx); FPD + variable heart rate exercise (FPD+varEx). Pre- and post-study assessments included dietary analysis, resting metabolic rate,  $VO_2$  max treadmill test, and hydrostatic weight.

**RESULTS:** The high fiber FPD (consisting of 40 grams of whole food fiber daily) alone improved energy balance (from +339 to -226 kcals) without counting calories, but was inadequate to achieve fat (or weight) loss in the 8 weeks. The FPD+conEx group (training intensity  $56.8\% \pm 14.1$  verified via Polar heart rate monitors) saw a significant drop in (health measure) percent body fat (35.3% to 31.3%,  $p=.03$ ), but no significant change in weight or (fitness measure)  $VO_2$ max. The FPD+varEx group (training intensity =  $67.7\% \pm 5.8$  verified via Polar heart rate monitors) saw a significant drop in weight (3.7 lbs,  $p=.03$ ) and significant improvement in fitness measure Relative  $VO_2$  max (20.8 to 24.1,  $p=0.016$ ) and Absolute  $VO_2$  max (1.94 to 2.20,  $p=0.03$ ), but no significant drop in percent body fat (39.9% to 38.2%,  $p=0.06$ ). No group showed a statistically significant metabolic efficiency change in resting metabolic rate (RMR).

**CONCLUSION:** The Full Plate Diet helped participants to regulate energy balance without counting calories by reducing caloric intake, so they were more aligned with the resting energy expenditure (REE). Both increased fiber intake and low intensity exercise appear to be necessary to reduce percent body fat in untrained, overweight/obese participants. In fact, it appears that there is an inverse relationship between increased fitness and increased fat oxidation. Further research in a larger population over a longer period of time is needed to clarify this competing health - fitness relationship.

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**1323** Board #104 MAY 30 11:00 AM - 12:30 PM

**Physiological and Psychosocial Benefits Associated with Weight Loss Programs: Changes in Body Weight, Social Physique Anxiety, and Exercise Enjoyment**

Lynn A. Darby, FACSM<sup>1</sup>, Bonnie G. Berger<sup>1</sup>, Rob A. Carels<sup>1</sup>, Roberta L. Pohlman<sup>2</sup>. <sup>1</sup>Bowling Green State University, Bowling Green, OH. <sup>2</sup>Wright State University, Dayton, OH.

(No relationships reported)

Weight loss has been correlated with changes in social psychic anxiety (SPA) and exercise enjoyment (PACES) after a behavioral weight loss program (BWLP) (Darby, Berger & Carels, 2011).

**PURPOSE:** To further explore relationships among psychophysiological variables and to assess changes from before to after two different weight loss programs.

**METHODS:** Thirty-six participants who were overweight or obese completed anthropometric assessments [visceral adipose tissue (VAT) determined from sagittal abdominal diameter (SAD) (Parr & Haight, 2006)], physiological tests (submax walking GXTs), and dietary and activity (accelerometer) reports. They also completed the psychological inventories of the PACES (Physical Activity Enjoyment Scale; Kendzierski & DeCarlo, 1991) and SPA (Social Physique Anxiety; Hart, Leary, & Rejeski, 1989). All measures were completed before and after weight loss programs (BWLP *LEARN*, Brownell, 2004 or *Transforming Your Life* (TYL), Carels et al., 2011).

**RESULTS:** Completers included 10 men and 26 women (Age =  $49 \pm 12$  yr). Body weight (BW), VAT, BMI, GXT time were significantly different ( $p < 0.05$ ) after 14-weeks. Mean scores pre- and post-program were as follows: BW ( $98.1 \pm 17.5$ ,  $93.3 \pm 18.2$  kg), VAT ( $10.6 \pm 2.5$ ,  $8.6 \pm 2.5$  lb), BMI ( $34.7 \pm 5.6$ ,  $32.3 \pm 5.6$  kg/m<sup>2</sup>), and GXT time ( $563 \pm 216$ ,  $673 \pm 216$  sec). Two-way ANOVAs (Time by Type of Program) indicated desirable changes in exercise enjoyment and social physique anxiety. Scores pre- and post-program were as follows: PACES ( $88.8 \pm 16.9$ ,  $97.7 \pm 14.1$ ), and SPA ( $41.8 \pm 8.4$ ,  $37.6 \pm 8.7$ ). There were no differences in PACES or SPA due to type of program, or sex. Not only did the PACES increase from beginning to end of the programs, pre- and post-values were significantly correlated with self-monitored average daily physical activity in minutes ( $r=.421$ ,  $p=.02$ ;  $r=.440$ ,  $p=.01$ ). Therefore, with participation in physical activity during the programs, there was a significant increase in exercise enjoyment and a decrease in anxiety. SPA scores at the beginning of the program were positively correlated with average energy intake during the program, however, lower SPA scores at the end of the program were not.

**CONCLUSION:** Weight loss programs, regardless of type, are associated with both desirable physiological and psychological changes.

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**1324** Board #105 MAY 30 11:00 AM - 12:30 PM

**Weight Loss Induced by Exercise Preserves Resting Metabolic Rate: Midwest Exercise Trial II (MET II)**

Jeffery J. Honas<sup>1</sup>, Richard A. Washburn, FACSM<sup>1</sup>, Stephen D. Hermann<sup>1</sup>, Kate Lambourne<sup>1</sup>, Jaehoon Lee<sup>2</sup>, Joseph E. Donnelly, FACSM<sup>1</sup>. <sup>1</sup>University of Kansas Medical Center, Kansas City, KS. <sup>2</sup>University of Kansas, Lawrence, KS.

(No relationships reported)

Weight loss resulting from decreased energy intake has been associated with decreases in resting metabolic rate (RMR). The RMR response to weight loss by exercise without energy restriction is unclear. The inconsistent results on the effect of exercise induced weight loss on RMR may be due, in part, to variability in length, intensity, duration, and the level of supervision/verification of the exercise intervention.

**PURPOSE:** To evaluate the impact of weight loss induced by 2 levels of exercise energy expenditure (EEEx) on RMR.

**METHODS:** 91 sedentary, overweight/obese (BMI 25-39.9) young adults (18-30 yrs.; 55% female), were randomized to either 2,000 (N=36) or 3,000 (N=37) kcal/wk. of supervised treadmill exercise at 70-80% max heart rate (HR), or to a sedentary control group (N=18) for 10 mos. Participants were instructed not to alter energy intake. Exercise was progressed slowly in both exercise groups with participants reaching their target level at the end of mo. 4. The intensity and duration of all exercise sessions were verified by HR monitor. EEEx was assessed monthly by indirect calorimetry. RMR was assessed by indirect calorimetry at baseline and 10 mos. between the hrs. of 6-9 am, after a 12 hr. fast, and no exercise for 48 hrs.

**RESULTS:** Exercise at both 2000 or 3000 kcals/wk. resulted in clinically significant weight loss (2000 = - 4.2%, 3000 = - 5.3%) compared to the control group (+ 0.3%). Despite clinically significant weight loss, there were no significant decreases in RMR within or between exercise groups (2000 = -1.0%, 3000 = -1.6%;  $p=0.81$ ) or between exercise and control (Exercise = - 1.3%, Control = +1.1%;  $p=0.48$ ). The RMR response to exercise did not differ by gender ( $p=0.76$ ).

**CONCLUSIONS:** Weight loss induced by exercise without energy restriction prevents the decreases in RMR typically associated with weight loss by energy restriction alone. These results suggest that exercise may be the preferable mode of weight loss for the prevention of weight regain.

Supported by NIH R01 DK49181

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1325 Board #106 MAY 30 11:00 AM - 12:30 PM

**Self-reported Diet And Exercise Are Similar in Clinic And Phone Based Interventions**

Kate Lambourne, Stephen D. Herrmann, Jeffrey J. Honas, Richard A. Washburn, FACSM, Joseph E. Donnelly, FACSM. *University of Kansas Medical Center, Kansas City, KS.*  
(No relationships reported)

Self-monitoring is a crucial component of diet and exercise interventions and has been associated with greater amounts of weight loss. It is not known whether self-monitoring data reported for diet and exercise are different when participants are not seen directly by a health educator, such as in a phone-based intervention.

**PURPOSE:** To compare self-reported use of pre-packaged meals (PMs-shakes/entrees), fruit and vegetable (F/V) consumption, and physical activity (minutes, pedometer steps/day) between individuals receiving a group-based intervention delivered face-to-face (FTF) or by conference call, and to determine if these measures are predictive of weight loss.

**METHODS:** 395 overweight and obese adults (BMI 25-39.9, age 18-65) were randomly assigned to a 6-month weight loss intervention delivered by conference call or FTF clinic. The intervention targeted 300 min/week of moderate-to-vigorous exercise and 10,000 steps/day. Energy intake was reduced to ~1,200-1,500 kcal/day using PMs and F/V. Participants in both groups attended weekly clinics consisting of lessons on exercise, nutrition, and lifestyle modification. T-tests compared differences in the self-reported diet and exercise data between the phone and FTF groups. A regression analysis examined whether self-reported diet and physical activity data predicted weight loss after controlling for baseline weight and sex among the participants who completed the intervention.

**RESULTS:** No significant differences were observed in the self-reported diet and physical activity data between the phone and FTF group ( $p > 0.05$  for all comparisons). The number of pre-packaged shakes used ( $M = 2.6$ ,  $SD = 0.34$ ) and number of steps/day ( $M = 8485$ ,  $SD = 2508$ ) were significant predictors of weight loss ( $\beta = 0.14$ ,  $p = 0.02$ ;  $\beta = 0.17$ ,  $p < 0.01$ , respectively;  $R^2 = 0.28$ ). The reported number of pre-packaged entrees, F/V, and minutes of physical activity were not significant predictors of weight loss.

**CONCLUSION:** Changes in self-reported diet and physical activity were similar between weight loss interventions delivered FTF or by conference call. The use of pre-packaged shakes and a pedometer to monitor physical activity resulted in greater weight loss, independent of the clinic delivery method.

Supported by NIH DK076063 and Health Management Resources, Boston, MA.

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1326 Board #107 MAY 30 11:00 AM - 12:30 PM

**Exercise Adherence By Energy Expenditure Level: Midwest Exercise Trial II (MET II)**

Stephen D. Herrmann, Jeffrey J. Honas, Richard A. Washburn, FACSM, Kate Lambourne, Joseph E. Donnelly, FACSM. *University of Kansas Medical Center, Kansas City, KS.*  
(No relationships reported)

The current ACSM position stand on exercise and weight management recommends > 250 min/wk. of moderate intensity physical activity (~1250-2450 kcal/wk. for a 100 kg individual at 3.0-5.9 METs) to achieve clinically significant weight loss. However, higher levels of exercise energy expenditure (EEEx) may have an adverse impact on adherence to an exercise protocol, and thus diminish the practicality of exercise recommendations for weight loss.

**PURPOSE:** To assess the effect of two levels of EEEx on adherence to 10 months of supervised exercise in sedentary, overweight/obese young adults.

**METHODS:** 115 sedentary, overweight/obese (BMI 25-39.9) young adults (18-30 yrs.; 55% female), were randomized to either 2,000 (N=53; 31 females) or 3,000 (N=62; 32 females) kcal/wk. of treadmill exercise at 70-80% max heart rate (HR), 5 days/wk. (supervised  $\geq 4$  days/wk.) over 10 months. Exercise was progressed slowly with participants reaching their target level at the end of month 4. EEEx was assessed monthly by indirect calorimetry to guide exercise prescription. The intensity and duration of all exercise sessions were verified by HR monitor. Compliance was assessed at 3 month intervals and defined as completing > 90% of scheduled exercise sessions at the target intensity and duration. Individuals falling below 90% compliance were dismissed from the study. Participants received \$2,000 at study completion.

**RESULTS:** Overall, 64.3% of the sample completed the study per protocol. The majority of attrition (> 95%;  $n = 39$ ) occurred during months 1-6. Those completing the study did not differ by EEEx (2,000 kcal/wk. = 69.8%, 3,000 kcal/wk. = 59.7%;  $\chi^2(1) = 1.28$ ,  $p = 0.26$ ), sex (males = 71.2%, females = 58.7%;  $\chi^2(1) = 1.92$ ,  $p = 0.17$ ); or baseline weight status (overweight = 64.9%, obese = 63.8%;  $\chi^2(1) = 0.02$ ,  $p = 0.90$ ). Logistic regression indicated no significant impact of EEEx on adherence ( $p = 0.31$ ) after controlling for sex, baseline weight and baseline fitness.

**CONCLUSIONS:** These results suggest that sedentary, overweight/obese young adults are capable of adhering to levels of EEEx associated with clinically significant weight loss. Additional studies to identify potential modifiable factors associated with improving adherence, particularly during the early months of an exercise intervention, are warranted.

Supported by NIH R01 DK49181

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1327 Board #108 MAY 30 11:00 AM - 12:30 PM

**Insulin Resistance and Body Fat Gains in Non-Diabetic Women: A Prospective Study**

Jared M. Tucker<sup>1</sup>, Larry A. Tucker<sup>2</sup>. <sup>1</sup>North Dakota State University, Fargo, ND. <sup>2</sup>Brigham Young University, Provo, UT.  
(No relationships reported)

**PURPOSE:** To determine the effect of insulin resistance (IR) on risk of gaining body fat (BF) over time in women, and to examine the potential confounding effects of age, education, initial BF, objectively measured physical activity, and energy intake.

**METHODS:** A prospective cohort study was conducted with 226 women completing the assessments at baseline and follow-up, 18 months later. IR was assessed using fasting blood insulin and glucose levels to calculate HOMA. Participants were divided into High IR (4th quartile) Moderate IR (2nd and 3rd quartiles) and Low IR (1st quartile) categories. BF was estimated using plethysmography (Bod Pod) at baseline and follow-up. Participants wore accelerometers and completed weighed food logs for 7 consecutive days to objectively index physical activity and energy intake, respectively.

**RESULTS:** On average, women in the High IR group decreased in BF ( $-0.48 \pm 3.60$ ) from baseline to follow-up, whereas those in the Moderate ( $0.40 \pm 3.66$ ) and Low IR ( $1.17 \pm 3.15$ ) groups gained in BF in a dose-response manner over the 18 months ( $F = 5.4$ ,  $p = 0.0211$ ). Controlling for differences in age, education, physical activity, and energy intake had little impact on changes in BF across the insulin resistance groups, but adjusting for baseline BF nullified differences in body fat changes across the IR groups.

**CONCLUSIONS:** Women with High IR have less than half the risk of gaining substantial BF (>5%) over 18 months compared to women with low or moderate levels of IR. The decreased risk appears independent of potential confounders except for initial body fat levels, which seem to play a key role in the relationship.

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1328 Board #109 MAY 30 11:00 AM - 12:30 PM

**Changes In Physical Fitness And Body Composition During Inpatient Treatment Of Longstanding Eating Disorders**

Eva M. Støa, Solfrid Bratland-Sanda. *Telemark University College, Norway, Telemark, Norway.*  
(No relationships reported)

**PURPOSE:** The purpose of this study was to examine changes in aerobic fitness, muscular strength and body composition during inpatient treatment of underweight and normal weight patients with longstanding eating disorders (ED).

**METHODS:** Twenty-nine underweight (BMI < 18.5,  $n = 7$ ) and normal weight (BMI  $\geq 18.5$ ,  $n = 22$ ) inpatients meeting the DSM-IV criteria for anorexia nervosa, bulimia nervosa or eating disorders not otherwise specified (mean (SD) age: 31.0 (9.0) yrs, ED duration: 14.9 (8.8) yrs, duration of treatment: 16.6 (5.5) weeks) completed this prospective naturalistic study. The treatment consisted of nutritional counseling, two weekly sessions of 60 min moderate intensive physical activity, and psychotherapy. Patients with BMI < 18.5 aimed to increase body weight with 0.5 kg/week until BMI  $\geq 18.5$ . Aerobic fitness, muscular strength (1RM) in lower and upper body and body composition were measured at admission and discharge.

**RESULTS:** There was a 28.5% increase in lower body muscular strength among the underweight patients, and 18.9% increase in upper body muscular strength among the normal weight patients from admission to discharge. No changes were detected in aerobic capacity. Total body mass increased with 7% among the underweight patients (from 46.2 to 49.5 kg,  $p < 0.001$ ), although three out of seven underweight patients were still underweight at discharge. No significant changes in total body mass were observed among the normal weight patients. Altering in

body composition was observed, with an increase of 36% and 6% in fat mass among underweight and normal weight patients, respectively. Lean body mass increased among underweight, but not normal weight patients. Nine of the 29 patients had a body fat percentage exceeding healthy limits at admission; none of these showed decrease in body fat percentage at discharge.

**CONCLUSIONS:** Several underweight patients were still underweight at discharge, whereas none of the patients with excess amounts of body fat managed to reduce body fat percentage. Increase in aerobic capacity would have been beneficial to especially patients with excess body fat. These results call for a more individualized treatment approach to achieve a more optimal body composition among both underweight and normal weight patients with longstanding ED.

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**1329** Board #110 MAY 30 11:00 AM - 12:30 PM

**Systemic Inflammation and Disease Risk Factors in Mexican-American Children after an Intensive Lifestyle Intervention**

Whitney L. Breslin<sup>1</sup>, Craig A. Johnston<sup>2</sup>, Jennette P. Moreno<sup>2</sup>, Kelley Strohacker<sup>1</sup>, Katie C. Carpenter<sup>1</sup>, John P. Foreyt<sup>2</sup>, Brian K. McFarlin, FACS<sup>1</sup>. <sup>1</sup>University of Houston, Houston, TX. <sup>2</sup>Baylor College of Medicine, Houston, TX. (Sponsor: Brian K McFarlin, FACS)  
(No relationships reported)

**PURPOSE:** Obesity is an independent risk factor for chronic disease. The prevalence of obesity is especially high among Mexican-American children. Peripheral blood monocytes are altered with obesity and may contribute to systemic inflammation that mediates the relationship between obesity and chronic disease. In addition, obesity alters the circulating levels of cytokines/chemokines that influence monocyte behavior. To evaluate the effects of a 6-month school-based healthy lifestyle program on systemic inflammation and disease risk markers in healthy weight (zBMI  $\leq$  85th percentile), overweight (zBMI=85th-95th percentile), and obese (zBMI  $\geq$  95th percentile) Mexican-American children.

**METHODS:** Participants were randomized to either a 6-month intensive intervention or self-help group. Pre- and post-intervention blood samples were analyzed for total monocyte concentration, pro-inflammatory monocyte concentration, and classic monocyte concentration via flow cytometry. Serum MCP-1, Fractalkine, IL-8, and TNF- $\alpha$  were measured using a Milliplex MagPix assay. Serum cholesterol, HDL, triglycerides, and glucose were measured using an enzymatic reagent kit.

**RESULTS:** At baseline, Total monocyte concentration (P=0.012), classic monocyte concentration (P=0.045), MCP-1 (P=0.015), and TNF- $\alpha$  (P=0.002) were significantly greater in obese children compared to healthy weight children. Also, overweight and obese children had elevated triglycerides (P=0.001) and reduced HDL (P=0.033) compared to healthy weight children. Post-intervention samples will be analyzed to determine the effect of the intervention on these markers of systemic inflammation and disease risk.

**CONCLUSIONS:** Elevations in circulating monocytes, MCP-1, and TNF- $\alpha$  have been implicated in the development of obesity-related chronic disease in adults. School-based healthy lifestyle interventions that promote zBMI reduction may reduce systemic inflammation and prevent the future development of obesity-related chronic diseases.

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**1330** Board #111 MAY 30 11:00 AM - 12:30 PM

**Daily Exercise and Caloric Restriction Impact Fibroblast Growth Factor-21 in Hyperphagic OLETF Rats**

Justin A. Fletcher, Grace M. Meers, Jamal A. Ibdah, John P. Thyfault, R. Scott Rector. University of Missouri, Columbia, MO.  
(No relationships reported)

**PURPOSE:** Chronic treatment with fibroblast growth factor-21 (FGF-21) favorably improves obesity and nonalcoholic fatty liver disease (NAFLD) outcomes; however, FGF-21 expression is paradoxically elevated in obese conditions. Here, we sought to determine the effects of obesity prevention by daily exercise (EX) vs. caloric restriction (CR) on hepatic FGF-21 in the hyperphagic, Otsuka Long-Evans Tokushima Fatty (OLETF) rat.

**METHODS:** At 4 wks of age, male OLETF rats (n=7-8/group) were randomized to groups of ad libitum fed, sedentary (OLETF-SED), voluntary wheel running exercise (OLETF-EX), or CR (OLETF-CR; 70% of SED) until 40 wks of age. Nonhyperphagic, Long-Evans Tokushima Otsuka (LETO-SED) rats served as controls.

**RESULTS:** Both daily EX and CR prevented obesity and NAFLD development observed in the OLETF-SED animals. This was associated with significantly (p<0.01) lower serum FGF-21 (~80% lower) and hepatic FGF-21 mRNA expression (~65% lower) in the OLETF-EX and OLETF-CR rats compared with OLETF-SED. However, hepatic FGF-21 protein content was reduced to the greatest extent in the OLETF-EX animals (50% of OLETF-SED) and did not differ between OLETF-SED and OLETF-CR. Further examination of hepatic FGF-21 signaling mediators revealed that the protein content of the hepatic co-factor of FGF-21 ( $\beta$ -Klotho), hepatic FGF-21 receptor 2 (FGFR2) mRNA expression, and hepatic FGF-21 receptor substrate 2 (FRS2) protein content were elevated (+30-50%, 60-100%, and ~40%, respectively) in the OLETF-EX and OLETF-CR compared with OLETF-SED animals.

**CONCLUSIONS:** Daily exercise and caloric restriction modulate hepatic FGF-21 and its primary signaling mediators in the hyperphagic OLETF rat. Enhanced metabolic action of FGF-21 may partially explain the benefits of exercise and caloric restriction on NAFLD outcomes. Supported by NIH grant T32 AR 048523-07 and VHA-CDA2 IK2BX001299-01.

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**1331** Board #112 MAY 30 11:00 AM - 12:30 PM

**Effects of Obesity and Exercise Training on Regional Adipose Tissue VEGF Production in Rats**

Tongjian You, FACS<sup>1</sup>, Beth Disanzo<sup>2</sup>. <sup>1</sup>University of Massachusetts Boston, Boston, MA. <sup>2</sup>State University of New York at Buffalo, Buffalo, NY.  
(No relationships reported)

Vascular endothelial growth factor (VEGF) plays an important role in angiogenesis within adipose tissue. However, the effects of obesity and chronic exercise on regional adipose tissue VEGF production are still not well known.

**PURPOSE:** To compare the regional differences in VEGF production in subcutaneous and intra-abdominal adipose tissue, and investigate the effects of obesity and chronic exercise on adipose tissue VEGF production in rats.

**METHODS:** Lean (Fa/Fa) and obese (fa/fa) male Zucker rats at 2 months of age were randomly assigned to a sedentary and an exercise training group (lean sedentary: n=7, lean exercise: n=8, obese sedentary, n=7, obese exercise: n=8). The exercise group walked on a rat treadmill at 20 m/min for 60 min, 5 times per week for 8 weeks. Inguinal and epididymal adipose tissue samples were collected and in vitro VEGF secretion levels were determined.

**RESULTS:** In the whole cohort, VEGF secretion levels were higher in epididymal (13.20 $\pm$ 3.93 ng/g protein) compared to inguinal (6.41 $\pm$ 1.18 ng/g) adipose tissue (P<0.01). There were significant main effects of obesity on inguinal (lean: 2.66 $\pm$ 0.23 ng/g, obese: 10.17 $\pm$ 1.93 ng/g, P<0.01) and epididymal (lean: 6.92 $\pm$ 1.85 ng/g, obese: 19.48 $\pm$ 7.42 ng/g, P<0.05) adipose tissue VEGF secretion, and significant main effects of exercise training on epididymal adipose tissue VEGF secretion (sedentary: 5.80  $\pm$ 0.77 ng/g, exercise: 19.68 $\pm$ 7.05 ng/g, P<0.05). There were no obesity-exercise interactions on the variables.

**CONCLUSIONS:** Our results support that intra-abdominal adipose tissue releases more VEGF than subcutaneous adipose tissue, and both obesity and exercise training increase adipose tissue VEGF production in rats. Future studies are needed to identify the role of VEGF in angiogenesis in response to chronic exercise in obesity.

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**1332** Board #113 MAY 30 11:00 AM - 12:30 PM

**The Supplement Of A-keto Acids Supports Diabetes Patients To Do Physical Exercise**

Yuefei Liu, Tamara Spreng, Jürgen M. Steinacker, FACS<sup>1</sup>. Sports and Rehabilitation Medicine, Ulm, Germany.  
(No relationships reported)

**PURPOSE:** Type 2 diabetes mellitus (DM) is one of the most important epidemic diseases that threaten the public health, and physical inactivity plays an important role in the development of DM. Therefore, to improve physical activity is of critical significance for dealing with DM. However, to do physical exercise brings about a variety of physiological changes including metabolic challenges that can reduce exercise tolerance. The aim of this study was to investigate supportive effects of nutritional supplement of a-keto acids (KAS) in patients with DM doing physical training.

**METHODS:** In the double-blinded, placebo-controlled study 30 patients with DM (non-insulin-dependent) were recruited (60  $\pm$  10 yrs, 173  $\pm$  8 cm, 91  $\pm$  16 kg) and randomized into two groups (placebo and KAS, respectively). The subjects underwent 6 weeks of physical training on cycle-ergometers supervised by a professional assistant. The training program was composed of 3 obligatory sessions (3 x 15 min endurance training followed by 5 min high intensity strength training each) and voluntarily additional training. The agents with placebo or 0.2 g/kg/d a-keto acids (0.1g a-ketoglutarate and 0.1g branched-chain keto acids) were supplemented during the training phase and one following recovery week.

**RESULTS:** In the placebo group only 28 min/week voluntary training were performed while in the KAS group 78 min ( $P < 0.05$ ). With KAS the subjects attained higher maximum power output (224 vs 193 watts,  $P < 0.05$ ). A greater improvement in glucose control and Quantitative Insulin Sensitivity Check-Index was achieved in the KAS group.

**CONCLUSIONS:** The supplement with  $\alpha$ -keto acids in patients with DM during physical training could improve exercise tolerance and training effect along with beneficial effect on glucose control and insulin sensitivity. Thus, KAS supports patients with DM to do physical exercise.

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**1333** Board #114 MAY 30 11:00 AM - 12:30 PM

**Similar Metabolite Shifts Following 75-Km Cycling Time Trials When Ingesting Bananas Or a Carbohydrate Beverage**

David C. Nieman, FACSM<sup>1</sup>, Nicholas Gillitt<sup>2</sup>, Wei Sha<sup>3</sup>, Andrew Shanely<sup>1</sup>, Amy Knab<sup>1</sup>, Lynn Kam<sup>1</sup>. <sup>1</sup>Appalachian State University, Kannapolis, NC. <sup>2</sup>Dole Nutrition Research Institute, Kannapolis, NC. <sup>3</sup>UNC-Charlotte, Bioinformatics Research Center, Kannapolis, NC.

(D.C. Nieman: Contracted Research - Including Principle Investigator; Dole Foods.)

**PURPOSE:** This study compared the acute effect of ingesting bananas (BAN) versus a 6% carbohydrate sports drink (CHO) on 75-km cycling performance and shifts in metabolites using metabolomics-based profiling.

**DESIGN:** Trained cyclists ( $N=14$ , age  $37 \pm 1.9$  y,  $Watts_{max}$   $379 \pm 12.5$ ) completed two 75-km cycling time trials (3 weeks apart, randomized, crossover) while ingesting BAN or CHO. Subjects cycled on CompuTrainers for 75-km at the fastest pace possible while ingesting 0.2 gm/kg carbohydrate from BAN or CHO every 15 min. Blood samples were taken pre-exercise, immediately following, and 1-h post-exercise, and analyzed for metabolic profiles using gas chromatography-mass spectrometry (GC-MS).

**RESULTS:** Performance time did not differ between BAN and CHO ( $2.41 \pm 0.06$ ,  $2.36 \pm 0.05$  h, respectively,  $P=0.258$ ). Of 103 metabolites detected, 56 had significant time effects following the 75-km cycling bouts, and only one (dopamine) had a pattern of change that differed between BAN and CHO. Score plots from the partial least squares discriminant analysis (PLS-DA) model visualized the global metabolic differences between pre-exercise, immediately post-exercise, and 1-h post-exercise, indicating a distinct separation between time points [ $R^2 Y(cum) = 0.869$ ,  $Q^2(cum) = 0.766$ ]. Of the top 15 metabolites (ranked by both variable influence on the projection, VIP, and FDR adjusted  $p$ -values), five (2-hydroxybutyric acid, 2-aminobutyric acid, L-glutamic acid, L-methionine, and L-proline) were related to liver glutathione production, four (palmitoleic acid, palmitic acid, oleic acid, and heptadecanoic acid) to lipid metabolism, three (2,3,4-trihydroxybutanoic acid, D-fructose, and pyruvic acid) to carbohydrate metabolism, two (malic acid and succinic acid) were intermediates in the tricarboxylic acid cycle (TCA cycle), and one (L-isoleucine) was involved in branched chain amino acid metabolism.

**CONCLUSIONS:** With the exception of higher dopamine in BAN (a polyphenolic found in bananas), shifts in metabolites following BAN and CHO 75-km cycling time trials indicate a similar pattern of heightened production of glutathione and utilization of fuel substrates in several pathways including glycolysis, lipolysis, and amino acid catabolism.

Supported by a grant from Dole Foods

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**1334** Board #115 MAY 30 11:00 AM - 12:30 PM

**High Physical Activity Counteracts the Altered Incretin Response to High Fructose Consumption**

Jill A. Kanaley, FACSM<sup>1</sup>, Amy Bidwell<sup>2</sup>, Timothy Fairchild<sup>3</sup>. <sup>1</sup>University of Missouri, Columbia, MO. <sup>2</sup>Syracuse University, Syracuse, NY. <sup>3</sup>Murdoch University, Perth, Australia.

(No relationships reported)

Fructose consumption has increased substantially in the past few decades and has been linked with metabolic maladaptations. Whether increased physical activity (PA) may confer protection against these maladaptations is yet to be determined. Although the glucose and insulin response to fructose ingestion has been well studied, the incretin response is not well understood.

**PURPOSE:** The purpose of this study was to determine the interaction between high fructose consumption and PA levels on the incretin response to a fructose rich meal in normal weight individuals.

**METHODS:** Twenty normal weight men and women (age: 21-30 yr) consumed an additional 64 g high fructose corn syrup for 14 days on 2 occasions. During these 14 days, subjects maintained either low PA (4,500 steps/day) or high PA (12,500 steps/day). Each condition was followed by a study day where subjects were given a fructose-rich meal (600 calorie mixed meal (45% carbohydrate [7.3% fructose], 40% fat, and 15% protein)) in the morning after a 12 h overnight fast, and blood was sampled at baseline and for 6 h after the meal. Samples were analyzed for glucagon-like peptide 1 (GLP-1), glucose-dependent insulinotropic peptide (GIP) and insulin concentrations. The incremental area under the curve (iAUC) was calculated to quantify the postprandial responses.

**RESULTS:** GIP concentrations showed a significant PA by fructose loading interaction ( $P=0.00$ ) such that fructose increased the GIP iAUC levels from pre to post-loading more so in the physically inactive condition (pre  $14,575 \pm 2339$ ; post  $30,431 \pm 3502$  pg/ml) than in the high PA condition (pre  $12,812 \pm 1303$ ; post  $14,938 \pm 1834$  pg/ml). GLP-1 concentrations also demonstrated a significant interaction ( $P=0.05$ ,  $n=13$ ) such that high PA lowered the GLP-1 levels (pre  $8203 \pm 1484$ ; post  $6248 \pm 1678$  pg/ml) during fructose loading, while low PA resulted in an increase in GLP-1 levels (pre  $6977 \pm 1508$ ; post  $8432 \pm 1539$  pg/ml). The glucose and insulin response to the fructose challenge showed no changes with the loading or PA changes. There were no sex differences.

**CONCLUSIONS:** The combination of high fructose intake in conjunction with more sedentary behavior results a larger incretin response to a fructose-rich meal, while glucose levels are maintained. High PA appears to protect the incretin response to increased fructose loading.

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## A-33 Free Communication/Poster - Exercise Recovery Measures

MAY 30, 2012 7:30 AM - 12:30 PM

ROOM: Exhibit Hall

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**1335** Board #116 MAY 30 9:30 AM - 11:00 AM

**The Influence of Aerobic Fitness on the Recovery of Peak Power Output**

Mark Glaister, John R. Pattison, Bernadette Dancy, Gillian McInnes. *St Mary's University College, Twickenham, United Kingdom.* (Sponsor: Gregory B Dwyer, FACSM)

(No relationships reported)

**PURPOSE:** The aim of this study was to evaluate the influence of aerobic fitness on the recovery of peak power output (PPO) following a maximal 30 s sprint.

**METHODS:** On separate occasions, 16 well-trained men (age:  $21 \pm 3$  years; height:  $1.84 \pm 0.05$  m; body mass:  $78.8 \pm 7.8$  kg; and  $VO_{2max}$ :  $4.28 \pm 0.54$  L $\cdot$ min<sup>-1</sup>) performed a 30 s maximal sprint on a cycle ergometer, followed by a predetermined stationary rest period (5, 10, 20, 40, 80, or 160 s) and a subsequent 5 s sprint to determine the kinetics of PPO during recovery. On another occasion, oxygen uptake ( $VO_2$ ) was monitored during recovery from a 30 s sprint to enable the recovery kinetics of  $VO_2$  and PPO to be compared. In addition, subjects completed a  $VO_{2max}$  test to evaluate the influence of this parameter on the recovery of PPO.

**RESULTS:** Comparison of the recovery kinetics of PPO and  $VO_2$  revealed no significant difference between the variables ( $F_{(1,15)} = 3.16$ ,  $p = 0.096$ ); there was, however, a significant effect of time ( $F_{(5,75)} = 374.44$ ,  $p < 0.001$ ), and a significant variable  $\times$  time interaction ( $F_{(5,75)} = 3.86$ ,  $p = 0.004$ ). Post hoc tests detected differences between the two variables at 20 s only ( $p < 0.05$ ). Time constants for the kinetics of PPO and  $VO_2$  ( $54.0 \pm 19.1$  s and  $51.8 \pm 11.0$  s, respectively) were poorly correlated ( $r = -0.17$ ;  $p = 0.541$ ), but were not significantly different ( $t_{(15)} = 0.385$ ,  $p = 0.705$ ). There were no significant correlations between  $VO_{2max}$  and the time constants of either PPO ( $r = 0.20$ ;  $p = 0.455$ ) or  $VO_2$  ( $r = -0.13$ ;  $p = 0.641$ ).

**CONCLUSION:** Despite many similarities, the results of this study suggest that the recovery of PPO may be faster than that of  $VO_2$  in the early phase of recovery following a maximal sprint; moreover, the speed of that recovery does not appear to be related to  $VO_{2max}$ .

1336 Board #117 MAY 30 9:30 AM - 11:00 AM

**The Effect of Short and Long Recovery Periods on the Contribution of Oxidative Processes to Energy Expenditure During Multiple Bouts of Supramaximal Exercise**

Eric C. Olson<sup>1</sup>, Kenneth V. Christensen<sup>2</sup>, Adam Jajtner<sup>2</sup>, Jen Copeland<sup>2</sup>, Matt Unthank<sup>2</sup>, Joel B. Mitchell, FACSM<sup>2</sup>. <sup>1</sup>Texas Christian University, Dallas, TX. <sup>2</sup>Texas Christian University, Fort Worth, TX.

(No relationships reported)

The contribution of oxidative energy to multiple sprint exercise is of interest due to implications for the training needs of people engaging in anaerobic activities.

**PURPOSE:** The purpose of this study was to examine the effect of short and long active recovery durations on oxidative and anaerobic energy contributions during maximal intensity cycle ergometry.

**METHODS:** Six male subjects completed the study. After a VO<sub>2</sub>max test on the bicycle ergometer, each subject completed 2 conditions: a short recovery condition (SRC) and a long recovery condition (LRC). The SRC consisted of 10, 10-sec. supramaximal sprints with 30-sec. recovery periods. The LRC consisted of 10, 10-sec supramaximal sprints with 3-min. recovery periods. The load applied to the ergometer was 1.2 g/kg and the RPM during the sprints varied based on the maximal output. During recovery, no load was applied and subjects maintained a cadence of 80 RPM. VO<sub>2</sub> was measured throughout both conditions and peak power and total work were calculated from two, 5-sec RPM averages generated during the sprints. Blood samples were taken pre-exercise, after sprints 4, 7, and 10, and 3 minutes post-exercise.

**RESULTS:** Peak power and total work were significantly greater ( $p < 0.05$ ) in the LRC (1091.3 + 88.7 W and 1363.6 + 34.6 kg-m) compared to the SRC (915.3 + 109.2 W and 1161.6 + 33.9 kg-m). In addition, peak power decayed by 21.7% over the 10 sprints in the SRC compared to no decay in the LRC. Oxygen uptake averaged 28.3 + 0.9 ml/kg/min for the entirety of the LRC; whereas, in the SRC there was a large increase in oxygen uptake during the second sprint that remained elevated and averaged 47 + 1.5 ml/kg/min for the remaining sprints. There was no difference in blood lactate between conditions.

**CONCLUSION:** The heightened aerobic response and the lower work and power outputs seen in the SRC are suggestive of a decrement in both anaerobic glycolysis and phosphocreatine activity as successive sprints were completed. After repeated bouts of explosive exercise with short rest periods, oxidative processes play a more important role in energy production, most likely due to fatigue occurring in the anaerobic energy producing systems. These findings point to the need for enhancing the aerobic capacity of athletes engaging in consecutive high intensity bouts of exercise when rest intervals are short.

1337 Board #118 MAY 30 9:30 AM - 11:00 AM

**Post-match Recovery In Elite Soccer Referees**

Matthew Weston, Alan M. Batterham, FACSM. Teesside University, Middlesbrough, United Kingdom.

(No relationships reported)

The measurement of recovery following competition is required to facilitate the effective planning and timing of subsequent training sessions. Soccer refereeing at the elite-level represents a significant physical challenge. The effect of match intensity on post-match recovery, however, has yet to be investigated.

**PURPOSE:** To examine the effect of match intensity on recovery in elite soccer referees.

**METHODS:** Data were collected from 14 elite soccer referees for 194 English Premier and Football League matches (range: 5 to 21 matches). Internal match loads were RPE (CR-10 scale) and heart rate (HR) load, computed by multiplying the accumulated duration in each of five different HR zones by a multiplier for each zone and summing the results. Each match was analysed using a semi-automated match-analysis system. External match loads were the referees' total distance covered (m) and the total high-speed running distance (m; running speed >19.8 km·h<sup>-1</sup>). The referees' recovery was recorded 30-min after waking on the day following their match, with a score of 0 representing poor recovery and 10 representing full recovery. A within-referee design was used to determine if high internal and external match loads were associated with low post-match recovery scores. Within-subject correlations between the referees' measures of external and internal match load and post-match recovery ( $n=194$ ) were examined, with 90% confidence intervals (CI) and effect sizes (Cohen's  $d$ ) also presented.

**RESULTS:** Match internal loads were  $6.7 \pm 1.5$  and  $304 \pm 47$  au for RPE and HR load, respectively. Match external loads were  $11648 \pm 609$  and  $1025 \pm 338$  m for total distance and high-speed running, respectively. Post-match recovery was  $6.7 \pm 1.2$  au. There was a small correlation between post-match recovery and match RPE ( $r = -0.24$ ; 90% CI -0.36 to -0.12,  $d = 0.49$ ) and trivial correlations between recovery and total distance ( $r = 0.10$ ; -0.02 to 0.22,  $d = 0.20$ ), high-speed running ( $r = -0.03$ ; -0.15 to 0.09,  $d = 0.06$ ) and HR load ( $r = 0.06$ ; -0.07 to 0.18,  $d = 0.11$ ).

**CONCLUSION:** Elite soccer referees' post-match psychophysiological recovery was influenced by the perceived exertion of their matches but not by their match running distances or match heart rates. Future research should investigate the effect of fitness levels and age on the post-match recovery process.

1338 Board #119 MAY 30 9:30 AM - 11:00 AM

**Effects of Recovery Duration from Prior Heavy Exercise on VO<sub>2</sub> Kinetics and Performance**

Glen R. Belfry, Seung-Jun Park, William J. Karelson, Juan M. Murias, Matthew D. Spencer, John M. Kowalchuk, Donald H. Paterson, FACSM. University of Western Ontario, London, ON, Canada.

(No relationships reported)

**PURPOSE:** To examine the effect of recovery duration (R) to heavy-intensity priming exercise (HVY1) on i) O<sub>2</sub> uptake (VO<sub>2</sub>) kinetics during a subsequent HVY exercise bout (HVY2), and ii) VO<sub>2</sub> kinetics and endurance time (TTF) during a subsequent maximal exercise bout (VHVY) performed to fatigue. It was hypothesized that VO<sub>2</sub> kinetics would be faster in HVY2 than in HVY1, and that the TTF would be longer after priming exercise.

**METHODS:** Nine (22±2 yrs (mean±SD)) healthy and active males ( $n=4$ ) and females ( $n=5$ ) volunteered to participate. A ramp (25 W/min) test to fatigue was performed on a cycle ergometer on Day 1 to determine estimated lactate threshold ( $\theta_L$ ) and peak VO<sub>2</sub> (VO<sub>2</sub>peak). Subjects returned on 8 separate occasions to perform the exercise protocols. These included transitions from 20 W to HVY1, HVY2 and VHVY. Each transition was separated by the same recovery period lasting 5 (R5), 12 (R12) or 25 min (R25) that were randomly assigned for each visit. The power outputs (PO) for HVY1 and HVY2 corresponded to 50% of the difference between the VO<sub>2</sub> at  $\theta_L$  and VO<sub>2</sub>peak ( $\Delta 50\%$ ); the PO for the VHVY endurance test was 92% of peak VO<sub>2</sub> (271±77 W). Two repetitions of the protocol were performed for each of R5, R12 and R25. Two TTF tests with no priming exercise were also performed.

**RESULTS:** Peak VO<sub>2</sub> and  $\theta_L$  were  $3.02 \pm 1.09$  L·min<sup>-1</sup> (at 293±97 W) and  $2.08 \pm 1.02$  L·min<sup>-1</sup> (at 164±44 W), while  $\Delta 50\%$  was  $2.68 \pm 0.94$  L·min<sup>-1</sup> (at 228±69 W). With R5, VO<sub>2</sub> kinetics (Mean Response Time) were faster ( $p < 0.05$ ) in HVY2 (49±10 s) and VHVY (47±13 s) compared to HVY1 (63±10 s); additionally, with R12, VO<sub>2</sub> kinetics were faster ( $p < 0.05$ ) during VHVY (57±8 s) than in HVY1 (64±14 s). TTF was greater ( $P < 0.05$ ) after R25 (323±94 s) than no priming exercise (245±61 s), R5 (226±62 s), and 12 min R (255±65 s).

**CONCLUSION:** This study suggests after HVY priming exercise VO<sub>2</sub> kinetics during a subsequent HVY exercise is faster when the R time is shorter (R5 vs R12 and R25). Improvements in TTF during very heavy-intensity exercise are observed with longer recovery (R25 vs R5 and R12), when enhanced VO<sub>2</sub> kinetics are not seen. These data suggest that at exercise intensities above the lactate threshold, benefits of faster VO<sub>2</sub> kinetics are attenuated by the production of fatigue-inducing metabolites that may require a longer recovery time to resolve.

1339 Board #120 MAY 30 9:30 AM - 11:00 AM

**Recovery Of Heart Rate Variability Immediately After Endurance Exercises On Trained And Non-trained Individuals**

Piia Kaikkonen<sup>1</sup>, Ari Nummela<sup>2</sup>, Heikki Rusko<sup>3</sup>. <sup>1</sup>Tampere Research Center of Sports Medicine, Tampere, Finland. <sup>2</sup>KIHU-Research Institute for Olympic Sports, Jyväskylä, Finland. <sup>3</sup>University of Jyväskylä, Jyväskylä, Finland.

(No relationships reported)

**PURPOSE:** The goal of endurance training is to disturb homeostasis of the body to induce a training effect. Heart rate variability (HRV) has been used as a non-invasive technique to assess modulations in autonomic nervous system, regulating homeostasis. This study investigated the effects of different running exercises on immediate post-exercise HRV in individuals with different training backgrounds, to find out if immediate HRV recovery could offer additional information on disturbance of homeostasis, the training load and training effect of different exercises.

**METHODS:** Non-trained females (NT, n = 13, age 35 ± 3 years, VO<sub>2max</sub> 36 ± 3 ml/kg/min) and recreational trained males (T, n = 13, age 35 ± 5 years, VO<sub>2max</sub> 54 ± 4 ml/kg/min) performed three running exercises on a treadmill, separated at least by two days. In both group, the effects of increased intensity (NT from 50 to 74 %, T from 60 to 85 % of vVO<sub>2max</sub>) or the duration (NT from 3.5 to 7 km, T from 3 to 14 km) of the typical control exercise of the group was investigated. HRV data was collected during pre-exercise baseline, exercise and controlled recovery of 1 minute and analyzed with STFT method. The decrease in high frequency power, as an indicator of changes in vagal activation, from the baseline (HFP<sub>bl</sub>) to the first minute of the recovery (HFP<sub>rec1</sub>, % HFP<sub>bl</sub>) was investigated.

**RESULTS:** HFP<sub>bl</sub> in NT and T were 6.6 ± 1.1 and 7.8 ± 0.9 ln ms<sup>2</sup>, respectively. When compared to HFP<sub>bl</sub>, HFP<sub>rec1</sub> varied from 41 ± 17 % (NT, 3.5 km at 74 % of vVO<sub>2max</sub>) to 83 ± 20 % (NT, 3.5 km at 50 % of vVO<sub>2max</sub>) after different exercises. Increased intensity of the typical exercise resulted in further decreased (P < 0.05) HFP<sub>rec1</sub> in both NT (from 83 ± 20 to 41 ± 17 %) and T (from 60 ± 15 to 46 ± 18 %). Increased duration of typical exercise resulted in lower HFP<sub>rec1</sub> in T (from 60 ± 15 to 47 ± 18 %, P < 0.05) while no change was seen in NT (83 ± 20 vs. 76 ± 26 %).

**CONCLUSION:** The effects of increased exercise intensity or duration, i.e. increased training load, of typical endurance exercises could be detected by HRV during the first recovery minute. However, small changes in duration or intensity may not necessarily induce changes on immediate HRV recovery. HRV during the first recovery minute seems to reflect training load of different exercises, and may be useful in evaluating the physiological training effects.

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**1340** Board #121 MAY 30 9:30 AM - 11:00 AM

**Effects of Two-Minutes Active Recovery On A “Booster” VO<sub>2max</sub> Test Using Collegiate Female Soccer Players**

Andy Bosak<sup>1</sup>, Matt Hawkey<sup>2</sup>, Thomas Andre<sup>1</sup>, Nathan Winn<sup>1</sup>. <sup>1</sup>Georgia Southwestern State University, Americus, GA. <sup>2</sup>Oklahoma State University, Stillwater, OK.  
(No relationships reported)

Maximal oxygen consumption (VO<sub>2max</sub>) tests typically end at the point of volitional exhaustion. However, previous research with averagely fit individuals and highly fit NCAA Division II female athletes suggest that concluding a maximal treadmill test with 2min active recovery and allowing subjects to exercise a second time at the workload eliciting volitional exhaustion results in significantly greater VO<sub>2</sub> max values (1.4% and 4.2% mean increase, respectively). The potential effects of this testing sequence (2min recovery) on VO<sub>2max</sub> treadmill tests has not been evaluated utilizing highly fit NCAA Division I elite female soccer players.

**PURPOSE:** To examine changes in VO<sub>2max</sub> values, in elite collegiate female soccer players, following 2min of active recovery at the conclusion of a treadmill GXT to volitional exhaustion.

**METHODS:** Twelve NCAA Division I female soccer players completed a max treadmill GXT until reaching volitional exhaustion (MAX1). Immediately following 2min active recovery (at 0% grade & 2.5 mph), each subject exercised to volitional exhaustion a second time (MAX2). MAX1 and MAX2 were compared using a paired T-test. Differences were considered significant at p ≤ 0.05.

**RESULTS:** No significant differences (p = 0.15) occurred between MAX1 (47.4 ± 4.7 ml/kg/min) and MAX2 (48.0 ± 5.3 ml/kg/min). Yet, the mean change from MAX1 to MAX2 following 2min active recovery was +1.3% with individual values ranging from -4.2% to +5.9%. Also, 66.7% of the subjects benefited (+3.3% mean increase) from the booster test with individual increases of +0.5% up to +5.9%.

**CONCLUSION:** Mean results suggest that 2min active recovery may not allow significantly greater VO<sub>2</sub> max values to be achieved by highly fit NCAA Division I elite female soccer players during treadmill testing, yet 66.7% of the subjects increased their VO<sub>2max</sub> during the “booster max” treadmill protocol. Further research is needed to determine if fitness level, training experience, age, sport specificity, or other variables might affect this exercise testing protocol.

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**1341** Board #122 MAY 30 9:30 AM - 11:00 AM

**In Vs. Out Of Water Recovery Methods, Performance And Inflammation Response: A Comparative Study**

Mahdi Hosseini Zadeh<sup>1</sup>, Valiollah Dabidi Roshan<sup>2</sup>, Hosein Babaei<sup>3</sup>, Vahid Shirinbayan<sup>2</sup>, Lars Arendt-Nielsen<sup>1</sup>. <sup>1</sup>Aalborg University, Center for Sensory-Motor Interaction (SMI), Aalborg, Denmark. <sup>2</sup>College of Physical Education and Sport Sciences, University of Mazandaran, Babolsar, Iran, Babolsar, Iran, Islamic Republic of. <sup>3</sup>Islamic Azad University, Branch Sari, Sari, Iran, Sari, Iran, Islamic Republic of. (Sponsor: Jonathan Myers, FACSM)  
(No relationships reported)

**BACKGROUND:** Repeated swimming sprints are commonly used to develop anaerobic performance in swimmers. The ability to recover from each high intensity sprint bout is an important factor for eliciting the best neuromuscular adaptations in order to attain the highest possible speed for each repetition, and therefore the best performance.

**PURPOSE:** To compare the effect of in (IN) vs. out of water (OUT) active recovery on cytokines (IL-6 and CRP), CK, lactate, and mean repeated sprint time (RSm).

**METHODS:** 16 volunteer male swimmers (age:19±4years; weight:75±12kg) were assigned to either IN vs. OUT recovery methods. Six 50-m sprint swimming bouts were performed with a 120-second interval of either IN or OUT recovery in between. Measurements were done at baseline and after third and sixth sprint swimming bout.

**RESULTS:** Serum IL-6, CRP and lactate levels (mg/dl) increased from baseline to the third and sixth bouts in both groups (IL-6: from 1.69±.78 to 2.40±1.047 and 3.86±1.81 vs. 1.84±.7 to 3.76±2.2 and 4.99±2.5, P<0.05, IN vs. OUT respectively); (CRP: from 0.39±0.21 to 1.26±0.69 and 1.95±1.14 vs. 0.37±0.25 to 1.29±0.42 and 1.75±0.56, P<0.05 IN vs. OUT respectively); and (Lactate: from 18.21±2 to 50.32±13 and 57.13±10 vs. 19.80±4 to 57.02±14 and 55.03±8, P<0.05 IN vs. OUT respectively). The CK level (U/l) and the RSm time (s) only increased in OUT (CK: from 245±109 to 294±117 and 302±121, P<0.05), (RSm: from 4.56±2.06 to 5.18±2.24 and 6.48±2.28, P<0.05).

**CONCLUSION:** Inflammatory and muscle damage markers are not affected by the IN vs. OUT recovery methods; however, out of water recovery might be associated with higher inflammatory responses. In-water recovery can improve performance compared with out-water recovery at the same intensity.

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**1342** Board #123 MAY 30 9:30 AM - 11:00 AM

**Establishing An Active Recovery Protocol For Paralympic-level Swimming**

Shane P. Esau, Jared R. Fletcher, Brian R. MacIntosh, FACSM. University of Calgary, Calgary, AB, Canada.  
(No relationships reported)

Following a competitive event, subsequent performance is thought to be enhanced by an active recovery. In competitive Paralympic-level swimming, the athletes compete twice a day for 4-8 consecutive days. Blood lactate concentration ([BLa]) has been used as a measure of the effectiveness of an active recovery. With this in mind, an active recovery protocol was investigated which could allow individualized prescribed active recovery.

**PURPOSE:** To determine [BLa] clearance during warm-down of elite Paralympic swimmers and test this in competition circumstances.

**METHOD:** 29 elite Paralympic swimmers (age = 20±3 years) completed either a 150 or 300 meter time trial in the shortest time possible, five days before the IPC Swimming World Championships. The distance covered was based on the athlete's main event at the World Championships. Post event [BLa] was determined 5 minutes after the completion of the event. Subsequently, the athletes swam 1000 meters at a heart rate between 140-150 bpm as an active recovery. [BLa] was measured every 200 meters of the active recovery. Individual [BLa] clearance rates were determined from the half-life in exponential decay (t<sub>1/2</sub>). The following week, individual [BLa] clearance rates were used to determine active recovery distance after each event during the IPC World Championships (WC).

**RESULTS:** Mean post time-trial [BLa] was 9.3±3.4 mM. The mean [BLa] t<sub>1/2</sub> was 399.2±121 m. The distance required for the athletes [BLa] to return to 4.0 mM and 2.0 mM based on the t<sub>1/2</sub> was 470±190 m and 799±239 m, respectively. During the IPC WC, the distance required to return [BLa] to at least 4.0 mM was 543±157 m. This distance was not significantly different than the active recovery distance calculated from the t<sub>1/2</sub> and was significantly shorter than the athletes traditional active recovery distance (P<0.05).

**CONCLUSION:** The results suggest that determining [BLa] t<sub>1/2</sub> could be an effective method to determine an appropriate active recovery distance in elite Paralympic swimmers. Next it will be necessary to determine the appropriate target lactate for an active recovery.



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**1343** Board #124 MAY 30 9:30 AM - 11:00 AM  
**Weight Lifting Performance And Heart Rate Variability During A Training Recovery**  
Mu-Tsung Chen<sup>1</sup>, Jui-Lien Chen<sup>2</sup>, Chung-Yu Chen<sup>2</sup>. <sup>1</sup>*Shih-Chien University, Taipei, Taiwan.* <sup>2</sup>*Taipei Physical Education College, Taipei, Taiwan.* (Sponsor: Chia-Hua Kuo, FACSM)  
(No relationships reported)

Weight training can cause muscle damage, which elicits a protracted repair process and resulted in greater muscle strength following approximately 48-72 h of recovery. It is currently unknown how the autonomic nervous system is modulated in relation to the strength training recovery.

**PURPOSE:** This study determined heart rate variability (HRV) during a 72-h recovery following a weight training bout for elite weight lifters, and its links to muscle strength, pain feeling and plasma creatine kinase level.

**METHODS:** After a 10-d detraining period, seven weight lifters performed a 2-h strength training program including back squat, seated shoulder press, dead lifts, and front squat. Weight lifting performance was evaluated at baseline (before training) and 3, 24, 48, 72 h following training. Electrocardiogram was continuously recorded for 5 min at rest in seated positions immediately before each strength performance measurement.

**RESULTS:** Weight lifting performance was recovered to baseline in approximately 24 h following training. Plasma creatine kinase level was peaked at 3 h following training and gradually decline for 72 h. Weight lifting performances were maximally increased above baseline at 72 h of recovery. Although the subjective pain feeling was not completely vanished, vagal activity (mirrored by natural log HF) was maximal at 72 h after training.

**CONCLUSIONS:** After an acute weight lifting training program, vagal activity dropped significantly and gradually elevated above baseline at 72 hour post training while the weight lifting performance was recovered to highest level.

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**1344** Board #125 MAY 30 9:30 AM - 11:00 AM  
**The Influence Of Recovery Time Following A Dynamic Warmup On Lower Body Balance And Flexibility**  
Lee Everett, Matt Beekley, FACSM. *University of Indianapolis, Indianapolis, IN.*  
(No relationships reported)

Previous studies have reported improvements in flexibility following dynamic warm-ups. However, it is possible that the recovery period may influence subsequent performance changes.

**PURPOSE:** The purpose of this study was to examine the influence of recovery time following a dynamic warm up on lower body flexibility and balance.

**METHODS:** Twenty-eight healthy, recreationally active males [(mean  $\pm$  SD) age, 21.3  $\pm$  1.4 years; height, 178.0  $\pm$  6.3 cm; weight, 80.9  $\pm$  10.7 kg] volunteered for this study. The 28 participants reported engaging in a total of 6.9  $\pm$  2.9 h $\cdot$ wk<sup>-1</sup> of exercise. Each subject performed a dynamic warm-up which included an exercise routine that gradually progressed in intensity. Furthermore, each participant performed a pretest, and three post tests (0 min, 10 min, and 20 min). Flexibility was measured using both a straight leg raise test (SLR) for hamstring flexibility and Thomas test for hip flexor flexibility. Balance was measured in the number of ground contacts and balance time during a 30 second balance test using a balance wobble board. A one-way repeated measures ANOVA was used to analyze all dependent variables. Bonferonni adjusted pairwise comparisons were used as post hoc analysis. An alpha level of  $P \leq 0.05$  was set for statistical significance.

**RESULTS:** There was a significant decrease in hip flexor flexibility from 0 min post to 10 min ( $p = .015$ ) and 20 min ( $p = .010$ ) post warm up while also being significantly lower ( $p = 0.16$ ) at 20 min post warm up compared to pre warm up values. Hamstring flexibility significantly increased from pre to 0 min post warm up ( $p < .001$ ) while also significantly decreasing from 0 min post to both 10 min ( $p = .003$ ) and 20 min ( $p < .001$ ) post warm up. Hamstring flexibility was also significantly higher at 10 min post warm up ( $p = .006$ ) when compared to pre warm up values. Balance contacts significantly decreased from pre to 10 min post warm up ( $p = .026$ ), while balance time also significantly increased from pre to 10 min post warm up ( $p = .009$ ).

**CONCLUSION:** A dynamic warm up may influence hamstring flexibility, however a longer recovery time following the warm up is less effective in maintaining hamstring and hip flexor flexibility improvements. Furthermore, the influence a dynamic warm up may have on balance may be minimal.

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**1345** Board #126 MAY 30 9:30 AM - 11:00 AM  
**Recovery And Soreness In Trained Females After An Exhaustive Resistance Training Protocol**  
Jason A. Campbell<sup>1</sup>, Phillip A. Bishop<sup>2</sup>. <sup>1</sup>*Murray State University, Murray, KY.* <sup>2</sup>*The University of Alabama, Tuscaloosa, AL.*  
(No relationships reported)

**PURPOSE:** To examine the recovery capabilities and soreness profiles of 10 resistance-trained females (ages 19-35) following three sets to failure for eight resistance exercises.

**METHODS:** The intensity used to elicit responses was the participants' 10-repetition maximum for each lift. Recovery was measured as the ability to replicate the total number of repetitions performed in the first set of the baseline workout compared to the first set total in subsequent workouts. Participants repeated the baseline session following 24, 48, 72, or 96 hours of passive recovery.

**RESULTS:** After 24 hours, the group mean for repetitions (10.0  $\pm$  1.1 reps) was similar to baseline (10.7  $\pm$  0.5 reps;  $p > 0.05$ ). But at 48 hours and 72 hours, the group performed significantly better (11.5  $\pm$  1.3  $p = 0.01$  and 11.4  $\pm$  1.2,  $p = 0.004$  reps for 48 and 72 hours, respectively) than at 24 hours. Soreness was also measured using a 100-mm visual analog scale (VAS). Soreness peaked at 24h and was significantly higher than baseline for all recovery periods (all  $p < 0.05$ ). Additionally, at 48 hours, soreness was significantly correlated to the number of repetitions ( $r = -0.77$ ,  $p = 0.01$ ). Large inter-subject variability existed across all recovery periods for all variables.

**CONCLUSIONS:** These findings suggest that trained females can recover within 24 hours following an exhaustive resistance training protocol. Women were able to perform similarly to baseline at all time points despite experiencing a significant level of soreness.

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**1346** Board #127 MAY 30 9:30 AM - 11:00 AM  
**Examining Racial Differences in Sympathetic Overactivity Assessed During Recovery from Exercise in Obese Female Adolescents**  
Stacey L. Hall, R. Lee Franco, Mary K. Bowen, Ronald K. Evans, Edmond P. Wickham. *Virginia Commonwealth University, Richmond, VA.* (Sponsor: Edmund O Acevedo, FACSM)  
(No relationships reported)

Sympathetic overactivity (SO) is associated with several disease states including type 2 diabetes, obesity, and hypertension. Black Americans have the highest risk for hypertension and black females have a greater prevalence in hypertension and obesity compared to white females.

**PURPOSE:** To evaluate differences in SO, as assessed by an exercise recovery index (ERI; heart rate/VO<sub>2</sub> plateau), between black (BOA) and white obese female adolescents (WOA). An additional aim was to determine the association of ERI with insulin resistance (HOMA-IR), cardiovascular fitness (VO<sub>2</sub>peak) per fat free mass (FFM), systolic blood pressure (SBP), and percent body fat (%FAT) in both BOA and WOA.

**METHODS:** Fifty-six obese females volunteered to participate in this study. HOMA-IR, SBP and %FAT were assessed during resting conditions in BOA ( $n=45$ , 13.7 $\pm$ 1.6 yrs, 38.1 $\pm$ 6.1 kg/m<sup>2</sup>) and WOA ( $n=11$ , 13.3 $\pm$ 2.2 yrs, 34.3 $\pm$ 4.9 kg/m<sup>2</sup>). An ERI was calculated during a 5-minute passive recovery period immediately following a graded treadmill exercise test to exhaustion.

**RESULTS:** The ERI was significantly greater (29.7 $\pm$ 6.1 vs. 23.9 $\pm$ 3.1,  $P=0.004$ ) in BOA compared to WOA females. Using multiple linear regression modeling, there was a significant independent association between ERI and VO<sub>2</sub>peak per FFM ( $r = -0.317$ ,  $P=0.049$ ) in BOA after controlling for HOMA-IR, SBP, and %FAT. HOMA-IR ( $r=0.232$ ,  $P=0.155$ ), SBP ( $r = -0.237$ ,  $P=0.146$ ), and %FAT ( $r=0.178$ ,  $P=0.280$ ) were not independently associated with ERI in BOA. Additionally, VO<sub>2</sub>peak per FFM ( $r = -0.075$ ,  $P=0.860$ ), HOMA-IR ( $r=0.112$ ,  $P=0.792$ ), SBP ( $r=0.060$ ,  $P=0.887$ ), and %FAT ( $r = -0.026$ ,  $P=0.951$ ) were not independently associated with ERI in WOA.

**CONCLUSIONS:** These results suggest that BOA females have greater SO, as assessed by an ERI, than WOA females. Understanding racial differences can contribute to both prevention and treatment of hypertension in obese female adolescents.

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## A-34 Free Communication/Poster - Military Physiology

MAY 30, 2012 7:30 AM - 12:30 PM  
ROOM: Exhibit Hall

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1347 Board #128 MAY 30 11:00 AM - 12:30 PM

### Load Carriage Increases Exposure Time during Tactical Combat Movements

Andrew P. Hunt<sup>1</sup>, Aaron J. Silk<sup>2</sup>, Paul J. Tofani<sup>2</sup>. <sup>1</sup>Defence Science and Technology Organisation, Melbourne, Australia. <sup>2</sup>University of Wollongong, Wollongong, Australia. (Sponsor: Christopher Gore, FACSM)  
(No relationships reported)

Dismounted combatants engaging an enemy force are required to move tactically between points of cover, involving repeated high-intensity short duration bounds.

**PURPOSE:** To quantify the effect of external load carriage on exposure time, the period of vulnerability to enemy fire as the combatant moves between points of cover, during a tactical combat movement simulation.

**METHODS:** Nineteen qualified Airfield Defence Guards (age 21.7±2.4 years, height 181.4±8.0 cm, body mass 81.0±9.0 kg) provided written informed consent to participate. Experimental procedures were approved by the Australian Defence Human Research Ethics Committee. The tactical movement simulation involved sixteen 6-m bounds commencing every 20 s, each starting from a prone position and ending in a kneeling position. The simulation was performed in five load conditions (A - E) ranging between 10-30 kg (5 kg increments) and comprised a replica weapon, chest webbing, protective vest, and helmet. During all trials participants were fitted with a global positioning device which contained a 10 Hz global positioning chip and nine inertial sensors. The data were analysed by custom software algorithms that were developed to objectively identify the start and end points of each bound. Repeated measures ANOVA assessed statistical differences between the load conditions.

**RESULTS:** Exposure time significantly increased as a function of external load (A 3.72±0.26 s, B 3.86 ±0.29 s, C 4.09 ±0.31 s, D 4.32 ±0.43 s, E 4.53 ±0.41 s, p<0.001). Peak velocity tended to decrease with increasing load, but this was not significant (A 2.65±0.26 m·s<sup>-1</sup>, B 2.67±0.26 m·s<sup>-1</sup>, C 2.58±0.30 m·s<sup>-1</sup>, D 2.51±0.30 m·s<sup>-1</sup>, E 2.42±0.25 m·s<sup>-1</sup>, p=0.095). However, a significantly greater time was required to reach peak velocity as external load increased (A 2.16±0.33, B 2.25±0.31, C 2.47±0.37, D 2.65±0.45, E 2.82±0.36, p<0.001). When normalised to exposure time, time to peak velocity did not differ, averaging 60% of the exposure duration.

**CONCLUSION:** Load carriage significantly impairs the ability to move between points of cover during tactical movement simulations. With technology advancing and dismounted combatants being required to carry increasing amounts of equipment, these findings highlight how additional load may impact survivability and ultimately mission outcomes.

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1348 Board #129 MAY 30 11:00 AM - 12:30 PM

### Foot Trajectory and Swing Time changes with Soldier Borne Loads in Walking and Running

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(No relationships reported)

Soldiers are often tasked with carry heavy loads. Little is known on how these loads affect trip avoidance. Previous researchers have used foot trajectory and swing time as predictors of tripping in the young and elderly adults.

**PURPOSE:** To compare foot trajectory and swing time of Soldiers during walking and running while carrying loads.

**METHODS:** Eight male soldiers walked (1.34m/s) or ran (2.24m/s) for 10 minutes on the treadmill with torso armor only (No RUCK: 17kg) and with a rucksack (RUCK: 40kg). Kinematic data was collected for 20s per condition; five strides from each trial were analyzed. Three landmarks on each foot (toe, 5th metatarsal head, and heel) were used to calculate foot trajectory and swing time. Foot trajectory variables were defined using minimum toe clearance (MTC), first and second peak in toe trajectory (TOE1 and TOE2), first peak in 5th metatarsal trajectory (MET5) and first peak in the heel trajectory (HEEL). Swing time was examined as percent stride time. Two-way repeated measures ANOVA were performed for each variable.

**RESULTS:** At both speeds, increased load significantly decreased swing time (walk: No RUCK: 37.7±0.3% RUCK: 35.9±0.5% p=0.005; run: No RUCK: 58.2±1.0% RUCK: 48.3±0.3% p<0.001). Increased speed for all load conditions significantly increased HEEL (No RUCK: walk: 31.7±0.4cm run: 36.3±0.7cm p<0.001, RUCK: walk: 31.8±0.5cm run: 34.8±0.5cm p<0.001) and MET5 (No RUCK: walk: 15.7±0.4cm run: 19.2±0.4cm p=0.001, RUCK: walk: 15.5±0.3cm run: 17.3±0.5cm p=0.011); but significantly decreased TOE2 (No RUCK: walk: 18.2±0.4cm run: 15.0±0.4cm p<0.001, RUCK: walk: 17.7±0.5cm run: 14.9±0.5cm p=0.006). During running, increased load significantly decreased HEEL (p=0.012) and MET5 (p=0.010). However, MTC (p=0.085) was not significantly affected by load or speed.

**CONCLUSIONS:** When carrying a load while ambulating, toe clearance appears to be preserved while swing time and other foot trajectory variables change. This implies that toe clearance is a crucial factor to keep consistent and Soldiers attempt to do this to prevent tripping while running with heavy loads. However, the decrease of the heel and 5th metatarsal head peaks; and reduction of swing time during running with heavy loads will decrease the ability of the Soldier to adjust their gait to prevent trips and falls on varied terrains.

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1349 Board #130 MAY 30 11:00 AM - 12:30 PM

### Improving Estimation of Energy Expenditure with Accelerometers during Military Training using a Field-Based Calibration Procedure

Sam D. Blacker, Fleur E. Horner, David M. Wilkinson, Denise M. Linnane, Peter I. Brown, Mark P. Rayson. *Optimal Performance Ltd, Bristol, United Kingdom.*  
(No relationships reported)

Estimation of physical activity energy expenditure (PAEE) in military populations is an important measurement. The gold standard for estimating PAEE is doubly labelled water (DLW). However it is expensive and can only be used following observation periods greater than seven days. Accelerometers are low cost and their output (Physical Activity Counts; PAC) is often used in linear prediction models. However, the contribution of PAC in predicting PAEE can be low unless individual calibration is performed.

**PURPOSE:** To determine if simple field-based individual user calibrations could improve the relationship between accelerometer PAC and PAEE.

**METHODS:** Following ethical approval, 32 participants (16 female and 16 male, body mass 67.9 ± 12.4 kg, stature 1.71 ± 0.10 m, estimated VO<sub>2</sub>max 44.3 ± 8.5 mL·kg<sup>-1</sup>·min<sup>-1</sup>) volunteered for the study. During 10 days of military training, PAC were measured using a 3-dimensional accelerometer device worn around participants' waist and PAEE was measured using DLW. Participants completed a multistage fitness test (MSFT) to estimate VO<sub>2</sub>max while wearing the accelerometers. Daily PAC were divided by PAC recorded during the first six levels of the MSFT (PAC<sub>MSFT</sub>) to calibrate the outputs to individual participants' movement patterns during the walking and running shuttles. Relationships between PAC and PAC<sub>MSFT</sub> with PAEE were established using Pearson bivariate correlations. Linear regression was used to develop multivariable models to predict PAEE from body mass and PAC or PAC<sub>MSFT</sub>. All data are expressed as mean ± one standard deviation and priori  $\alpha$  was set at p<0.05.

**RESULTS:** Mean 10 day PAC and PAEE were 536,341 ± 55,143 counts·day<sup>-1</sup> and 1,600 ± 386 kcal·day<sup>-1</sup>, respectively. PAEE showed a moderate relationship with PAC (r=0.44, p=0.02) and a stronger relationship with PAC<sub>MSFT</sub> (r=0.71, p<0.01). PAC did not contribute (p=0.10) to a multivariable model that included body mass to predict PAEE. However, PAC<sub>MSFT</sub> contributed (p<0.01) to the multivariable model [PAEE= 505.48 - (body mass x 14.53) + (PAC<sub>MSFT</sub> x 1.29), R<sup>2</sup>=0.68, SEE=227].

**CONCLUSION:** Calibrating accelerometer PAC to sub-maximal individual participant movements using a field-based fitness test provides a simple method for improving the prediction of PAEE during military training.

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1350 Board #131 MAY 30 11:00 AM - 12:30 PM

**Injuries among Army Recruits during Occupational Training for Military Police and Combat Engineers**

Elizabeth Clearfield, Keith G. Hauret, Phillip Garrett, Ashly Westrick, Joseph J. Knapik, FACSM. *Army Institute of Public Health, Edgewood, MD.*  
(No relationships reported)

New Army recruits who enlist as combat engineers (Engs) and military police (MPs) train 14 weeks and 19 weeks, respectively, at Fort Leonard Wood, MO. Training includes both physically demanding basic combat and occupational skill training. Injury incidence and rates among Eng and MP students have not been reported previously.

**PURPOSE:** To determine and compare demographics and injury rates for male students enrolled in 14-week Eng and 19-week MP occupational training courses that began between 1 October 2009 - 30 September 2010.

**METHODS:** Electronic rosters with demographics (age, height, weight) were obtained from the Army Training and Doctrine Command for all males who entered Eng and MP training during the survey period. Records for Eng and MP students were linked to injury data from the Defense Medical Surveillance System. Injuries were identified based on specific diagnostic (ICD-9) codes. Body mass index (BMI) was calculated as weight/height<sup>2</sup>. Demographics were compared by independent sample t-tests. Injury incidences (recruits with  $\geq 1$  injury/total recruits X 100%) and injury rates (injured/100 person-months [p-mos]) for Engs and MPs were compared using  $\chi^2$  tests; rate ratios (RR) with 95% confidence intervals (CI) were calculated. All students were assumed to have completed the full training and to be at risk for injury for the full time.

**RESULTS:** There were 4,523 Engs and 4,090 MPs. Mean  $\pm$  SD age, height, weight and BMI for Eng and MPs were, respectively, 21.2  $\pm$  3.8 and 25.3  $\pm$  3.4 years ( $p < 0.01$ ), 175.5  $\pm$  7.0 and 175.8  $\pm$  6.8 cm ( $p = 0.02$ ), 77.9  $\pm$  14.2 and 78.7  $\pm$  14.2 kg ( $p = 0.02$ ), and 25.3  $\pm$  4.1 and 25.4  $\pm$  4.1 kg/m<sup>2</sup> ( $p = 0.13$ ). Injury incidence for Engs was 41.7% and for MPs, 33.6% ( $p < 0.01$ ). The overall injury rate was 14.0/100 p-mos for Engs and 8.5/100 p-mos for MPs (RR [Eng/MPs] = 1.65, 95% CI: 1.54 to 1.77). Lower extremity overuse injury rate among Engs was 10.6/100 p-mos and among MPs was 5.7/100 p-mos (RR [Eng/MPs] = 1.86, 95% CI: 1.71 to 2.02).

**CONCLUSION:** MP students were younger, taller and heavier than Eng students. Students in Eng training had higher overall injury and lower extremity overuse injury rates compared with MPs in training. Risk factors for injuries among Engs and MPs should be determined and injury prevention efforts focused on identified risk factors for students in these occupational training programs.

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1351 Board #132 MAY 30 11:00 AM - 12:30 PM

**Sleep and Activity Measurement in Search and Rescue Aircraft Crews Using Novel Sensing Technologies.**

Gregory C. May, Giles Warrington, FACSM, John Burke, Sarah Colclough, Brendan Maloney, Ciaran O' Cathain, Shauna O' Connor O' Connor, Stephen Ryan.  
*Dublin City University, Glasnevin, Ireland.*  
(No relationships reported)

Helicopter search and rescue crews (SARC) remain on 24 hour alert. This requires the SARC to remain in a state of readiness and maximise sleep opportunities. When on duty, depending on their proximity to the SAR base, crew members may either sleep on-base or at home. These factors may lead to possible variations in the level of physical activity (PA), sleep duration ( $S_{dur}$ ) and sleep efficiency ( $S_{ef}$ ).

**PURPOSE:** To investigate the levels of PA,  $S_{dur}$ , and  $S_{ef}$  of members of the SARC during a 24 hour on-call shift using several novel sensing technologies. **Method:** Ten members of the Dublin SARC (mean  $\pm$  SD: age 40  $\pm$  5 years; height 1.76  $\pm$  0.06m; mass 89.2  $\pm$  14 kg; 5 on-base, 5 off-base) were instrumented with 2 tri-axial accelerometers (XL) and a Sensewear armband (SW) with an internal accelerometer (SW<sub>XL</sub>). The XL were placed on the right ankle and right hip with the SW placed on the left triceps. Data was recorded for a 26 hour period during which the subjects kept a written record of their activity. Total estimated energy expenditure ( $\dot{E}_{EE}$ ),  $S_{ef}$  and  $S_{dur}$  were calculated for each sensor during the 24 hour period. Sleep periods were verified for each subject using a written activity log.

**RESULTS:** *Group:* Based on the placement location of the sensors (ankle; waist; triceps) significant differences were observed for  $\dot{E}_{EE}$  (1093.9kcal  $\pm$  329.8kcal; 502kcal  $\pm$  211.5 kcal; 2371.1kcal  $\pm$  838.2kcal,  $p < 0.01$ ). Sleep indices calculated from the SW were seen to be significantly different to the XL data, but not between the XL units themselves (triceps vs. ankle; waist):  $S_{ef}$  (72.8%  $\pm$  18.5% vs. 96.3%  $\pm$  2.6%; 97.3%  $\pm$  1.9%,  $p < 0.01$ ) and  $S_{dur}$  (257.9mins  $\pm$  80.1mins vs. 371.3mins  $\pm$  49.0mins; 379.6mins  $\pm$  53.9mins,  $p < 0.01$ ). *Home vs Base:* Significant differences were seen for  $\dot{E}_{EE}$  for the SW (1907.0kcal  $\pm$  397.3kcal vs. 2835.2kcal  $\pm$  940.4kcal,  $p < 0.01$ ) and SW<sub>XL</sub> (193.8kcal  $\pm$  63.2kcal vs. 893.2kcal  $\pm$  564.2kcal,  $p < 0.01$ ). Similarly a significant difference was observed for  $S_{dur}$  (231.4mins  $\pm$  82.1mins; vs. 284.4mins  $\pm$  77mins,  $p < 0.01$ ) on the SW.

**CONCLUSION:** The location of the sensor utilised to measure PA and sleep indices in SARC members appears to play a vital role in determining the accuracy of measurement. The SW recorded significant differences in PA levels and  $S_{dur}$  between SARC on-base and off-base. Further research is required to determine if this holds true for a larger sample size.

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1352 Board #133 MAY 30 11:00 AM - 12:30 PM

**The Metabolic Cost of Walking and Running while Wearing Standard Military Gear or Running Shoes**

Shannon R. Isom, Mariel Wenzel, Cory Whitmer, Michele Aquino, Nabil Boutagy, John W. Wygand, Robert M. Otto, FACSM. *Adelphi University, Garden City, NY.*  
(No relationships reported)

Military personnel wear official military issue boots when deployed, however during non-combat base related activity, military personnel are permitted to wear "go fasters" (running shoes) during their physical training. The military perception of using "go fasters" is based on empirical evidence from training exercises, but the energy cost of using either footwear has not been quantified.

**PURPOSE:** The purpose of this study is to measure the energy cost of walking and running in military boots and running shoes under conditions of no load and of simulated combat load (~29.5kg).

**METHODS:** 6 current or veteran US Marines volunteered to participate in 8 randomly assigned steady state treadmill trials walking [W] (80.4 m/min 5% grade) and running [R] (160.8 m/min 0% grade), while oxygen consumption was obtained by open circuit spirometry. Data were collected at W and R in trials of unloaded with boots (UB), loaded state with boots (LB), unloaded with running shoes (US), & loaded with running shoes (LS). The loaded trial requires each subject to wear their own military issued boots (~1.7 kg), a flak jacket without plates (~4.0 kg), a pack (20.5 kg) and carry a rubber rifle (3.5 kg). During the last minute of each stage, rating of perceived exertion was obtained. A lactate (LA) sample was obtained at 3 minutes post exercise.

**RESULTS:** The mean energy cost for WUS, WUB, WLS & WLB trials: 17.4, 18.6, 22.8 & 23.9 mL O<sub>2</sub>/kg-min, HR: 101, 114, 132 & 138 bpm, and LA: 2.9, 2.5, 2.4 & 2.3 mmol, respectively. The mean energy cost for RUS, RUB, RLS & RLB trials: 31.9, 32.2, 40.3 & 41.0 mL O<sub>2</sub>/kg/min, HR: 150, 164, 172 & 181 bpm, and LA: .4, 4.2, 5.7 & 7.5 mmol, respectively. Statistical analysis by ANOVA ( $p < .05$ ) revealed no significant difference between footwear trials. However, the additional load of 29.7 kg required a significantly greater metabolic and cardiovascular response at both W and R trials.

**CONCLUSIONS:** The use of running shoes during non-combat physical training elicits a similar metabolic demand as the use of military boots. Therefore, the use of running shoes during physical training may be advantageous if injury potential is reduced.

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1353 Board #134 MAY 30 11:00 AM - 12:30 PM

**A Physiological Comparison of Three Backpack Frames During Treadmill Walking**

Jana E. Hollins<sup>1</sup>, Kimberly A. Pribanic<sup>2</sup>, Brian Higginson<sup>3</sup>, Daniel P. Heil, FACSM<sup>1</sup>. <sup>1</sup>Montana State University, Bozeman, MT. <sup>2</sup>Mystery Ranch, LTD, Bozeman, MT. <sup>3</sup>Gonzaga University, Spokane, WA.  
(No relationships reported)

It is well known how heavy load positioning can influence cardiorespiratory (CR) responses when walking, but few studies have focused on how backpack frame design may impact these same parameters.

**PURPOSE:** This study compared CR variables for three backpack frames during treadmill walking, all of which are commonly used the U.S. Armed Forces.

**METHODS:** Backpack-experienced subjects (18 men, 4 women; Mean  $\pm$  SD: 32 $\pm$ 8 yrs, 79.7 $\pm$ 7.7 kg) completed 4 successive 15-min walking trials at a fixed treadmill speed (80.5 m/min)

and grade (2%). The Control trial (walking without a backpack) was always tested first, while the order of backpack frames tested were counterbalanced. Trials 2-4 corresponded to wearing one of 3 military backpack frames (MOLLE, FILBE, NICE), each of which was loaded with a 26.6 kg bag load. Subjects wore a portable metabolic measurement system for measuring oxygen uptake (VO<sub>2</sub>) and heart rate (HR), as well as carried a Rubber Ducky rifle in front, the total of which weighed another 4.1 kg (30.7 kg total load). CR variables were summarized at two time points (mins 6 and 13) for each trial, while blood lactate (BL) was measured during min 15. Data were evaluated using multivariate 2-factor RM ANOVA and Sheffe's post-hoc ( $\alpha=0.05$ ).

**RESULTS:** Mean VO<sub>2</sub> and HR values for the Control trial (Mean±SE: 13.7±0.4 ml/kg/min; 97±2 BPM) were significantly lower ( $P<0.05$ ) than those for the MOLLE (16.5±0.3; 128±3), FILBE (16.6±0.4; 128±3), or NICE frames (15.9±0.4; 125±4), while there were no differences between frames. Mean BL for the FILBE trial (1.5±0.1 mmol/L) was significantly higher ( $P<0.05$ ) than the Control (1.1±0.1) but not from either the MOLLE (1.3±0.1) or NICE (1.3±0.1) frames. The percent differences in VO<sub>2</sub> of both FILBE (+4.4%) and MOLLE (+3.8%) frames from the NICE frame were practically significant.

**CONCLUSION:** The influence of backpack frame designs on CR and BL responses were generally small and non-significant. However, the FILBE frame trial elicited a slightly higher BL than the Control trial, and the difference in walking economy (i.e., VO<sub>2</sub>) between the NICE frame and the other frames (+3.8-4.4%) was greater than the 2.5% practical significance threshold. This suggests that both practical and statistical significance are most likely observed when these frames are worn for longer rather than shorter walking bouts.

**1354 Board #135 MAY 30 11:00 AM - 12:30 PM**

**The Effects Of Wearing A Weighted Vest On Aerobic Efficiency, Muscular Strength and Body Composition: A Case Study**

John W. Wygand, Raymond Peralta, Michele Aquino, Cory Whitmer, Mariel Wenzel, Shannon Isom, Anthony Lucic, Nabil Boutagy, Robert M. Otto, FACSM.  
*Adelphi University, Garden City, NY.*  
*(No relationships reported)*

Operation Heavy Heart is a philanthropic effort by US Marine veterans in support of The Wounded Warrior Project. The objectives are to raise awareness and support for injured U.S. service members. Active duty military personnel are subject to unique and prolonged physiological stress. This includes chronic musculoskeletal loading with heavy combat gear for extended periods of time. Loading periods and subsequent unloading may be associated with specific physiological adaptations and may include alterations in body composition, energy expenditure, muscular strength and cardiovascular responses to exercise.

**PURPOSE:** To evaluate the effects of long term musculoskeletal loading on muscular strength, aerobic efficiency and body composition.

**METHODS:** Two US Marine veterans (Age 26.5 yr, Ht. 170 cm, Wt 76.5 kg) volunteered to participate in this nine month trial. Aerobic efficiency was measured by open circuit spirometry and heart rate by telemetry during steady state trials at 93.8 m/min and 10% grade. Body composition was measured by DEXA. Pull ups were performed to repetition max. with palms facing at shoulder width to a 3-1-3 cadence. Squats were performed to repetition max, on a Smith machine, with a load of 97.8 kg at a 3-1-3 cadence and a range of motion of 70-180 degrees of knee flexion. Each subject wore a 9.1 kg weighted vest during all daily activities except sleeping. All parameters were measured monthly during the nine months of weighted vest application and one month after they stopped wearing the vests.

**RESULTS:**

|                           | VO <sub>2</sub><br>(ml/min) | HR<br>(beats/min) | %HRR | PULL UPS | SQUATS | BMD<br>(g/cm <sup>2</sup> ) | MASS<br>(kg) | FFM<br>(kg) | %FAT |
|---------------------------|-----------------------------|-------------------|------|----------|--------|-----------------------------|--------------|-------------|------|
| PRE                       | 2376                        | 145               | 61   | 7.5      | 6.5    | 1.295                       | 76.5         | 63.9        | 16.4 |
| NINE MONTHS               | 2355                        | 136               | 53.5 | 11       | 5      | 1.328                       | 75.6         | 66.2        | 13.1 |
| 1 MONTH<br>POST UNLOADING | 2345                        | 137               | 54.5 | 11       | 6.5    | 1.33                        | 76.7         | 65          | 13.3 |

**CONCLUSION:** Chronic, long term musculoskeletal loading is associated with improvements in body composition, upperbody strength and cardiovascular efficiency that persist for at least four weeks after the loading period.

**1355 Board #136 MAY 30 11:00 AM - 12:30 PM**

**Effects of 4-Month Heat Exposure on Body Composition, Physical Performance and Serum Hormone Concentrations**

Heikki Kyröläinen<sup>1</sup>, Matti Santtilä<sup>2</sup>, Harri Lindholm<sup>3</sup>, Keijo Häkkinen<sup>1</sup>, Hanna Seikola<sup>1</sup>, Hannu Rintamäki<sup>3</sup>. <sup>1</sup>University of Jyväskylä, Jyväskylä, Finland. <sup>2</sup>Finnish Defence Forces, Helsinki, Finland. <sup>3</sup>Finnish Institute of Occupational Health, Helsinki, Finland. (Sponsor: Paavo V. Komi, FACSM)  
*(No relationships reported)*

Military operations in a hot environment together with body armor and helmet increase dramatically soldiers' heat strain, which may decrease the operational readiness.

**PURPOSE:** To investigate changes in body composition, physical performance and serum hormone concentrations of soldiers during a 4-month deployment in physically demanding a high ambient air temperature environment (range from 18.1 to 37.7 °C, in vehicles even 57.0°C).

**METHODS:** 20 voluntary male soldiers (age 23 ± 1 yrs, height 1.80 ± 0.06 m, body mass 78.4 ± 11.5 kg) participated in the study. Whole body composition was measured by bioimpedance device and the cross-sectional area (CSA) of the thigh by magnetic resonance imaging. Physical performance was measured before and after the mission, which resulted in the energy deficit was 677 ± 1023 kcal/day. Basal serum hormone concentrations were measured before, middle and after of the deployment.

**RESULTS:** Body mass decreased by 3.5 % ( $p<0.05$ ) but no changes were observed in fat % and CSA (subcutaneous fat and muscle) of the thigh. The mission did not cause any changes in the 12-min running distance (2785 ± 238 vs. 2749 ± 237 m,  $p=0.276$ ) but increased MVC of the leg extensors (3042 ± 614 vs. 3277 ± 706 N,  $p<0.05$ ). No changes were noticed in repeated squats and push-ups, while sit-ups and vertical jump improved ( $p<0.01-0.001$ ). No significant alterations in basal cortisol (COR) or testosterone (TES) concentrations were observed but sex hormone-binding globulin (SHBG) concentration was higher ( $p < 0.05$ ) at 2 (33 ± 10.2 nmol/L) and 4 months (31.2 ± 10.3 nmol/L) compared with the initial values (25.5 ± 9.1 nmol/L). Insulin-like growth factor I (IGF-I) concentration was lower ( $p < 0.05$ ) at 4 months (29.6 ± 6.5 nmol/L) compared with initial (33.1 ± 5.9 nmol/L) and middle (33.8 ± 5.1 nmol/L) concentrations.

**CONCLUSIONS:** Despite the heat stress and energy deficit, it seems that soldiers managed to retain their physical performance and basal COR and TES concentrations. Thus, it can be concluded that the overall stress during the mission was not very severe despite a decrease of the biomarker IGF-1. In addition, the type of physical activity, including strength training that soldiers often performed during the deployment might have played an important role in individual sustainability of the operational readiness.

**A-35 Free Communication/Poster - Motor Control**

MAY 30, 2012 7:30 AM - 12:30 PM  
 ROOM: Exhibit Hall

**1356 Board #137 MAY 30 9:30 AM - 11:00 AM**

**An Investigation Of Age, Task Complexity, And Gender As Potential Moderators Of Attentional Focus Effects.**

Peter J. Smith<sup>1</sup>, Kevin Becker<sup>2</sup>. <sup>1</sup>Illinois State University, Normal, IL. <sup>2</sup>University of Tennessee, Knoxville, TN. (Sponsor: Kristen Lagally, FACSM)  
*(No relationships reported)*

A large body of research has suggested that focusing on the effects of a movement (external focus) is more effective than focusing on the movement itself (internal focus) for learning and performing motor skills (for reviews see Wulf, 2007; Wulf and Prinz, 2001). Recent research has suggested that age and task complexity may moderate this attentional focus effect.

**PURPOSE:** The present study examined the effectiveness of internal and external attentional foci for learning two novel locomotor skills varying in complexity.

**METHODS:** 48 children (ages 8-10) and 48 adults (ages 19-26) learned to ride a Double Pedalo either with or without stability handles while adopting either an internal or external focus of attention. Participants were instructed to either push their feet (internal focus) or the boards of the Pedalo (external focus) forward to make the Pedalo move. The dependent measure used was time to travel 7 meters.

**RESULTS:** For the simpler task, no attentional focus effects were elicited during either acquisition or retention. With the complex task, there were no significant attentional focus effects in acquisition, but in retention, an external focus of attention resulted in faster times than an internal focus, but only in males.

**CONCLUSIONS:** These findings further support the findings of Wulf, Toellner, and Shea (2007), suggesting that a certain degree of instability or error is necessary to elicit external focus benefits. In addition, they corroborate the findings of Wulf, Wächter, & Wortmann (2003) which suggested females and males may be differentially affected by attentional focus instructions.

**1357** Board #138 **MAY 30 9:30 AM - 11:00 AM**  
**The Development Of General And Soccer-specific Perceptual Motor Skills During Adolescence**  
 Tomi Vanttinen. *Research Institute for Olympic Sports, Jyväskylä, Finland.*  
 (No relationships reported)

Expert-novice comparisons have indicated that perceptual motor skills are sport-specific. That is, the level of expertise is more important than the age itself in sports. However, it is not clear what is the dynamics of development of sport-specific perceptual skills compared to the development of general perceptual motor skills.

**PURPOSE:** To examine how general and soccer-specific perceptual motor skills develop during adolescence.

**METHODS:** The subjects of the present study were four age groups (10y, 12y, 14y and 16y) from a club team (n=74). Subject's simple reaction time was measured with Wayne Membrane Saccadic Fixator and peripheral reaction time with Wayne Peripheral Awareness Trainer. A specific laboratory test was used to measure soccer-specific decision making time and choice reaction time during simultaneous ball handling. Age comparisons were made using one-way ANOVA with Tukey's post hoc.

**RESULTS:** All perceptual motor skills improved with age (Table 1) from 10 to 16y but improvement was greater in soccer-specific perceptual skills (decision making time 79.0%,  $F_{73}=49.315$ ,  $p<0.001$ ; choice reaction time 27.7%,  $F_{73}=16.725$ ,  $p<0.001$ ) than in general perceptual motor skills (simple reaction time 17.6%,  $F_{73}=6.371$ ,  $p<0.01$ ; peripheral reaction time 26.1%,  $F_{73}=6.808$ ,  $p<0.001$ ).

**CONCLUSIONS:** These results suggest that soccer training provides training stimulus for soccer-specific perceptual skills that is beyond to be expected from the normal development of general perceptual skills. Decision making time was less than simple reaction time which means that the players ability to anticipate, not just react, is a key factor for success in soccer already at a young age.

Table 1. Mean  $\pm$  SD of the measured variables in the different age groups.

|     | Simple Reaction Time (ms)        | Peripheral Reaction Time (ms) | Choice Reaction Time with Ball Handling (ms) | Soccer-specific Decision Making Time (ms) |
|-----|----------------------------------|-------------------------------|--|---|
| 10y | 250 $\pm$ 34 <sup>12,14,16</sup> | 348 $\pm$ 54 <sup>16</sup>    | 336 $\pm$ 24 <sup>14,16</sup>                | 181 $\pm$ 39 <sup>14,16</sup>             |
| 12y | 224 $\pm$ 27 <sup>10</sup>       | 328 $\pm$ 58 <sup>16</sup>    | 329 $\pm$ 42 <sup>14,16</sup>                | 161 $\pm$ 33 <sup>14,16</sup>             |
| 14y | 213 $\pm$ 25 <sup>10</sup>       | 300 $\pm$ 61                  | 278 $\pm$ 51 <sup>10,12</sup>                | 95 $\pm$ 30 <sup>10,12,16</sup>           |
| 16y | 206 $\pm$ 27 <sup>10</sup>       | 257 $\pm$ 29 <sup>10,12</sup> | 243 $\pm$ 29 <sup>10,12</sup>                | 38 $\pm$ 45 <sup>10,12,14</sup>           |

(<sup>n</sup> =  $p<0.05$  difference with age group indicated by number)

**1358** Board #139 **MAY 30 9:30 AM - 11:00 AM**  
**Analysis Of Inter-limb Force Coordination During Isometric Bilateral Grip Control Task**  
 Chueh-Ho Lin, Wen-Hsu Sung, Li-Wei Chou, Shun-Hwa Wei. *National Yang-Ming University, Taipei, Taiwan.*  
 (No relationships reported)

Interhemisphere interaction plays an important role in motor performances, especially during inter-limb force control and coordination during exercise and activity of daily life. Simultaneous bilateral movement training can improve functional performance of the affected limb after CNS lesion. However, the effect of interhemisphere interactions on bilateral force control was still unclear.

**PURPOSE:** The aim of the preliminary study was to analyze interhemisphere interaction by investigating inter-limb force control and coordination during force-maintenance task.

**METHODS:** Seven female and seventeen male healthy adults participated in this study (mean age = 23.3 $\pm$ 3.4y/o). Subjects were asked to hold hand grip force of one hand at a given force level, then gradually decrease hand grip force of that hand while the other hand gradually increase hand grip force so that the sum of the total force from two hands maintained at the given force level. This task was performed at 10, 20 and 40% maximal force levels and was repeated in different order (right to left hand and left to right hand). The force outputs of the participant's hands were recorded and analyzed. The timing of grip force cross point between two hands during force generating process was used to evaluate the force balance between both hands. Two-way analysis of variance was performed to determine the timing differences in handgrip force control under different conditions.

**RESULTS:** The results demonstrated that the force modulation timing in right to left hand was longer than in left to right hand condition at 10% (46.2 $\pm$ 17.6% vs. 33.1 $\pm$ 14.7%,  $p=.005$ ), 20% (40.4 $\pm$ 11.3% vs. 29.8 $\pm$ 11.3%,  $p=.002$ ) and 40% (40.7 $\pm$ 13.7% vs. 27.9 $\pm$ 14.6%,  $p=.002$ ) isometric force-maintain tasks. The timing difference of target force-maintain task for both hands at 3 force levels was not significant different (18.9 $\pm$ 14.6% vs. 13.1 $\pm$ 11.6% vs. 17.6 $\pm$ 9.5%,  $p=.229$ ).

**CONCLUSIONS:** We concluded that left brain controlling right hand has greater control ability than right brain during bilateral force modulation. This finding could indicate interhemispheric interactions during bilateral limb control, which provide new information with implications for clinicians and therapists an evaluation parameter for inter-limbs coordination. Supported by the Taiwan NSC grant (NSC99-2221-E-010-002).

**1359** Board #140 **MAY 30 9:30 AM - 11:00 AM**  
**Visuospatial Working Memory in Children with Poor Motor Coordination as Revealed by Event-Related Potential**  
 Ming-Wei Chen<sup>1</sup>, Chia-Liang Tsai<sup>1</sup>, Chien-Yu Pan<sup>2</sup>, Tzu-Chi Chen<sup>1</sup>, Feng-Ying Chou<sup>3</sup>. <sup>1</sup>National Cheng Kung University, Tainan, Taiwan. <sup>2</sup>National Kaohsiung Normal University, Kaohsiung, Taiwan. <sup>3</sup>Chi Mei Medical Center, Tainan, Taiwan.  
 (No relationships reported)

Children with poor motor coordination have been demonstrated to show an impairment in working memory in visuospatial domains. However, no studies have yet been conducted on the mechanisms of deficits of visuospatial working memory (VSWM) in children with poor motor coordination as revealed by event-related potential (ERP).

**PURPOSE:** The present study aimed to investigate the mechanisms of motor processing in brain activity underlying behavioral anomalies in children with poor motor coordination, and to compare them with those found in children with normal motor coordination when performing the VSWM task. **METHOD:** Twenty-five children with poor motor coordination and 25 age- and sex-matched children with normal motor coordination were identified with the Movement Assessment Battery for Children-Second Edition test. Each child simultaneously performed one spatial non-delay and two time-delayed spatial memory tasks (i.e., 3s-dealy and 6s-delay) with concomitant ERP recording. Behavioral and ERP data were statistically analyzed using repeated measures ANOVA.

**RESULTS:** Children with poor motor coordination had a significantly longer reaction time (879.93 $\pm$ 67.13 vs. 829.07 $\pm$ 52.43ms in 3s-delay task; 864.84 $\pm$ 64.53 vs. 820.81 $\pm$ 50.22ms in 6s-delay task; both  $p<.05$ ) and lower accuracy rates (0.79 $\pm$ 0.08 vs. 0.87 $\pm$ 0.05 in 3s-delay task; 0.72 $\pm$ 0.08 vs. 0.82 $\pm$ 0.07 in 6s-delay task; both  $p<.05$ ) than children with normal motor coordination in the

two spatial memory tasks. With respect to the ERP components, children with poor motor coordination, as compared to children with normal motor coordination, showed smaller P3 (13.55±5.93 vs. 19.61±6.44µV in 3s-delay task; 16.54±7.83 vs. 21.05±7.59µV in 6s-delay task; both p<.05) and pSW (i.e., positive slow wave) (14.41±4.56 vs. 20.17±5.47µV in 3s-delay task; 15.40±5.75 vs. 19.38±7.93µV in 6s-delay task; both p<.05) amplitudes during the retrieval-process phase for later remembered items.

**CONCLUSION:** Children with poor motor coordination showed impairment when performing VSWM task and the mechanisms could allocate less resources and less effort for comparison of spatial locations and response selection.

**Key words:** motor coordination, visuospatial working memory, event-related potential, neuropsychology

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**1360** Board #141 MAY 30 9:30 AM - 11:00 AM

**Effects of Exercise Intervention on Attention Networks in Children with Poor Motor Coordination: ERP Evidences**

Tz-Chi Chen<sup>1</sup>, Chia-Liang Tsai<sup>1</sup>, Feng-Ying Chou<sup>1</sup>, Chien-Yu Pan<sup>2</sup>, Yu-Ting Tseng<sup>1</sup>. <sup>1</sup>National Cheng Kung University, Tainan, Taiwan. <sup>2</sup>National Kaohsiung Normal University, Tainan, Taiwan.

(No relationships reported)

Children with poor motor coordination (PMC) have been demonstrated to exhibit impaired inhibitory control capacity. However, no studies have been undertaken on the potential effects of exercise intervention on the attention networks of such individuals.

**PURPOSE:** The aim of the present study was to investigate the effects of soccer training on the inhibitory control of children with PMC, focusing on the event-related potential (ERP) components regarding early modality specific inhibition (N2) and late general inhibition (P3).

**METHODS:** Forty-two children were screened with the Movement Assessment Battery for Children test and categorized into those with normal motor coordination (n=14, control group) and those with PMC (n=28). Children with PMC were then quasi-randomly subdivided into either an exercise-intervention (EI) group (n=14) or a non-exercise-intervention (NEI) group (n=14). Before and after a ten-week training program (50-minute sessions, five times a week), all children performed the visuospatial attention task with centrally non-predictive gaze-directed cues with the lower extremities, while brain ERP were concurrently recorded. Repeated measure analysis of variance was used to analyze the training effect.

**RESULTS:** Before training, although the N2 component did not have any significant differences among the three groups, children with PMC, when compared to the control group, showed an impaired inhibitory control capacity (NEI: 49.15±37.99, EI: 43.04±23.80, Control: 10.00±17.99ms, p<.05), smaller P3 amplitude (NEI: 11.94±2.64, EI: 12.14±3.12, Control: 15.34±3.21µV, p<.05) and slower P3 latency (NEI: 335.73±30.34, EI: 332.37±36.28, Control: 300.12±26.30ms, p<.05) across conditions of the visuospatial attention orienting task. After training, beneficial effects emerged with regard to the strength of inhibitory control (NEI: 34.12±28.61 vs. EI: 11.62±16.83 and Control: 10.46±10.43ms, p<.05) and the P3 latency (NEI: 323.24±21.45 vs. EI: 292.89±24.43, Control: 299.96±24.43ms, p<.05) in the EI group.

**CONCLUSION:** The execution and acquisition of compound lower-limb motor skills during extensive soccer training for children with PMC seems to induce reinforced neuronal networks that enable faster cognitive processing.

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**1361** Board #142 MAY 30 9:30 AM - 11:00 AM

**Changes In Mental Simulation Of Goal-directed Movements In Healthy Adults Aged 20- 89**

Bouwien C. Smits-Engelsman. *KULeuven, Leuven, Belgium.*

(No relationships reported)

Mental simulation or imagery is a common mental training technique in sports and is gradually introduced for rehabilitation purposes in patient populations. Imagery research has demonstrated that motor imagery and motor execution share similar neural representations. However little is known about changes in the relation between the duration of actual and mental movements. We have recently shown that motor imagery training from a first person perspective in young healthy adults leads to improvements in performance of the executed movements (Herremans et al, 2011). However little is known about changes in the ability to represent actions during normal aging.

**PURPOSE:** To examine age-related similarities and differences in duration of mental and actual goal directed upper limb movements using a Fitts paradigm.

**METHODS:** 3 groups of adults performed the Radial Fitts Task with 5 Indexes of Difficulty (2.91-6.91) on a digitizer [young (20-29; n=39), senior (50-65; n=23) and elderly individuals (70-89 n=29); 97% right handed and 69% female].

**RESULTS:** Overall, the elderly group was significantly slower on the mental and executed tasks (F(1,2) 9.36, p<0.001, means 8.1, 7.5 and 12.7 seconds, respectively). However, no interaction with task condition (mental and executed) emerged, indicating that the mental and actual tasks slowed down comparably. In the second analysis the goodness of fit for the Index of Difficulty was determined. Here a highly significant group effect was found for the goodness of fit, testing for the adherence to Fitts' Law, (F(1,2) 15.92, p<0.001; mean R2 was 0.70, 0.65 and 0.43, respectively). Elderly adapted their movement time less to the task difficulty. Again no interaction with task (mental and executed) was found.

**CONCLUSIONS:** The oldest group had a clear idea of their movement durations: they knew they were slow. However when they imagined to move they were also very slow, leading to good correlations between motor imagery and motor execution duration. Therefore we conclude that the ability to mentally represent goal directed actions is still intact.

References: Herremans E, Smits-Engelsman B, Caeyenberghs K, Vercruyse S, Nieuwboer A, Feys P, Helsen WF. Keeping an eye on imagery: the role of eye movements during motor imagery training. *Neuroscience*. 2011 Nov 10;195:37-44.

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**1362** Board #143 MAY 30 9:30 AM - 11:00 AM

**Ankle Movement Discrimination Is Correlated with Sports Performance Levels**

Jia Han<sup>1</sup>, Gordon Waddington<sup>2</sup>, Judith Anson<sup>2</sup>, Roger Adams<sup>3</sup>. <sup>1</sup>University of Canberra; *Shanghai University of Sport, ACT, Australia.* <sup>2</sup>University of Canberra, ACT, Australia. <sup>3</sup>University of Sydney, Sydney, Australia.

(No relationships reported)

Numerous studies have tried to find evidence to suggest athletes specialized in particular sports have better ankle proprioceptive ability than athletes in other sports or non-athletes. However, the results in the literature are inconsistent. Although different testing methods and the diversity of testing range and planes of movement may account for this variability, other possible confounding variables such as years of training and sports performance levels have not been systematically investigated.

**PURPOSE:** To determine the relationship between ankle movement discrimination ability and years of training and sports performance levels.

**METHODS:** One hundred and twenty right handed, healthy young Chinese athletes (handedness was determined by the Edinburgh Handedness Test), without significant injuries during the past 6 months, mean 20.5 years, (range 18-25) and mean 8.2 years of current professional training, (range 2-15) across 6 sports (aerobic gymnastics (12F, 8 M), hand ball (9F, 11M), swimming (10F, 10M), soccer (7F, 13M), sports dancing (13F, 7M), badminton (8F, 12M)) were tested with a purpose-built ankle Active Movement Extent Discrimination Apparatus (AMEDA). Sports performance levels were determined by the athletes' best record within the past year (level 3: national top 6 and above; level 2: national top 16; and level 1: national top 32 or regional top 3; mean level 1.7, range 1-3). Participants were tested in standing position with bare feet and undertook 50 trials (10 for each of 5 different inversion displacements) presented at random to the right ankle. Pearson correlations, with statistical significance at p<0.05, were calculated to estimate the relationship between movement discrimination scores and years of training and sports performance levels.

**RESULTS:** Enhanced ankle movement discrimination was positively correlated with higher levels of sports performance (p<0.001), but not with years of training (p>0.05).

**CONCLUSION:** These results are consistent with Ericsson's (2006) hypothesis about deliberate practice underpinning high level sport performance. Given that higher level athletes have better ankle movement discrimination ability, ankle proprioception could possibly be considered as one of the measures used in sports talent identification testing.

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1363 Board #144 MAY 30 9:30 AM - 11:00 AM

**“Return To Driving”; Examining Driving Performance After Concussion**

Maria T. Schultheis<sup>1</sup>, Preeti Sunderaraman<sup>1</sup>, Bradley J. Sandella<sup>2</sup>, Taylor Blake<sup>1</sup>, Jocelyn Ang<sup>1</sup>, Nazaneen Zahedi<sup>1</sup>, Danielle Martin<sup>1</sup>, Joy Ricasa<sup>2</sup>, Eugene S. Hong<sup>2</sup>.  
<sup>1</sup>Drexel University, Philadelphia, PA. <sup>2</sup>Drexel University College of Medicine, Philadelphia, PA.  
(No relationships reported)

Management of concussions is commonly focused on “return to play” decision for athletes; however concussion may impact other activities, such as the ability to drive an automobile. Findings from other neurologically compromised populations have shown that deficits in information processing speed, working memory and executive functioning are related to changes in driving performance. Concussion research has implicated deficits in these same domains, yet little to no research has been done to examine the relationship between driving and concussion.

**PURPOSE** The current study compares driving performance (using a virtual reality driving simulator; VRDS) between individuals recently concussed (RC) and an age and gender-matched healthy control (HC) group.

**METHODS** Participants were recruited from consecutive referrals from 2 universities. Concussion was diagnosed by treating sports physician using the Zurich Concussion Consensus guidelines. Participants were seen for a 2.5 hr. testing session within the first 72 hours post-concussion. Testing included VRDS administration and a series of cognitive measures. The current findings are a part of a larger ongoing study. Sixteen individuals (11m, 5f; M=20 yrs old) were included. All participants were licensed, active drivers with greater than 2 years driving experience.

**OUTCOME MEASURES** The VRDS generates a variety of driving performance measures. For the current analysis, 2 driving variables; 1) center lane deviation and 2) mean speed were examined across 3 environments; 1) straight lane segment, 2) curve lane segments and 3) a complex driving task of following a truck. **RESULTS** Paired sample T-tests were used to compare group differences. In the straight driving task, the RC group spent more time outside their designated lane compared to HC ( $p = 0.005$ ). In the curved driving task, the RC group drove significantly slower than the HC group ( $p = 0.02$ ). During driving while following a truck, speed was significantly reduced for the RC group ( $p = 0.001$ ). Exploratory correlational analysis between cognitive and VRDS measures revealed some significant relationships.

**CONCLUSIONS** These preliminary findings suggest that changes in driving behaviors may exist at 72 hours post-concussions and this may be related to cognitive performance. Supported by NIH Grant # 1R03HD064847

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1364 Board #145 MAY 30 9:30 AM - 11:00 AM

**Changes in Target Displacement and the Effects on Quiet Eye Duration**

Michelle S. Okumura<sup>1</sup>, Robert R. Horn<sup>2</sup>, Michele M. Fisher<sup>2</sup>, Melissa G.F. Alexander<sup>2</sup>, Curtis T. Sylvester<sup>2</sup>. <sup>1</sup>University of Georgia, Athens, GA. <sup>2</sup>Montclair State University, Montclair, NJ.  
(No relationships reported)

The role of gaze in aiming tasks (e.g., throwing a ball or shooting a gun) is an important characteristic of human performance, including certain aspects of sport and military performance. In aiming tasks, the final fixation of the eye before the initiation of a movement is called the quiet eye (QE) period. The location-suppression hypothesis proposes that the QE period is used to program the movement parameters (e.g., force, velocity, angle of release) during execution of an aiming task.

**PURPOSE:** To examine QE duration in response to directional and displacement-based changes in target location using a sky dart aiming task.

**METHODS:** 11 male participants (22.91±3.39 yrs) completed two sets of 46 throws to targets located on a grid on the floor. Each throw resulted in changes in target displacement in terms of direction (X-, Y-, or Z-axis) and distance (1-, 2-, or 3-increment changes on the grid). Changes in target displacement required the participant to scale the movement parameters on successive trials. The duration of the QE period was assessed on each trial using the vision-in-action approach.

**RESULTS:** A two-way ANOVA with repeated measures revealed a main effect for both direction,  $F(1.30, 13.05) = 204.85, p \leq .001$ , and displacement,  $F(1.16, 11.61) = 21.20, p \leq .001$ . An interaction effect was also observed between target direction and target distance. For Y-axis changes, 3-increment changes resulted in longer QE duration (+0.039 s) than 1-increment changes. For Z-axis changes, 3-increment changes resulted in longer QE duration than both 1- and 2-increment changes (+0.144 s; +0.041 s), and 2-increment changes resulted in longer QE duration than 1-increment changes (+0.073 s).

**CONCLUSION:** Larger target displacements result in longer QE duration compared to smaller target displacements. Therefore, when throws require greater reprogramming of movement parameters, the QE period will be longer.

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1365 Board #146 MAY 30 9:30 AM - 11:00 AM

**Gross Motor Skills of Children and Adolescents with Mental Health Problems: a Pilot Study**

Alain S. Comtois<sup>1</sup>, Claudia Verret<sup>1</sup>, Tommy Chevrette<sup>2</sup>, Jean P. Boucher, FACSMT<sup>1</sup>, Jordan Lefebvre<sup>1</sup>, Émilie Kalinova<sup>1</sup>, Mario Leone<sup>2</sup>. <sup>1</sup>University of Quebec in Montreal, Montreal, QC, Canada. <sup>2</sup>University of Quebec in Chicoutimi, Chicoutimi, QC, Canada.  
(No relationships reported)

**PURPOSE:** There is a growing body of literature providing evidence on the gross motor (GM) deficit of children having internalised or externalised mental health problems. Despite this, motor troubles are rarely reported in the primary diagnosis, and the impact of motor difficulties are not well documented. Thus, the goal was to evaluate the GM skills of children and adolescents having a mental health problem.

**METHODS:** Twenty-four boys and girls were divided into children and adolescents (n=11, n=5, n=6 and n=2, respectively). All participants had a primary diagnosis of mental health problem using DSM-IV and were referred into the study by a paediatrician. GM performance was evaluated with the UQAC-UQAM GM skills test battery comprising 12 items that assesses 5 GM qualities: Upper and Lower limb speed; Agility; Static and Dynamic Balance; Simple Reaction Time; and Coordination. Results were compared to percentile ratings gathered from 1494 boys and 1551 girls across 5 regions in Quebec all ranging in age 6.0 to 12.9 years.

**RESULTS:** The mean age of the children and adolescents, boys and girls, was 10.6±1.0 and 9.2±2.6, and 13.3±0.5 and 14.0±1.4 years, respectively. The children boys and girls were compared to their respective age groups (11.0 to 11.9 and 9.0 to 9.9 years, respectively), while both adolescent groups were compared to their gender respective 12.0 to 12.9 year age group. The children and adolescent boys and girls for weight, height and BMI scored in the 50<sup>th</sup> to 80<sup>th</sup> percentile. The upper and lower limb speed revealed that all boys and girls scored below the 20<sup>th</sup> percentile. The agility test percentile scores for children boys and adolescent girls was all within median range (40<sup>th</sup> to 70<sup>th</sup> percentile) while for the adolescent boys and children girls the range was within the 10 to 40<sup>th</sup> percentile. Static and dynamic balance indicated that all participants scored in the 10<sup>th</sup> to 30<sup>th</sup> percentile range. All participants scored in the 20<sup>th</sup> to 50<sup>th</sup> percentile range for the simple reaction time test, while for coordination the range was in the 10<sup>th</sup> to 50<sup>th</sup> percentile.

**CONCLUSIONS:** In this limited number of participants GM skills were all within the median range or lower (10<sup>th</sup> percentile) suggesting that mental health problems may lead to impaired GM skills development.

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1366 Board #147 MAY 30 9:30 AM - 11:00 AM

**Video Feedback on Advanced Wheelchair Skills Training for Individuals with Spinal Cord Injury**

Xiang Ke<sup>1</sup>, Li-Shan Chang<sup>1</sup>, Michelle Nemeth<sup>2</sup>, Abhinandan Batra<sup>1</sup>, Weerawat Limroongreungrat<sup>3</sup>, Yong Tai Wang, FACSMT<sup>1</sup>. <sup>1</sup>Georgia State University, Atlanta, GA. <sup>2</sup>Shepherd Center, Atlanta, GA. <sup>3</sup>Mahido University, Salaya, Thailand.  
(No relationships reported)

**PURPOSE:** This study was to investigate the effectiveness of the implementation of immediate video feedback on advanced manual wheelchair skills training for individuals with spinal cord injury (SCI)

**METHODS:** Twenty-one manual wheelchair users with SCI level between T1 and L1 were recruited. Participants signed informed consent forms were matched (9 pairs) on gender and motor function level and randomized to the control group (using conventional training) or experimental group (using immediate video feedback training). Twelve participants were in the control

group (33.22±11.33 yrs) and 9 in the experimental group (34.50±12.69 yrs). Each participant was expected to learn three advanced wheelchair skills (wheelie, ramping, and curbing) through four sessions: training session, competence test, retention test, and transfer test. The paired t-test was employed to determine the differences of learning and performing time (minutes), spotter intervention (times), occurrence of tip (times) and successful rate of performance between the two groups. A mixed-model ANOVA and Bonferroni post hoc test were used to compare mean differences between the two groups on three wheelchair skills and four sessions

**RESULTS:** In the pair t-test, out of the 51 comparisons, only three comparisons were significantly different between the two groups. The experimental group had a significantly less performing time in wheelie competence test (1.33±.17 minutes vs. 2.05±.76 minutes,  $p<.05$ ), a significantly more spotter intervention in curbing transfer test (6.15±1.3 times vs. 4.35±1.7 times,  $p<.05$ ), and a significantly lower successful rate in curbing transfer test (33.5% vs. 81.5%,  $p<.05$ ). In the mixed-model ANOVA analysis, no significant differences on ramping and wheelie skills across the four sessions were found between the two groups, except a significantly higher successful rate on the curbing in the control group than experimental group (81.4% vs. 56.7%,  $p<.05$ ).

**CONCLUSIONS:** This study didn't demonstrate the superiority of video feedback to conventional training for advanced manual wheelchair skills training for individuals with SCI. However, the immediate video feedback might be used to assist the conventional training for advanced wheelchair skills.

Supported by NIDRR Center Grant #: H133E080003

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## A-36 Free Communication/Poster - Nutritional Supplementation: Alternative Nutrients and Physiological Outcomes

MAY 30, 2012 7:30 AM - 12:30 PM  
ROOM: Exhibit Hall

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### 1367 Board #148 MAY 30 11:00 AM - 12:30 PM

#### Effects of Three Weeks of Carnitine Supplementation and High-intensity Interval Training on Endurance Performance

Kuei-Hui Chan, Shao-Zeng Hu, Kang-Hao Lu, Chun-Yi Shih. *National Taiwan Sport University, Taoyuan, Taiwan.*  
(No relationships reported)

Carnitine has been presented to have the benefits on anti-oxidative and endurance capacity. High-intensity interval training (HIT) was demonstrated to increase the endurance capacity and oxidative stress.

**PURPOSE:** To investigate the effects of three weeks of carnitine supplementation and HIT combination on aerobic capacity and oxidative stress.

**METHODS:** Ten untrained healthy males were recruited and randomly assigned into carnitine group (25.0±4.4 yr, 80.3±8.5 kg, 170.2±4.3 kg) or placebo group (22.4±3.3 yr, 69.1±11.2 kg, 172.2±6.3 kg). Subjects received carnitine or placebo supplementation 2 g per day for 3 weeks. All subjects also performed the HIT three per week. The HIT protocol contains 10 bouts of cycling trail at 90%VO<sub>2</sub>max, with each bout lasting 2 min and separated by 1 min of rest. The increment running tests and high-intensity interval exercise tests were conducted before and after supplementation. The VO<sub>2</sub>max and time to fatigue were measured by the increment running test. Blood samples were drawn before test, immediately after test, 1 h and 3 h after test of high-intensity interval exercise test to determine the activities or concentrations of creatine kinase (CK) and uric acid.

**RESULTS:** After 3 week of supplementation, VO<sub>2</sub>max (43.0±2.4 vs. 37.6±5.0 mL/min/kg) and time to fatigue (1563.0±221.0 vs. 1496.0±207.6 sec) significantly increased ( $p<.05$ ) in carnitine group. However, there were no differences in placebo group. In carnitine group, the values of blood CK and uric acid in high-intensity interval exercise test before supplementation still elevated at 3 h after test (170.0±44.6 vs. 160.8±32.8 U/L for CK and 8.88±2.16 vs. 7.88±2.0 mg/dL for uric acid,  $p<.05$ ). But the values returned to baseline after 3 weeks of supplementation (184.8±48.7 vs. 174.6±43.5 U/L for CK and 7.82±1.98 vs. 7.74±1.95 mg/dL for uric acid).

**CONCLUSION:** Carnitine supplementation during HIT is benefit to aerobic capacity and recovery of high-intensity interval exercise.

Supported by NTSU Grant 99D014.

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### 1368 Board #149 MAY 30 11:00 AM - 12:30 PM

#### Effects Of Chronic Green Tea Extract Supplementation On Substrate Utilization And Time-trial Performance

Brian J. Martin, J. Albert Bartolini, Taylor S. Thurston, Nicholas W. Aguirre, Benjamin M. Kamel, Jared W. Coburn, FACSM, Lee E. Brown, FACSM, Daniela A. Rubin, Daniel A. Judelson, FACSM. *California State University, Fullerton, Fullerton, CA.*  
(No relationships reported)

Supplementation with green tea extract (GTE) has been shown to increase fat oxidation at rest and during moderate intensity exercise. Despite its potential ergogenic utility, little work examines if or how GTE supplementation influences metabolic function and performance during time-trial exercise in humans.

**PURPOSE:** To examine the effects of chronic GTE supplementation on markers of substrate oxidation and physiological stress during 1 h constant load submaximal exercise and performance during a subsequent 10 km time-trial.

**METHODS:** Nine male participants with previous 10 km or half-marathon race experience volunteered (age = 27 ± 5 y, height = 174.8 ± 7.2 cm, mass = 71.6 ± 6.1 kg, body fat = 10.3 ± 2.7%, and VO<sub>2</sub>max = 64.2 ± 6.0 ml·kg<sup>-1</sup>·min<sup>-1</sup>). In a double-blind crossover design, subjects supplemented with GTE (725 mg) or placebo for 14 days then performed 1 h of treadmill running at 50% VO<sub>2</sub>max immediately followed by a 10 km time-trial. Investigators collected 1) expired gasses during the constant load exercise only, and 2) heart rate (HR) and ratings of perceived exertion (RPE) throughout both bouts. A 14 day washout separated supplementation periods.

**RESULTS:** No significant differences existed between trials in VO<sub>2</sub> or respiratory exchange ratio during constant load exercise. GTE supplementation also failed to affect HR and RPE during either constant load exercise or time-trial. Time-trial performance was similar between trials (placebo = 47.9 ± 6.7 min, GTE = 46.6 ± 5.8 min).

**CONCLUSIONS:** Supplementation with GTE did not affect metabolic, physiological or perceptual variables during moderate intensity exercise. Additionally, no differences were observed in performance during a 10 km time-trial. These data suggest chronic GTE supplementation does not alter substrate utilization or increase endurance exercise performance in trained individuals.

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### 1369 Board #150 MAY 30 11:00 AM - 12:30 PM

#### Green Tea Consumption And Risk Of Prostate Cancer: Meta-analysis Of Epidemiologic Studies

Byungjung Kim, Seunghyun Lee. *Kyunghee University, Seoul, Korea, Republic of.*  
(No relationships reported)

**PURPOSE** Worldwide, prostate cancer has the second highest incidence of all male cancers. Prostate cancer incidence and mortality varies widely between geographic regions, with overall rates in USA being nearly six-times higher than that of Asian countries. This variation suggests that prostate cancer may be linked to lifestyle-related factors, particularly dietary factors. Several epidemiologic studies have focused on the lower incidence of prostate cancer in Asian countries where green tea consumption is high. We undertook a meta-analysis to verify the relation between green tea consumption and prostate cancer.

**METHODS** We performed meta-analysis with the search of MEDLINE (PubMed), EMBASE and Cochrane Library, using the keywords "green tea" or "polyphenols" or "catechins" for the exposure factors, and "prostate cancer" for the outcome factors. Studies included in this review are prospective cohort and case-control studies published between 1966 and July 2010. The search was limited to English language.

**RESULTS** A total of 20 articles were identified for this review. Only 6 studies met the inclusion criteria. When using all the case-control and cohort studies, the pooled RR of prostate cancer for the highest vs lowest category of green tea consumption was 0.82 (95% CI, 0.75-1.07). In case-control studies, green tea drinking habit showed preventive effect on prostate cancer with the odds ratio of 0.40 (95% CI, 0.17-0.92). When cohort studies were pooled, no significant association was seen between green tea consumption and prostate cancer. (RR, 1.08 CI, 0.89-1.32)

**CONCLUSION** Green tea consumption was not associated with the risk of prostate cancer in this meta-analysis. Further cohort studies are needed.



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1370 Board #151 Abstract Withdrawn

1371 Board #152 MAY 30 11:00 AM - 12:30 PM

**American Ginseng And Swimming Combined Effect On Glucose Tolerance In Fructose-Fed Rats**

HUNG-MIN TSENG<sup>1</sup>, Chung-hsiang Yang<sup>1</sup>, Kuei-yu Chien<sup>2</sup>, Mei-chich Hsu<sup>2</sup>. <sup>1</sup>National Taipei University of Education, Taipei, Taiwan. <sup>2</sup>National Taiwan Sport University, Taoyuan, Taiwan. (Sponsor: Chia-Hua Kuo, FACSM)  
(No relationships reported)

**PURPOSE:** The purpose of the present study was to investigate the combined effect of American ginseng and swimming on regulation of blood glucose homeostasis in fructose-fed insulin resistance rats.

**METHODS:** Seventy Wistar male rats were divided into ten groups. First group served as control, and remaining nine groups treated with 21% fructose water for 8 weeks to induce insulin resistance and hyperglycemia. After 8 weeks, oral glucose tolerance test (OGTT) was performed to confirm the insulin resistance (IR). Then, we treated rats with different doses of American ginseng and combined with swimming exercise for 28 days (low-dose, low-dose and exercise, medium-dose and exercise, high-dose, high-dose and exercise, placebo, placebo and exercise, metformin). Second time OGTT was performed to know American ginseng and swimming effects.

**RESULTS:** In our study, we found that fasting blood glucose was significantly increased in fructose-fed groups. After 8 weeks, the insulin resistance was markedly increased in fructose groups compare to control group ( $p < .05$ ). Calculated glucose area under curve (GAUC) was significantly decreased in both high-dose of ginseng and medium-dose of ginseng combined with exercise compared to placebo group. The HOMA (homeostasis model assessment of IR), an indicator of insulin sensitivity, was significantly increased in placebo, low-dose and medium-dose groups ( $p < .05$ ) compared to control group. This elevation was attenuated by exercise in placebo and low-dose groups. High-dose intake of ginseng also decreased the HOMA compare to placebo ( $p < .05$ ) group.

**CONCLUSIONS:** Our study concludes that high-dose of American ginseng can control the blood glucose levels in hyperglycemia rats. Furthermore, medium-dose of American ginseng combined with swimming exercise also able control the blood glucose in hyperglycemia rats.

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1372 Board #153 MAY 30 11:00 AM - 12:30 PM

**Panax ginseng Extracts Suppress Hepatic Oxidative Damage in Exhaustive Exercised Rats**

Ming-Fen Hsu<sup>1</sup>, Hsin-Yi Hsu<sup>2</sup>, Szu-Hsien Yu<sup>1</sup>, Mallikarjuna Korivi<sup>1</sup>. <sup>1</sup>Taipei Physical Education College, Taipei, Taiwan. <sup>2</sup>Aletheia University, Taipei, Taiwan. (Sponsor: Chia-Hua Kuo, FACSM)  
(No relationships reported)

**PURPOSE:** Chinese herbal medicine is most popular in the world, and ginseng is widely used herb in that traditional medicine. Previous studies showed divergent results from ginseng extracts. This study was aimed to examine the effects of purified ginseng extract on oxidative damage in liver of rats.

**METHODS:** In the present study, 80 male Sprague Dawley (SD) rats were equally divided into four groups, including placebo (0.9% saline), DS-20 (Dammarane oligo-saponins 20 mg/kg), DS-60 (60 mg/kg) and DS-120 (120 mg/kg bodyweight) groups. DS was orally administered for a period of 10 weeks. After completion of the last treatment half number of rats ( $n=10$ ) from each group performed exhaustive swimming exercise.

**RESULTS:** A significant ( $p < .05$ ) decrease in hepatic glutathione peroxidase (GSH-Px) activity after exhaustive exercise in placebo group was ameliorated in DS pretreated rats. Glutathione S-transferase (GST) and glutathione reductase (GR) activities were not significantly altered after exhaustive exercise in placebo. Interestingly, DS pretreatment for 10 weeks significantly increased GST activity. The activity of free radical source enzyme, xanthine oxidase (XO) was significantly elevated after exhaustive swimming and abolished in DS pretreated rats. In addition, the lipid peroxidation marker, thiobarbituric acid reactive substance (TBARS) was dramatically raised after exhaustive performance in placebo group and attenuated in DS pre-treated group.

**CONCLUSIONS:** Administration of Panax ginseng extract, Dammarane oligo-saponins can protect liver from oxidative damage by suppressing free radical production and increasing antioxidant status after exhaustive exercise.

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1373 Board #154 MAY 30 11:00 AM - 12:30 PM

**Dose Dependant Studies of Panagin DS-1227 on Free Radical Scavenging System in the Liver of Exhaustive Exercise Rats**

Mallikarjuna Korivi<sup>1</sup>, Hsin-Yi Hsu<sup>2</sup>, Ming-Fen Hsu<sup>1</sup>, Szu-Hsien Yu<sup>1</sup>, Feng-Chih Hsu<sup>3</sup>, Chih-Yang Huang<sup>4</sup>. <sup>1</sup>Taipei Physical Education College, Taipei, Taiwan. <sup>2</sup>Aletheia University, Taipei, Taiwan. <sup>3</sup>National Taoyuan Agricultural & Industrial Vocational High School, Taoyuan, Taiwan. <sup>4</sup>China Medical University, Taichung, Taiwan. (Sponsor: Kuo Chia-Hua, FACSM)  
(No relationships reported)

**PURPOSE:** Ginseng extracts are able to cope against oxidative stress condition; however it is limited to emphasize the therapeutic application of specific compounds with specific dose. This study was designed to explore the therapeutic properties of Panagin DS-1227 (HPLC-grade extract of ginseng stem and leaves), against exhaustive exercise-induced oxidative stress in rats.

**METHODS:** Rats ( $n=120$ ) were evenly divided into four groups such as, control, P-20, P-60 and P-120. Panagin DS-1227 (P) extracts were orally administered to respective groups at 20 (low), 60 (medium) and 120 (high) mg/kg bodyweight for 10-week. Half number of rats from each group performed exhaustive exercise in a swimming pool and sacrificed along with their unexercised rats immediately after exercise.

**RESULTS:** Exhaustive exercise-induced drastic ( $P < .001$ ) drop in liver glutathione (GSH) content was significantly restored in P-20 and P-60 groups, while unable to restore in DS-120 group. Oxidative damage to proteins was evidenced by increased protein carbonyl (PC) levels in control exercised rats. Interestingly, low dose was marginally, and medium dose was completely decreased the PC levels, whereas, no change with high dose of Panagin. In addition, high dose significantly increased the PC levels at resting condition. Nitric oxide (NO) levels were increased in control group after exhaustive exercise, nevertheless, no change with all doses of Panagin. Superoxide dismutase (SOD) and catalase (CAT) activities were significantly decreased as a result of exercise in control group, and also with high dose of Panagin treatment at resting condition. In contrast, glutathione S-transferase (GST) activity was increased with all doses of Panagin.

**CONCLUSIONS:** Our findings elucidate that purified ginseng extract, Panagin DS-1227 attenuates the oxidative damage in liver of exhaustive exercised rats. Interestingly, low and medium doses of Panagin showed better results than the high dose.

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1374 Board #155 MAY 30 11:00 AM - 12:30 PM

**Effect of Dammarane Oligo-Saponins on Selected Biochemical Parameters in Blood of Rats after Exhaustive Exercise**

Yi-Ting Lin<sup>1</sup>, Szu-Hsien Yu<sup>1</sup>, Ming-Fen Hsu<sup>1</sup>, Feng-Chih Hsu<sup>2</sup>, Mallikarjuna Korivi<sup>1</sup>. <sup>1</sup>Taipei Physical Education College, Taipei, Taiwan. <sup>2</sup>National Taoyuan Agricultural & Industrial Vocational High School, Taoyuan, Taiwan. (Sponsor: Chia-Hua Kuo, FACSM)  
(No relationships reported)

**PURPOSE:** Therapeutic applications of ginseng extracts are controversial due to inconsistency in ginsenoside profile. In this study we investigated the beneficial effects of Dammarane Oligo-Saponins (DS) and their dose response on selected biochemical parameters in the blood of exhaustive exercised rats.

**METHODS:** Total sixty Sprague Dawley rats were evenly divided into four groups, including control, DS-20, DS-60 and DS-120. DS extract was orally administered to respective groups at the dose of 20, 60, 120 mg/kg bodyweight for a period of 8-week. All the rats were performed exhaustive swimming exercise after the last treatment. Blood samples were collected from the tail vein before exercise, immediately, 1-h and 3-h after exercise.

**RESULTS:** Recorded average swimming duration seems higher in DS treated groups, but statistically not reached the significant level. Baseline blood glucose, lactate, glutamic-oxaloacetic transaminases (GOT), blood urea nitrogen (BUN) and creatine kinase (CK) were not significantly different among groups. Blood glucose levels were significantly ( $P < .05$ ) higher in DS-60 and DS-120 groups compared to control group immediately after exercise, and 1-h after exercise. Contrary to other doses, high dose (DS-120) group showed significantly lower GOT levels 1-h

after exercise. BUN levels were significantly lower 3-h after exercise in DS-60 group compared to control group at same time point. Interesting finding of the present study is that increased CK levels after exercise were decreased in all DS treated groups 3-h after exercise compared to control group.

**CONCLUSIONS:** The data of the present study concludes that purified ginseng extracts, Dammarane Oligo-Saponins possesses beneficial effects against exhaustive exercise challenge. Further detailed investigations are under progress to suggest the DS as nutraceutical substance.

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**1375** Board #156 MAY 30 11:00 AM - 12:30 PM

**Coffee Reduces Liver Damage through Increased SOD Activity in Liver of NASH Rats**

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(No relationships reported)

**PURPOSE:** Non-alcoholic fatty liver diseases (NAFLD) are wide spectrum diseases ranging from simple steatosis, non-alcoholic steatohepatitis (NASH) to liver cirrhosis, and induce hepatocellular carcinoma. Coffee has been reported to reduce the risk of advanced liver disease and its complications as well as hepatocellular carcinoma. To investigate whether coffee improved MCD diet induced steatosis and oxidative stress in liver.

**METHODS:** In this study, 8-week-old male Sprague Dawley rats were randomly divided into 5 groups: control (fed normal diet, W0), methionine-choline-deficient (MCD) diet fed for 9 weeks or 14 weeks combined fed with water (W9, W14) or fed with coffee (W9+Co, W14+Co). Coffee (corresponding to approximately 6 cups of espresso coffee or 2 cups of filtered coffee for a person weighing 70 kg) was fed daily for 4 weeks to the rats who were being fed a MCD diet for the previous 5 or 10 weeks. The blood were collected and analyzed for AST. The liver tissues were collected, extracted and assayed for the production of glutathione (GSH) and lipid peroxidation and the activities of antioxidant enzymes by using commercial kits. The hematoxylin-eosin staining was used to determine the degree of lobular inflammation and fibrosis in liver. The degree of fibrosis and inflammation were evaluated by METAVIR score. The statistical analysis was done using the one-way ANOVA for independent samples, with significance level of 5%.

**RESULTS:** Rat fed with the MCD diet showed a rapid induction of AST and hepatic steatosis, loss of body weight and liver weight, but increased the ratio of liver and body weight. Coffee significantly decreased steatosis of W9 ( $p<0.05$ ) and fibrosis of W14 ( $p<0.05$ ). The production of lipid peroxidation in liver increased significantly in W14 ( $24.0\pm 6.9$  vs  $0.40\pm 0.05$  nmole/min/ $\mu$ g protein,  $p<0.05$ ) but not in W14+Co compared with W0 group. The activity of superoxide dismutase (SOD) in W14 and W14+Co were increased compared with W0. Feeding with MCD diet for 14 weeks significantly decreased the activities of catalase ( $p<0.01$ ), glutathione peroxidase (GPx) ( $p<0.05$ ), and glutathione reductase (GR) ( $p<0.05$ ). Administration of coffee did not alter MCD diet abolished activities of antioxidant enzymes.

**CONCLUSIONS:** Administration of coffee improves NAFLD through increased activity of SOD in liver.

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**1376** Board #157 MAY 30 11:00 AM - 12:30 PM

**Baker's Yeast Beta Glucan Supplementation Reduces The Number Of Cold/Flu Symptomatic Days After Completing A Marathon**

James A. Navalta<sup>1</sup>, Katie C. Carpenter<sup>2</sup>, Whitney L. Breslin<sup>2</sup>, Tiffany Davidson<sup>2</sup>, Brian K. McFarlin, FACSM<sup>2</sup>. <sup>1</sup>Western Kentucky University, Bowling Green, KY. <sup>2</sup>University of Houston, Houston, TX. (Sponsor: Brian K McFarlin, FACSM)  
(No relationships reported)

**PURPOSE:** Marathon running places a profound stress on one's body. Such stress manifests itself in the form of muscle soreness, fatigue, and a weakened immune system. It is common for marathon runners to develop an upper respiratory tract infection in the days and weeks following completion of a marathon. The present study sought to examine a commercially available form of Baker's yeast  $\beta$ -glucan (BG); this form of BG has been previously demonstrated to boost immune system function in marathon runners and in laboratory studies where subjects completed a defined exercise stimulus.

**METHODS:** We recruited 324 subjects who were completing in the 2011 Austin Livestrong Marathon (Austin, TX). Upon enrolling in the study, subjects completed a demographics question designed to provide information about their exercise training patterns and health status. Subjects were also provided either a BG (250 mg/d) or placebo (sugar pill, PL) supplement. Double-blind administration of the supplement was used to reduce bias. Subjects were also given 2 packets of surveys that were returned at 2 and 4 weeks post marathon. Of the 324 enrolled, only 182 subjects completed and returned both sets of surveys. The set of surveys included were the Profile of Mood States (POMS), the Wisconsin Upper Respiratory Tract Symptom Survey (WURSS), and a daily health/exercise log. Survey data was entered into a database using a custom scanning solution. Data were analyzed for significance using separate repeated measures ANOVAs with a  $P<0.05$ .

**RESULTS:** BG supplementation significantly reduced both the number of days that subjects reported both general health problems as well as cold/flu symptoms. We did not find any significant differences in either POMS or WURSS scores between groups.

**CONCLUSIONS:** The key finding of the present study was that BG supplementation post-marathon reduced the number of symptomatic days experienced by a subject. Based on previous studies from our lab and others, it is reasonable to speculate that the improvements associated with BG were likely due to alterations in monocytes, plasma cytokines, and improved mucosal immunity. This study was funded by Biothera, The Immune Health Company.

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**1377** Board #158 MAY 30 11:00 AM - 12:30 PM

**Supplementation With Baker's Yeast Beta Glucan Improves Mucosal Immunoglobulin Profile After Exercise In A Hot, Humid Environment**

Brian K. McFarlin, FACSM, Whitney L. Breslin, Katie C. Carpenter, Tiffany Davidson, Amy Adams. University of Houston, Houston, TX.  
(No relationships reported)

**PURPOSE:** Strenuous exercise is known to suppress mucosal immunity for up to 24-h, which can increase the risk of developing an upper respiratory tract infection. While many dietary interventions have been used to combat post-exercise immune suppression, most have been ineffective. Recent evidence has suggested that a commercially-available form of baker's yeast  $\beta$ -glucan may be useful as an immune-booster. The purpose of this study was to determine if 10-d of supplementation with baker's yeast  $\beta$ -glucan (BG) prior to a bout of exercise in a hot ( $37\pm 2^\circ\text{C}$ ), humid ( $45\pm 5\%$  relative humidity) environment improves mucosal immunity during recovery from exercise in recreationally active subjects (29 men, 31 women,  $22\pm 4$  y).

**METHODS:** Subjects completed  $49\pm 6$  min of cycling after consuming either BG (250 mg/d) or a placebo (sugar pill, PL) for 10-d prior to each exercise session. The investigators were blinded to the supplement conditions until all data was collected and analyzed. Saliva was collected using a salivette placed under the tongue at baseline (BASE), before exercise (PRE), immediately after (POST), and two-hours after (2H) exercise. The salivette was kept in the mouth for 10-min and then transferred to a specially designed freezer tube and frozen ( $-80^\circ\text{C}$ ) until analysis for salivary IgA, IgM, IgG1, and IgG2 using a multiplex kit (MagPix). Data were analyzed using separate repeated measures ANOVAs and significance was set at  $P<0.05$ .

**RESULTS:** BG supplementation was associated with an increase in salivary IgA ( $P=0.048$ ) and a decrease in salivary IgM ( $P=0.029$ ) at 2H compared to placebo. In the placebo condition, there was a progressive decline in IgA and an increase in IgM, with the most pronounced changes occurring at 2H. Also, in the BG condition, IgA was increased and IgM was decreased at 2H compared to PRE and the placebo 2H samples. We did not find any significant differences for either salivary IgG1 or IgG2.

**CONCLUSIONS:** These findings suggest that supplementation with baker's yeast  $\beta$ -glucan may improve mucosal immunity following a strenuous bout of exercise. While previous research is not conclusive, a boost to mucosal immunity may reduce susceptibility to upper respiratory tract infection. This study was funded by Biothera, The Immune Health Company.

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**1378** Board #159 MAY 30 11:00 AM - 12:30 PM

**Baker's Yeast  $\beta$ -glucan Supplementation Improves Monocyte And Cytokine Responses Following Exercise In A Hot, Humid Environment**

Katie C. Carpenter, Whitney L. Breslin, Tiffany Davidson, Amy Adams, Brian K. McFarlin, FACSM. University of Houston, Houston, TX. (Sponsor: Brian K McFarlin, FACSM)  
(No relationships reported)

**PURPOSE:** Strenuous exercise is known to suppress the immune system, which can increase the chances of getting sick in the hours after exercise. The purpose of this study was to determine if 10-d of supplementation with yeast  $\beta$ -glucan alters monocyte concentration, LPS-stimulated cytokine production, and plasma cytokine concentration in recreationally active subjects.

**METHODS:** Recreationally active subjects (29 men, 31 women, 22±4 y) completed 49±6 min of cycling (37±2°C, 45±5% relative humidity) after consuming either yeast β-glucan (250 mg/d, BG) or a placebo (sugar pill, PL) for 10-days prior to each exercise session. The investigators were blinded to the supplement conditions until all data was collected and analyzed. Venous blood was collected at baseline (prior to supplement), pre-, post-, and 2-hours (2H) post exercise. Total and subset monocyte concentration was measured by flow cytometry. LPS-stimulated production of 12 cytokines was measured using a whole blood assay. Plasma concentration of 13 cytokines was measured using a high-sensitivity MagPlex assay.

**RESULTS:** Monocyte (CD14+) concentration was significantly greater at 2H (P=0.05) with BG. Also, compared to PL, BG boosted LPS-stimulated production IL-2, IL-4, IL-5, and IFN-γ at PRE and POST (P<0.05). Plasma concentration of IL-2, IL-4, IL-5, IL-7, IL-10, and IFN-γ were significantly greater at 2H in the BG compared to PL. In the placebo condition we observed the traditional response to strenuous exercise (rise at POST and suppression at 2H). It appears that 10-days of supplementation with BG primed blood leukocytes for the production of IL-2, IL-4, IL-5, and IFN-γ. These cytokines were elevated prior to and immediately after exercise in LPS-stimulated cultures and subsequent elevation were observed at 2H with unstimulated plasma measures. In addition to cytokine changes, BG appeared to blunt post-exercise reduction in blood monocyte concentration, which may have implication of immune-surveillance.

**CONCLUSIONS:** The key findings of the present study demonstrate that BG may be a suitable countermeasure to protect and boost the immune system following stressful exercise. Such boost is likely to lower the duration of the “open window” response. This study was funded by Biothera, The Immune Health Company.

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1379 Board #160 MAY 30 11:00 AM - 12:30 PM

**Effect of Six Weeks of Oral Echinacea Purpurea Supplementation on Erythropoiesis**

Tyler D. Martin<sup>1</sup>, Michael S. Green<sup>1</sup>, Malcolm T. Whitehead<sup>2</sup>, Timothy P. Scheett<sup>3</sup>, Michael J. Webster, FACSM<sup>1</sup>, <sup>1</sup>Troy University, Troy, AL, <sup>2</sup>Arkansas State University, State University, AR, <sup>3</sup>College of Charleston, Charleston, SC, <sup>4</sup>The University of Southern Mississippi, Hattiesburg, MS.

(No relationships reported)

*Echinacea purpurea*, a purple coneflower plant of the compositae family (Asteraceae), is native to North America and commonly used as an herbal supplement to enhance immune function. Recent research has demonstrated that four weeks of oral *Echinacea purpurea* supplementation (8,000 mg·d<sup>-1</sup>) in untrained males (42.5 ± 1.6 mL·kg<sup>-1</sup>·min<sup>-1</sup>) significantly increased serum erythropoietin (EPO). The increase in EPO was not accompanied by a significant increase in the number of red blood cells (RBCs) or hemoglobin concentration [Hb]; however, there were non-significant increases in the erythropoietic status by the end of the four week study (% change in RBC, hematocrit (Hct), [Hb], mean corpuscular volume (MCV)), suggesting the initiation of erythropoiesis.

**PURPOSE:** To investigate the effect of six weeks of oral *Echinacea purpurea* supplementation on serum EPO and erythropoietic status.

**METHODS:** Twenty-four males (mean ± SE): age = 25.2 ± 1.4 yr, height = 178.1 ± 1.4 cm, mass = 78.1 ± 1.6 kg, percent body fat = 12.7 ± 0.9 %, VO<sub>2max</sub> = 52.9 ± 0.9 mL·kg<sup>-1</sup>·min<sup>-1</sup> were randomly grouped using a matched-pair, double-blind design and self-administered 8,000 mg·d<sup>-1</sup> (5 × 400 mg × 4 times·d<sup>-1</sup>) of either *Echinacea purpurea* (ECH) (n=12) or placebo (PLA) (n=12) for 42 consecutive days. Blood samples were collected and analyzed for EPO, RBCs, Hb, Hct, MCV, and mean corpuscular hemoglobin concentration (MCHC). Separate 2 × 4 (Group × Time) factorial ANOVA with repeated measures were used to determine statistical differences with significance set at p ≤ 0.05.

**RESULTS:** There were no statistically significant (p > 0.05) interaction, group or time effects observed for EPO or erythropoietic status markers.

**CONCLUSION:** Six weeks of oral ECH supplementation in apparently healthy, recreationally active, males with above average fitness status (VO<sub>2max</sub> = 52.9 ± 0.9 mL·kg<sup>-1</sup>·min<sup>-1</sup>), does not enhance EPO or erythropoietic status. These findings are in contrast with previous reports of *Echinacea* supplementation. Any explanation for these differences, including the role that training and/or physical fitness level of participants, is unclear and speculative.

Supported by Troy University Faculty Development Research Grant.

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1380 Board #161 MAY 30 11:00 AM - 12:30 PM

**Effects of 16wk Fucoxanthin and Punicic Acid Supplementation I: Body Composition and Hemodynamic Changes**

Geoffrey M. Hudson, Lisa A. Knecht, Cody J. Tullos, Emily R. Buras, Bethany L. Boleware, James T. Goetz, David E. Krzeminski, Alicia D. Sample, Michael J. Webster, FACSM. *The University of Southern Mississippi, Hattiesburg, MS.*

(No relationships reported)

Supplementation with 100 mg brown seaweed extract (0.8 % fucoxanthin) and 100 mg pomegranate seed oil (70 % punicic acid), abbreviated as Xan, has been shown to significantly reduce body fat, liver fat, and blood pressure (BP) in obese females.

**PURPOSE:** To determine the effects of Xan supplementation on body composition, heart rate, and BP in obese men and women.

**METHODS:** Twenty-nine obese men and women (29±8 y; 36.50±5.39 kg/m<sup>2</sup>; 43.8±8.0 % body fat) were matched on gender, age, and body fat percentage and randomized to either a Xan (n=14) or olive oil placebo (Pla; n=15) group. This study was double-blind and placebo-controlled. Participants were instructed to ingest 200 mg capsules of their given supplement three times per day (prior to meals) for 16 weeks while consuming a reduced calorie diet (equivalent to their resting energy expenditure). The 2011 ACSM physical activity guidelines were also recommended. Data were analyzed with repeated measures ANOVA and presented as means ± SD changes from baseline.

**RESULTS:** Analysis of the data demonstrated that body mass (Xan:-1.83±3.48 kg; Pla:-3.17±3.42 kg) and body mass index (Xan:-0.64±1.19 kg/m<sup>2</sup>; Pla:-1.14±1.21 kg/m<sup>2</sup>) were significantly reduced over the 16 weeks (p=0.001; p=0.001) with no group differences. Diastolic BP was significantly reduced (Xan:-6±9 mmHg; Pla:-2±9 mmHg; p=0.021), while there was a trend for a reduction of systolic BP (Xan:-10±10 mmHg; Pla:-3±13 mmHg; p=0.059). No significant within- or between-group effects were observed in body fat percentage or lean body mass.

**CONCLUSION:** The 16 weeks of Xan supplementation (600 mg/d) did not augment the effects of exercise and a reduced calorie diet on weight and BP in this obese population.

Supported by a grant from P.L. Thomas & Co., Inc.

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1381 Board #162 MAY 30 11:00 AM - 12:30 PM

**Effects of 16wk Fucoxanthin and Punicic Acid Supplementation II: Metabolism**

Bethany L. Boleware, Lisa A. Knecht, Geoffrey M. Hudson, Cody J. Tullos, Emily R. Buras, David E. Krzeminski, James T. Goetz, Alicia D. Sample, Michael J. Webster, FACSM. *The University of Southern Mississippi, Hattiesburg, MS.*

(No relationships reported)

Supplementation with 100 mg brown seaweed extract (0.8 % fucoxanthin) and 100 mg pomegranate seed oil (70 % punicic acid), abbreviated as Xan, has been shown to significantly reduce body fat and liver fat assumedly by increasing metabolism.

**PURPOSE:** To determine the effects of Xan supplementation on resting energy expenditure (REE) and respiratory quotient (RQ) in obese men and women.

**METHODS:** Twenty-nine obese men and women (29±8 y; 36.50±5.39 kg/m<sup>2</sup>; 43.8±8.0 % body fat) were matched on gender, age, and body fat percentage and randomized to either a Xan (n=14) or olive oil placebo (Pla; n=15) group. This study was double-blind and placebo-controlled. Participants were instructed to ingest 200 mg capsules of their given supplement three times per day (prior to meals) for 16 weeks while consuming a reduced calorie diet (equivalent to their resting energy expenditure). The 2011 ACSM physical activity guidelines were also recommended. Data were analyzed with repeated measures ANOVA and presented as means ± SD changes from baseline.

**RESULTS:** Analysis of the data demonstrated significant reductions in REE (Xan:-38±140 kcal·d<sup>-1</sup>; Pla:-59±153 kcal·d<sup>-1</sup>) and absolute VO<sub>2</sub> (Xan:-0.003±0.021 L·min<sup>-1</sup>; Pla:-0.008±0.021 L·min<sup>-1</sup>) over the 16 weeks (p=0.007; p=0.001) with no between-group effects. No within- or between-group effects were observed with relative VO<sub>2</sub>, VCO<sub>2</sub>, or RQ.

**CONCLUSION:** As expected, weight loss resulted in a reduced REE; however, 16 weeks of Xan supplementation (600 mg/d) did not prevent reductions in REE typically occurring with weight loss.

Supported by a grant from P.L. Thomas & Co., Inc.

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1382 Board #163 MAY 30 11:00 AM - 12:30 PM

**Effects of 16wk Fucoxanthin and Punicic Acid Supplementation III: Serum Lipids Changes**

Cody J. Tullios, Lisa A. Knecht, Geoffrey M. Hudson, Bethany L. Boleware, Emily R. Buras, Alicia D. Sample, Michael J. Webster, FACSM. *The University of Southern Mississippi, Hattiesburg, MS.*  
(No relationships reported)

Supplementation with 100 mg brown seaweed extract (0.8 % fucoxanthin) and 100 mg pomegranate seed oil (70 % punicic acid), abbreviated as Xan, has been shown to significantly reduce body fat, liver fat, and serum lipids in obese females.

**PURPOSE:** To determine the effects of Xan supplementation on serum lipid levels [i.e. high-density lipoprotein (HDL), low-density lipoprotein (LDL), total cholesterol, triglycerides] in obese men and women.

**METHODS:** Twenty-nine obese men and women (29±8 y; 36.50±5.39 kg/m<sup>2</sup>; 43.8±8.0 % body fat) were matched on gender, age, and body fat percentage and randomized to either a Xan (n=14) or olive oil placebo (Pla; n=15) group. This study was double-blind and placebo-controlled. Participants were instructed to ingest 200 mg capsules of their given supplement three times per day (prior to meals) for 16 weeks while consuming a reduced calorie diet (equivalent to their resting energy expenditure). The 2011 ACSM physical activity guidelines were also recommended. Data were analyzed with repeated measures ANOVA and presented as means ± SD changes from baseline.

**RESULTS:** Data analysis demonstrated that there was a trend for a reduction in serum triglycerides (Xan:-31±45 mg-dl-1; Pla:-5±66 mg-dl-1; p=0.071) and a trend for an interaction effect (p=0.088). No significant within- or between-group effects were observed in serum total cholesterol, HDL, or LDL levels.

**CONCLUSION:** The 16 weeks of Xan supplementation (600 mg/d) did not significantly augment the beneficial effects of exercise and a reduced calorie diet on serum cholesterol and triglyceride levels in this obese population. However, a larger decrease in serum triglyceride levels was observed in the Xan group, which may be of clinical significance. Supported by a grant from P.L. Thomas & Co., Inc.

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1383 Board #164 MAY 30 11:00 AM - 12:30 PM

**Effects of 16wk Fucoxanthin and Punicic Acid Supplementation IV: Markers of Liver and Kidney Function**

Emily R. Buras, Geoffrey M. Hudson, Lisa A. Knecht, Bethany L. Boleware, Cody J. Tullios, Alicia D. Sample, Michael J. Webster, FACSM. *The University of Southern Mississippi, Hattiesburg, MS.*  
(No relationships reported)

Supplementation with 100 mg brown seaweed extract (0.8 % fucoxanthin) and 100 mg pomegranate seed oil (70 % punicic acid), abbreviated as Xan, has been shown to significantly reduce body fat, liver fat, and improve serum markers of liver function in obese females.

**PURPOSE:** To determine the effects of Xan supplementation on serum markers of liver and kidney function in obese men and women.

**METHODS:** Twenty-nine obese men and women (29±8 y; 36.50±5.39 kg/m<sup>2</sup>; 43.8±8.0 % body fat) were matched on gender, age, and body fat percentage and randomized to either a Xan (n=14) or olive oil placebo (Pla; n=15) group. This study was double-blind and placebo-controlled. Participants were instructed to ingest 200 mg capsules of their given supplement three times per day for 16 weeks while consuming a reduced calorie diet (equivalent to their resting energy expenditure). The 2011 ACSM physical activity guidelines were also recommended. Data were analyzed with repeated measures ANOVA and presented as means ± SD changes from baseline.

**RESULTS:** Data analysis demonstrated that significant reductions in serum levels of alkaline phosphatase (ALP; Xan:-5±6 U-L-1; Pla:-3±9 U-L-1; p=0.001), alanine aminotransferase (ALT; Xan:-12±22 U-L-1; Pla:-4±7 U-L-1; p=0.021), total protein (Xan:-0.3±0.3 g-dl-1; Pla:-0.2±0.3 g-dl-1; p<0.001), and creatinine (Xan:-0.11±0.15 mg-dl-1; Pla: X:-0.08±0.13 mg-dl-1; p<0.001) were observed over the 16 weeks with a trend for an interaction effect for ALT (p=0.101), but no other between-group effects. Blood urea nitrogen (BUN) levels did not change over time, but there was a significant between-group effect (Xan:14±4 mg-dl-1; Pla:11±3 mg-dl-1; p=0.018). No within- or between-group effects were observed in serum aspartate aminotransferase, total bilirubin, or albumin.

**CONCLUSION:** The 16 weeks of Xan supplementation (600 mg/d) did not affect these liver and kidney function markers in this obese population.

Supported by a grant from P.L. Thomas & Co., Inc.

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1384 Board #165 MAY 30 11:00 AM - 12:30 PM

**The Effect of Yoga Exercise and Ascorbic acid Supplementation on Stress Hormones in Korean Young Females**

Malryun Shin<sup>1</sup>, Jungho Cho<sup>1</sup>, Ikwon Kang<sup>2</sup>, Jihyun Lee<sup>1</sup>, Jaehyun Jung<sup>1</sup>, Sunmin Kim<sup>1</sup>, Myungjoo Yang<sup>1</sup>, Sooyoun Kim<sup>1</sup>. <sup>1</sup>*Sookmyung Women's University, Seoul, Korea, Republic of.* <sup>2</sup>*Hongik University, Seoul, Korea, Republic of.*  
(No relationships reported)

**PURPOSE:** The purpose of this study was to investigate the effects of 8 weeks of ascorbic acid supplementation and yoga exercise on epinephrine, norepinephrine, glucagon and cortisol.

**METHODS:** Thirty young females were randomly assigned to one of three group. I.e., Group I(n=10): placebo(1000mg/day); GroupII(n=10): ascorbic acid(500mg/day) and placebo(500mg/day); Group III(n=10): ascorbic acid(1000mg/day) with yoga exercise(55-75% of HRmax, 3-4 d/w, 60-90min/d). The following measurements were made on all subjects before and after 8 week of experiment. Analysis of covariance and bonferroni test were used to determine the statistical significance.

**RESULTS:** There were no significant differences in epinephrine, norepinephrine and glucagon but cortisol were significantly changed(p<.05).

**CONCLUSIONS:** 8 week's ascorbic acid supplementation with yoga exercise was effective for epinephrine, norepinephrine, glucagon and cortisol in Korean young females. Determination of which exercise types, ascorbic acid dosage and fitness status of individuals would produce reproducible ergogenic effects is a logical extension of current research.

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1385 Board #166 MAY 30 11:00 AM - 12:30 PM

**Vitamin C Does Not Prevent Endurance Training-induced Improvement Of Glucose Tolerance And Insulin Sensitivity**

Ayuko Nii, Koichi Yada, Shigeru Obara, Hideki Matoba. *The University of Tokushima, Tokushima, Japan.*  
(No relationships reported)

Conflicting results have been reported concerning the involvement of reactive oxygen species (ROS) in endurance training-induced improvement of glucose tolerance and insulin sensitivity.

**PURPOSE:** The purpose of this study was to determine whether vitamin C supplementation prevented the training-induced improvement of glucose tolerance and insulin sensitivity in rats.

**METHODS:** Twenty male rats, 4-week of age, were assigned to four groups: sedentary control, sedentary with vitamin C supplementation, trained control, trained with vitamin C supplementation (n=5 each). The rats of vitamin C supplemented groups were administered 500mg per kg body weight of vitamin C from 12 days before the start of the training until the end of the training period. The rats of the trained groups swam 6h/day with two 3h sessions separated by 45 min of rest. The training lasted for 2 weeks with a frequency of 5 days per week. After the training period, the rats underwent intraperitoneal glucose tolerance test (IPGTT). Glucose and insulin responses during IPGTT were assessed by the area under the curve (AUC). Insulin resistance was evaluated using homeostasis model assessment as an index of insulin resistance (HOMA-R). Insulin sensitivity was evaluated using composite whole-body insulin sensitivity index (ISI (comp)).

**RESULTS:** The training significantly suppressed body weight gain (P<0.01). There was no difference in fasting glucose levels and fasting insulin levels among the groups. There was also no significant difference in the HOMA-R indices among the groups. On the other hand, the training significantly lowered the AUC for glucose and insulin (P<0.05). The training significantly increased ISI (comp) (P<0.05). The vitamin C supplementation did not alter the AUC for glucose, the AUC for insulin and ISI (comp).

**CUNCLUSION:** This study suggests that the vitamin C supplementation does not prevent the training-induced improvement of glucose tolerance and insulin sensitivity in rats.

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1386 Board #167 MAY 30 11:00 AM - 12:30 PM

**Effects of Quercetin Supplementation on Physical Function in Older Adults**

Stephen C. Chen<sup>1</sup>, J. Mark Davis, FACSM<sup>1</sup>, E. Angela Murphy<sup>1</sup>, Michele Neese<sup>2</sup>, Matthew Kostek<sup>1</sup>, Kei Lam<sup>1</sup>, John Sieverdes<sup>1</sup>, Victor Hirth<sup>2</sup>, Andres Leone<sup>2</sup>, Seung H. Jung<sup>1</sup>, Benjamin Gordon<sup>1</sup>, Katie Becofsky<sup>1</sup>, Toni Torres-McGehee<sup>1</sup>, Steve Blair, FACSM<sup>1</sup>, J. Larry Durstine, FACSM<sup>1</sup>. <sup>1</sup>University of South Carolina, Columbia, SC. <sup>2</sup>Palmetto Health Senior Primary Care, Columbia, SC. (Sponsor: Mark Davis, FACSM)  
(No relationships reported)

Fatigue is a common complaint among older adults and is associated with functional decline and multiple adverse health outcomes. Previous studies in our laboratory have shown that the dietary flavonoid quercetin can enhance voluntary activity and endurance performance in mice as well as aerobic capacity in young adults. However, the benefits of quercetin on physical function in older adults has not yet been evaluated.

**PURPOSE:** To determine the effects of short-term quercetin (QUE) versus placebo (PLA) supplementation on habitual physical activity ( $N=10$ ), physical performance ( $N=18$ ) as well as markers of mitochondrial biogenesis ( $N=4$ ) in healthy older adults (61 to 89 years).

**METHODS:** Subjects were randomized to receive QUE (1000 mg-day<sup>-1</sup>) or PLA for 14 days using a double-blind, placebo controlled, crossover study design with a 2-week washout period. Physical activity patterns were assessed by accelerometry daily throughout the study. After completion of treatments, physical performance including VO<sub>2</sub> peak, Short Physical Performance Battery (SPPB) and 6-minute walk (6MW) were determined, and muscle biopsies acquired from the vastus lateralis were analyzed for mRNA gene expression of PGC-1 $\alpha$ , citrate synthase and cytochrome c using RT-PCR.

**RESULTS:** QUE feedings significantly increased daily steps count by 16.7% compared with PLA (4811.7  $\pm$  778.5 vs. 5614.9  $\pm$  993.3 steps-day<sup>-1</sup>, respectively,  $P=0.02$ ), along with a trend for increased minutes of moderate intensity of physical activity (10.5  $\pm$  3.9 vs. 7.6  $\pm$  2.6 min-day<sup>-1</sup>,  $P=0.11$ ). QUE increased mRNA gene expression of PGC-1 $\alpha$ , citrate synthase and cytochrome c by 49%, 26% and 32%, respectively, although these did not reach statistical significance which is likely due to the small sample size that was used in this analysis. No differences were found between QUE and PLA conditions for VO<sub>2 peak</sub>, SPPB score, and 6MW distance.

**CONCLUSION:** These novel data suggest that short-duration QUE feedings can promote physical activity in older adults, and that these effects may be partially attributed to the increased muscle mitochondrial biogenesis which plays a role in fatigue development. Overall, the results of this study provide evidence in support of dietary QUE as a possible safe and effective nutritional strategy for disease prevention and health promotion in the elderly.

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1387 Board #168 MAY 30 11:00 AM - 12:30 PM

**Effect Of Resveratrol On Oxidative Stress And Skeletal Muscle Oxygenation With NIRS In Trained Cyclists**

Claude Lajoie, Sana Driss, Maria-Grazia Martinoli, Simon Bergeron-Vaillancourt, Louis Laurencelle, Fanny Longpré. UQTR, Trois-Rivieres, QC, Canada. (Sponsor: Francois Trudeau, FACSM)  
(No relationships reported)

During strenuous exercise, there is a dramatic increase in oxygen consumption that leads to an increased oxygen species (ROS) production. This increase in ROS results in oxidative stress, which has been associated with muscle fatigue and impaired recovery following high-intensity aerobic exercise.

**PURPOSE:** The purpose of the present study was to evaluate the effects of a Resveratrol supplementation on protein blood markers of oxidative stress and blood antioxidant capacity during a single bout of intermittent exercise and recovery in trained cyclists. A second purpose was to measure vastus lateralis muscle oxygenation, using near infrared spectroscopy (NIRS), blood lactate concentration and whole body oxygen consumption under the Resveratrol condition.

**METHODS:** A double-blind study was conducted with 7 male trained cyclists, aged 37.3  $\pm$  11.7 years. The participants completed two sessions high intensity interval training (HIT) in two conditions, with and without Resveratrol supplementation (1000 mg daily) in orange juice, 7 consecutive days before the experiment, with partially counterbalanced conditions across subgroups. Blood sampling was collected pre- and post-exercise for the determination of protein carbonyls (PC) and total antioxidant capacity (TAC).

**RESULTS:** Resveratrol supplementation did not improve organism's antioxidant defence and protein carbonyl blood concentrations following HIT. Under Resveratrol supplementation, tissue saturation index in oxygen (TSI%) in vastus lateralis was slightly less attenuated ( $p<0.05$ ) at the end of HIT ( $\Delta = -1.3\%$ ) as compared to placebo condition ( $\Delta = -2.0\%$ ). Resveratrol had no effect on skeletal muscle oxyhemoglobin (O<sub>2</sub>Hb) deoxyhemoglobin (HHb) and total hemoglobin (THb). Heart rate and blood lactate concentration recovery both showed a tendency ( $p 0.10$ ) to decrease following 15 min passive recovery under the Resveratrol condition. However, a positive correlation trend ( $r = 0.72$ ,  $p = 0.07$ ) was observed between THb and TAC.

**CONCLUSION:** This study did not show an effect of Resveratrol on protein carbonyl and antioxidant capacity. However, Resveratrol improved tissue saturation index (TSI%) in vastus lateralis during the HIT.

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1388 Board #169 MAY 30 11:00 AM - 12:30 PM

**Involvement of PI3K/Akt/mTOR Pathway in Angelica sinensis Induced Myotube Hypertrophy.**

Tzu-Shao Yeh, FACSM<sup>1</sup>, Jen-Fang Liu<sup>1</sup>, Mei-Chieh Hsu, FACSM<sup>2</sup>. <sup>1</sup>Taipei Medical University, Taipei, Taiwan. <sup>2</sup>National Taiwan Sport University, Taoyuan, Taiwan.  
(No relationships reported)

**PURPOSE:** Herbal medicine has long been used in ergogenic aids for athletes but there is little scientific evidence for their actions. To investigate whether Angelica sinensis increases hypertrophy of myotubes through activating the PI3K/Akt/mTOR pathway, have been proposed to promote skeletal muscle hypertrophy and prevent muscle atrophy.

**METHODS:** We examined the PI3K/Akt/mTOR pathway in C2C12 myotubes, a well-established in vitro model of skeletal muscle hypertrophy, with or without Angelica sinensis extract for 72 hours.

**RESULTS:** In Angelica sinensis extract treated, the average myotube diameter was 1.34 $\pm$ 0.13 fold to normal, which is significantly larger than the diameter in non-herbal supplements cultures. This indicates clearly that myotubes were hypertrophied by Angelica sinensis extract. Hypertrophy was largely suppressed by wortmannin or rapamycin, inhibitors of PI3K or mTOR, respectively. The PI3K inhibitor, wortmannin, decreased the diameter of Angelica sinensis extract treated myotubes by 25%, as well as that of positive controls by approximately 30%. The mTOR inhibitor, rapamycin behaved similarly to wortmannin. These results indicate that the PI3K/Akt/mTOR pathway plays an important role in Angelica sinensis-induced myotube hypertrophy.

**CONCLUSIONS:** Angelica sinensis promotes hypertrophy in cultured skeletal myotubes through activating the PI3K/Akt/mTOR pathway. Furthermore, phosphorylation of Akt was enhanced by Angelica sinensis treatment and suppressed by wortmannin. Angelica sinensis and its derivatives may be promising candidates for the treatment of muscular dystrophy.

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1389 Board #170 MAY 30 11:00 AM - 12:30 PM

**Efficacy of Tart Cherry Juice to Reduce Inflammation Among Patients with Osteoarthritis**

Adriana E. Sleight, Kerry S. Kuehl, Diane L. Elliot, FACSM. Oregon Health & Science University, Portland, OR.  
(No relationships reported)

**PURPOSE:** Osteoarthritis (OA) is a common syndrome affecting 65 million Americans characterized by joint pain, limitation of movement, crepitus, occasional effusion, and variable degrees of local inflammation. Up to 40% of OA patients have inflammation. Numerous antioxidant and anti-inflammatory agents have been identified in tart cherries and may be beneficial for the treatment of pain and inflammation. This study assessed the effects of tart cherry juice on serum inflammation biomarkers among women with inflammatory OA.

**METHODS:** We used a three week, randomized, placebo controlled design among twenty 40-70 year old females with inflammatory OA. All subjects fulfilled the 1990 American College of Rheumatology classification guidelines for the diagnosis of osteoarthritis with evidence of swelling in at least one joint in the past year. For 21 days, subjects ingested 10.5 fl oz of tart cherry juice or a placebo beverage twice a day. Pre and post drink intervention blood measurements included IL-6, IL-10, TNF- $\alpha$ , and CRP.

**RESULTS:** Among the subjects who consumed tart cherry juice, all serum biomarkers showed evidence of decreased inflammation, however the only statistically significant change was observed in TNF- $\alpha$  ( $P < 0.05$ ). In addition, a subset analysis was performed on those subjects with active inflammation as defined by CRP  $> 3.0$  mg/L. Within the high inflammation subset ( $n = 12$ ), there was a statistically significant decrease in TNF- $\alpha$  and CRP for subjects on the tart cherry juice as compared to placebo.

**CONCLUSIONS:** Tart cherries have the highest antioxidant and anti-inflammatory content of any food. This study suggests a benefit of tart cherry juice in reducing inflammation as measured by certain serum inflammatory biomarkers among women with OA. Pain relief and improvement of functional disability are the main goals of OA treatment and it is important to look at healthy alternative therapies to conventional methods in the treatment and management of inflammatory osteoarthritis. Tart cherries may provide beneficial anti-inflammatory activity helping OA patients manage their disease.

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**1390** Board #171 MAY 30 11:00 AM - 12:30 PM

**Melatonin And Sleep Quality Are Increased Following Tart Cherry Juice Consumption**

Glyn Howatson, FACSM<sup>1</sup>, Phillip G. Bell<sup>1</sup>, Jamie Tallent<sup>1</sup>, Benita Middleton<sup>2</sup>, Malachy P. McHugh, FACSM<sup>3</sup>, Jason Ellis<sup>1</sup>. <sup>1</sup>Northumbria University, Newcastle-upon-Tyne, United Kingdom. <sup>2</sup>University of Surrey, Guildford, United Kingdom. <sup>3</sup>Nicholas Institute of Sports Medicine and Athletic Trauma, NY, NY.  
(No relationships reported)

Tart Montmorency cherries contain high levels of phytochemicals that include melatonin. Considering the alleged rampant use of prescription sleep medications in professional sports with a lot of travel (e.g. NHL), cherry juice might be a viable non-pharmacological alternative. We hypothesized that consumption of a tart cherry juice concentrate would provide an exogenous supply of melatonin and have a positive influence on sleep.

**PURPOSE:** The aim of our investigation was to examine the effect of tart cherry juice on melatonin metabolism and the subsequent influence on sleep quality in healthy asymptomatic adults.

**METHODS:** Twenty volunteers participated in this randomized, double-blind, placebo controlled, cross-over trial. Cherry juice or a placebo was administered for 7 days following a 48 h baseline period. Measures of sleep quality were determined with actigraphy (sleep onset latency, time in bed, fragmentation index, total sleep time and sleep efficiency) and urinary 6-sulfatoxymelatonin (aMT6); these were recorded for both baseline periods and the final 48 h of each supplement period. Determination of the circadian rhythm (amplitude, acrophase and mesor of aMT6) was determined using cosinor analysis. In addition, total aMT6 was also determined for the aforementioned epoch.

**RESULTS:** Total sleep time was significantly greater with cherry juice than baseline and placebo trials ( $P = 0.003$ ; 95% CI = 14.7 - 63.6 min). Sleep efficiency also showed improvements with the cherry juice over placebo trials ( $P = 0.017$ ; 95% CI = 0.5 - 9.4%). Although circadian rhythm measures were not different, total aMT6 was greater with cherry juice ( $P < 0.001$ ; 95% CI = 2519 - 5450 ng).

**CONCLUSIONS:** Tart cherry juice provides an increase in exogenous melatonin, improves sleep indices and hence the propensity for improved sleep quality in healthy adults. These findings present athletic and clinical populations with an alternative and viable solution for managing disturbed sleep.

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**1391** Board #172 MAY 30 11:00 AM - 12:30 PM

**Dose Response Effects of Pomegranate Juice Concentrate Supplementation on DOMS**

Daniel R. Machin, Kevin M. Christmas, Ting-Heng Chou, Sarah C. Hill, Douglas Van Pelt, Justin R. Trombold, Edward F. Coyle, FACSM. *The University of Texas at Austin, Austin, TX.*  
(No relationships reported)

An acute bout of unaccustomed eccentric exercise causes prolonged strength loss and delayed onset muscle soreness (DOMS) for several days. Chronic dietary supplementation with polyphenols, from pomegranates, has been shown to accelerate recovery following eccentric exercise (Trombold et al. MSSE 42 (3) 493-498, 2010), however the optimal dose is unknown.

**PURPOSE:** To determine the effect of dietary supplementation with different doses of pomegranate juice concentrate (PJC) on isometric strength and soreness throughout a 96-hour period following an acute bout of eccentric exercise.

**METHODS:** Forty-five healthy, recreationally active males (22.3  $\pm$  4.0 y, 73.8  $\pm$  11.5 kg, 174.9  $\pm$  6.2 cm) were assigned to one of three treatment groups: Once-daily PJC (1x), twice-daily PJC (2x), or placebo (PLA) supplementation over a period of eight days. A 1x dose of PJC provided approximately 650 mg GAE. On day four of each treatment, subjects performed downhill running intervals (-10% decline) over a 40 minute period followed by 40 repetitions of eccentric elbow flexion at 100% of concentric 1-RM. Muscle soreness and maximal isometric strength of the elbow flexor and knee extensor muscles were assessed pre-exercise, 2, 24, 48, 72, and 96 hours post-exercise. Treatment comparisons were made using a one-way ANOVA with  $p < 0.05$ . Values were reported as mean  $\pm$  SD.

**RESULTS:** Throughout the 96-hour period after exercise, isometric elbow flexor strength was significantly higher in 1x and 2x groups as compared to PLA (main treatment effect, 83.6  $\pm$  2.7%, 85.6  $\pm$  1.9%, and 78.4  $\pm$  1.8%, respectively;  $p < 0.001$ ). Isometric knee extensor strength was significantly higher in 1x and 2x groups as compared to PLA (main treatment effect, 93.9  $\pm$  1.5%, 91.6  $\pm$  1.5%, and 87.1  $\pm$  1.8%, respectively;  $p < 0.001$ ). Muscle soreness peaked 24-48 hours following exercise, but was not different between treatments.

**CONCLUSION:** Dietary supplementation with 1x or 2x PJC results in higher isometric strength values compared to placebo for elbow flexor and knee extensor muscles during the 96-hour period after an acute bout of eccentric exercise. Once per day supplementation of PJC is equally effective as twice per day for recovery of isometric strength in the four days after downhill running or eccentric elbow flexion exercise.

Funded by POM Wonderful LLC

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**1392** Board #173 MAY 30 11:00 AM - 12:30 PM

**Effects Of A Botanical Supplement On Recovery From Delayed Onset Muscle Soreness**

Corey A. Rynders, Judy Y. Weltman, Chelsea Williams, Frank I. Katch, FACSM, Jay Hertel, FACSM, Arthur Weltman, FACSM. *University of Virginia, Charlottesville, VA.*  
(No relationships reported)

**PURPOSE:** We examined the effects of a supplement containing a proprietary blend of botanical concentrates of Aphanizomenon flos-aquae (blue-green algae), antioxidants, enzymes, and D-Ribose (StemSport, Stemtech HealthSciences, Inc., San Clemente, CA) suggested to increase circulating stem cells, decrease local muscle inflammation, and attenuate exercise induced muscle damage on recovery from delayed onset muscle soreness (DOMS).

**METHODS:** Fifteen males ( $N = 7$ ) and females ( $N = 8$ ); age  $24.4 \pm 4.8$  years; stature  $171.9 \pm 10.0$  cm, mass  $72.2 \pm 14.7$  kg) were randomized in a crossover, double-blind, placebo controlled trial to receive a placebo or supplement (4050 mg/day) for 14 days. DOMS was induced on day 7 for both placebo and active conditions in the non-dominant elbow flexor group with repeated eccentric contractions. Muscle swelling (biceps girth), elbow flexor isometric strength (hand held dynamometer), muscle pain/tenderness (visual analog scale), and range of motion (active elbow flexion and extension) were measured at baseline and at 24, 48, and 72 h post eccentric exercise. The crossover washout period was  $\geq 14$  days.

**RESULTS:** No significant condition-by-time interactions occurred between placebo and supplementation for the criterion measures of muscle swelling ( $p = 0.59$ ), elbow flexion ( $p = 0.27$ ), isometric strength ( $p = 0.74$ ), pain ( $p = 0.16$ ), or tenderness ( $p = 0.53$ ). Decrements in elbow extension range of motion between 24 and 48 h post-exercise were less following supplementation ( $\Delta$  elbow extension 24-48h post; supplement,  $-0.04 \pm 5.0$  deg; placebo,  $-2.8 \pm 5.5$  deg;  $p = 0.04$ ).

**CONCLUSIONS:** Compared to placebo, supplementation did not significantly improve recovery outcome measures related to muscle recovery after upper-arm induced DOMS.

Supported in part by an unrestricted gift from Stemtech HealthSciences, Inc., San Clemente, CA. 92673. F.I. Katch, J. Hertel, and A. Weltman serve as scientific advisors to Stemtech HealthSciences.

**1393** Board #174 MAY 30 11:00 AM - 12:30 PM  
**Can Therapeutic Use Of Terbutaline Be Distinguished From Doping Use With A Urine Sample**

Jimmi Elers. *Copenhagen University Hospital: Bispebjerg, Copenhagen, Denmark.*  
(No relationships reported)

**PURPOSE:** We examined urine and serum concentrations after therapeutic use of single and repetitive doses of inhaled terbutaline and suprathreshold use of a single oral dose of terbutaline.

**METHODS:** We compared the concentrations in asthmatics with regular use of beta2-agonists prior to study and healthy subjects with no previous use of beta2-agonists. We enrolled 10 asthmatics and 10 controls in an open-label, cross-over study in which subjects were administered 2 mg inhaled and 10 mg oral terbutaline on two study days. Further 10 healthy subjects were administered 1 mg inhaled terbutaline every second hour (total 4 mg), which is the maximum permitted daily dose by the World Anti-Doping Agency (WADA). Blood samples were collected at baseline, 30 min, 1, 2, 3, 4, and 6 h after the first inhalations. Urine samples were collected at baseline, 0-4 h, 4-8 h, and 8-12 h after the first inhalations.

**RESULTS:** Median (IQR) urine concentrations peaked in the period 0-4 h after inhalation with Cmax 472 (324) ng x mL<sup>-1</sup> in asthmatics and 661 (517) ng x mL<sup>-1</sup> in healthy subjects, and 4-8 h after oral use with Cmax 666 (877) ng x mL<sup>-1</sup> in asthmatic and 402 (663) ng x mL<sup>-1</sup> in healthy subjects. All urine concentrations were corrected for the urine specific gravity.

**CONCLUSION:** In conclusion we found no significant differences in urine and serum concentrations between asthmatic and healthy subjects. We compared urine and serum concentrations after therapeutic inhaled doses and suprathreshold oral doses and observed significant statistical differences in both groups. We found high variability in urine concentrations between subjects in both groups. The variability between subjects was still present after the samples were corrected for urine specific gravity. When evaluating our results we found it impossible to distinguish between permitted therapeutic use and prohibited suprathreshold use based on doping tests with urine and blood samples.

**1394** Board #175 MAY 30 11:00 AM - 12:30 PM  
**Effect of Exercise and Aged Garlic Extract on Metabolic Parameters in High-Fat Diet-Induced Obese Rats**

Dae Yun Seo<sup>1</sup>, Sung Ryul Lee<sup>1</sup>, Yeong Ho Baek<sup>2</sup>, Yi Sub Kwak<sup>3</sup>, Arturo Figueroa<sup>4</sup>, Nari Kim<sup>1</sup>, Byoung Doo Lee<sup>1</sup>, Kyueng Soo Ko<sup>1</sup>, Tae Hee Ko<sup>1</sup>, Jin Han<sup>1</sup>. <sup>1</sup>Inje University, Busan, Korea, Republic of. <sup>2</sup>Pusan National University, Busan, Korea, Republic of. <sup>3</sup>Dong Eui University, Busan, Korea, Republic of. <sup>4</sup>Florida State University, Tallahassee, FL.  
(No relationships reported)

The worldwide prevalence of obesity is increasing at an alarming rate, with major adverse consequences for human health. Aged garlic extract (AGE) is widely promoted as a cholesterol-lowering agent and exercise alone is widely perceived to be beneficial for improving metabolic function in high fat diet (HFD) induced obese rats through reducing metabolic parameters.

**PURPOSE:** The purpose of this study was to investigate the effect of exercise and/or AGE on body weight, lipid profiles, inflammatory and oxidative stress markers in HFD induced obese rats.

**METHODS:** Forty Sprague Dawley rats were switched to HFD diet for 6 week and randomized into five groups: HFD (n=10), HFD with exercise (n=10), HFD with AGE (n=10), and HFD with exercise and AGE (n=10) for 4 weeks. AGE was administered orally at a dose of 2.86 g/kg. Exercise consisted of 15-60 min of running 5 times/day with gradually increasing intensity.

**RESULTS:** AGE (p<0.01), Exercise, and Exercise with AGE (p<0.001) significantly decreased body weight gain, average weight gain and food efficiency rate compared to HFD. AGE significantly decreased visceral fat (p<0.05), and liver (p<0.01). Exercise significantly decreased visceral fat, and liver (p<0.01). In reducing visceral fat (p<0.001), epididymal fat (p<0.01) and liver weight (p<0.001), Exercise with AGE was effective but exercise showed stronger suppressing effect than AGE admin. Consumption of AGE significantly inhibited the increase in total cholesterol (65.1±10.0 vs HFD: 92.64±2.9) and low density lipoprotein-cholesterol (37.4±8.1 vs HFD: 52.1±18.6). C-reactive protein (CRP) and malondialdehyde (MDA) were significantly decreased compared to HFD (p<0.05).

**CONCLUSION:** AGE supplementation and exercise alone have anti-obesity effects AGE with exercise result in improvements of inflammatory and oxidative stress markers independently of changes in adiposity and lipids.

**1395** Board #176 MAY 30 11:00 AM - 12:30 PM  
**Effects of Oxygenated Water on Aerobic Performance in Division II Collegiate Male Soccer Players**

Tina M. Manos, Peter J. Fuller, Thomas J. Koesterer. *Humboldt State University, Arcata, CA.*  
(No relationships reported)

Supplemental oxygen (O<sub>2</sub>), ingested in commercially-available "oxygenated water" preparations, has not been shown to have consistent effects on aerobic performance measures. Most researchers have found no significant differences in oxygen saturation of hemoglobin, VO<sub>2</sub> max, and time to exhaustion when comparing the effects of oxygenated water to placebo; yet, in some studies, highly-fit subjects ingesting oxygenated water were found to have significantly higher values for these measures.

**PURPOSE:** To determine the effects of oxygenated water on aerobic performance in Division II male soccer players.

**METHODS:** A randomized, double-blind, cross-over design was used to study 12 Division II soccer players (age = 20.1 ± 1.4 years; mass = 73.3 ± 10.6 kg; height = 176.0 ± 6.9 cm) with the fastest two-mile run times (12:34 ± 0:19 min:sec) of their team (n = 20). Two maximal tests were conducted (8 mph, 2.5% grade initially, with increments of 2.5% grade every two minutes until volitional exhaustion) approximately 1 week apart; conditions were 500 ml of bottled water (placebo) or commercial "activated stabilized oxygen" water taken 15 min prior to the test. Time to exhaustion, oxygen saturation of hemoglobin (SpO<sub>2</sub>; via pulse oximetry), heart rate (HR), and expired gases were measured.

**RESULTS:** The SpO<sub>2</sub> (95.58 ± 3.05 vs. 96.08 ± 2.46%; p = .497), HR (187.00 ± 8.66 vs. 187.16 ± 7.73 bpm; p = .942), and VO<sub>2</sub> (57.26 ± 4.93 vs. 58.15 ± 3.87 ml/kg/min; p = .351) at the highest common workload achieved on both trials were not different between the placebo and oxygenated water conditions, respectively. The SpO<sub>2</sub> at the lowest point during the maximal testing (94.58 ± 2.90 vs. 94.92 ± 2.06%; p = .732) and the SpO<sub>2</sub> at exhaustion (94.75 ± 3.01 vs. 95.16 ± 2.24%; p = .610) were not different between conditions. VO<sub>2</sub> max (59.97 ± 4.24 vs. 60.92 ± 3.51 ml/kg/min; p = .247) and maximum HR (192.08 ± 7.69 vs. 191.08 ± 7.63 bpm; p = .597) also were not significantly different between the conditions. Although the time to exhaustion (428.83 ± 62.54 vs. 451.17 ± 57.05 sec; p = .072) was longer by 22.34 seconds for oxygenated water versus placebo, the difference did not reach statistical significance.

**CONCLUSION:** Ingestion of oxygenated water did not result in any changes in aerobic performance measurements in Division II male soccer players.

**1396** Board #177 MAY 30 11:00 AM - 12:30 PM  
**Polyphenol Rich Juice Supplementation in Olympic Swimmers does not alter Inflammation or Immune Biomarkers**

Amy M. Knab<sup>1</sup>, Nicholas D. Gillitt<sup>2</sup>, Lynn Ciadella-Kam<sup>1</sup>, David C. Nieman, FACSM<sup>1</sup>, R. Andrew Shanelly<sup>1</sup>. <sup>1</sup>Appalachian State University, Kannapolis, NC. <sup>2</sup>Dole Nutrition Research Institute, Kannapolis, NC.  
(No relationships reported)

**PURPOSE:** This study investigated the effects of consumption of a juice blend made from whole fruits and vegetables on innate immunity, and chronic and acute inflammation in elite swimmers training three hours per day, compared to non-athletic controls.

**METHODS:** Nine male swimmers and seven controls were recruited and compared before and after a 10-day study period. Swimmers were randomized, and completed 10 days supplementation with or without 16 fl oz of the juice ingested pre- and post-workout, with a three week wash out period between supplementation periods. Blood samples were taken pre-supplementation, post-10 days supplementation, and immediately post-exercise on the 10<sup>th</sup> day.

**RESULTS:** Age was not different between swimmers (24.6 ± 0.7 y) and controls (25.7 ± 1.3 y). Swimmers were significantly fitter (VO<sub>2max</sub> = 53.1 ± 1.4 ml·kg<sup>-1</sup>·min<sup>-1</sup>, body fat = 11.7 ± 0.8%) compared to controls (VO<sub>2max</sub> = 39.9 ± 2.7 ml·kg<sup>-1</sup>·min<sup>-1</sup>, body fat = 19.6 ± 1.6 %). All pre-exercise measures of inflammation and immune function were not different between swimmers and controls. The patterns of change (chronic) in inflammatory cytokines (IFN-γ, IL-1β, IL-6, IL-10, IL-8, IL-12p70, and TNF-α) and innate immune function (granulocyte and monocyte phagocytosis/oxidative burst activity) were not different between juice and non-juice conditions over the 10-day study period. A single training bout at the end of the 10-day supplementation period caused a small but significant increase in plasma IL-6 (0.3 ± 0.1 to 0.8 ± 0.1 pg·ml with juice, and 0.5 ± 0.1 to 0.8 ± 0.1 pg·ml with no juice) and IL-10 (but not other cytokines), with no

differences between juice and non-juice conditions. The training bout caused a small but significant increase in phagocytosis and oxidative burst activity, with no differences between juice and non-juice conditions.

**CONCLUSIONS:** Contrary to expectations, high-level training in elite swimmers was not associated with chronic inflammation or dysfunctional innate immunity, and acute changes post-3-h aerobic/anaerobic training bouts were mild or indicative of immune stimulation. The mixed fruit-vegetable juice supplement (~9500 ORAC units) is a nutritious addition to the training diet, but has no influence on inflammation and innate immune measures that could be considered already at favorable levels. (Funded by Dole Foods Inc.)

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**1397** Board #178 MAY 30 11:00 AM - 12:30 PM

**Effect of 4 Weeks Resveratrol Supplementation on Body Composition in Healthy Adults**

Sarah J. Wherry<sup>1</sup>, James M. Smoliga<sup>2</sup>. <sup>1</sup>Arizona State University, Phoenix, AZ. <sup>2</sup>High Point University, High Point, NC.

(No relationships reported)

Resveratrol, a polyphenol found in grapes and other plants, has been demonstrated to have a number of beneficial health effects in laboratory models. Current evidence suggests there is much potential for resveratrol to decrease fat mass and increase muscle mass and bone mass. However, no human clinical trials have examined the effects of resveratrol supplementation on body composition.

**PURPOSE:** To evaluate the effects of 4 weeks oral supplementation of a resveratrol mixture (400mg 98% pure *trans*-resveratrol, 400mg grape extract, 100mg quercetin) on body composition parameters in healthy individuals, including total mass, fat mass, lean mass, and bone mass.

**METHODS:** 41 healthy adults (13 male, 28 female) between the ages of 18-75 were randomized to either the resveratrol (RES, n = 21) or placebo (PLA, n = 20) groups. Individuals participated in two testing visits: baseline (Pre) and post-supplementation (Post). Each visit included a fasting Dual-Energy X-ray Absorptiometry (DEXA) scan during which total body mass, fat mass, lean mass, and bone mass were measured. Following Pre, participants self-administered their respective supplement once daily for 4 weeks. Participants then underwent their Post DEXA scan. Data were analyzed using Repeated Measures ANOVA to determine if a significant ( $p \leq 0.05$ ) Group x Visit effect existed.

**RESULTS:** Total body mass was unchanged between groups (mean  $\pm$  sd; PLA: Pre = 70.4  $\pm$  14.1kg, Post = 70.2  $\pm$  13.9kg; RES: Pre = 74.7  $\pm$  14.7kg, Post = 74.8  $\pm$  14.8kg;  $p = 0.317$ , power = 0.167). There were no significant Group x Visit effects for fat mass (PLA: Pre = 24.2  $\pm$  9.5kg, Post = 24.3  $\pm$  9.6kg; RES: Pre = 23.7  $\pm$  9.3kg, Post = 23.7  $\pm$  9.3kg;  $p = 0.664$ , power = 0.071), lean mass (PLA: Pre = 46.4  $\pm$  10.3kg, Post = 46.1  $\pm$  9.9kg; RES: Pre = 48.1  $\pm$  10.2kg, Post = 48.3  $\pm$  10.0kg,  $p = 0.195$ , power = 0.251), or bone mass (PLA: Pre = 2.83  $\pm$  0.62kg, Post = 2.84  $\pm$  0.63kg; RES: Pre = 2.87  $\pm$  0.62kg, Post = 2.87  $\pm$  0.63kg;  $p = 0.435$ , power = 0.120). **DISCUSSION:** It appears that short-term resveratrol supplementation does not alter body composition parameters in healthy adults. Further research using larger sample sizes, longer supplementation periods, and concurrent exercise in a variety of populations should be performed to better evaluate resveratrol's efficacy.

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**1398** Board #179 MAY 30 11:00 AM - 12:30 PM

**The Bioavailability Of Resveratrol (3,4',5 Trihydroxystilbene)**

Martin R. Lindley<sup>1</sup>, Annika Rasijeff<sup>1</sup>, Shannon R. Siegel<sup>2</sup>, Timothy D. Mickleborough, FACSM<sup>3</sup>. <sup>1</sup>Loughborough University, Loughborough, United Kingdom.

<sup>2</sup>California State University, San Bernardino, San Bernardino, CA. <sup>3</sup>Indiana University, Bloomington, IN. (Sponsor: T.D. Mickleborough, FACSM)

(No relationships reported)

**PURPOSE:** Resveratrol is one of many phenolic compounds that have been suggested as having potential applications in chronic disease prevention, however, most of the current evidence is based on in vitro findings. Given the potential benefits of resveratrol for combating chronic inflammatory diseases, it is important to evaluate the bioavailability of resveratrol especially as it has been suggested that the compound is rapidly metabolized and eliminated in humans.

**METHODS:** Twelve healthy, young males completed the study. Blood samples were collected at 30, 60 and 90 min following ingestion of a 1 g oral resveratrol dose (Transmax, Biotivia Biocenticals, Vienna, Austria). Plasma samples were analyzed using high performance liquid chromatography and eluted resveratrol and metabolite peaks identified by mass spectrometry. The identity of resveratrol was confirmed by MS in plasma samples containing a standard at 100 ng/mL and 200 ng/mL concentrations with retention time identified by spikingOut of six peaks appearing on the HPLC chromatogram, the identities of resveratrol, and two metabolites were confirmed by MS (Metabolite B - mono-glucuronide; metabolite C- mono-sulfate conjugate).

**RESULTS:** The concentration of resveratrol (ng/mL) and metabolites (resveratrol equivalents in ng/mL) showed an increasing trend over time following ingestion. Plasma concentrations of resveratrol and metabolites at 30, 60 and 90 min post-dose were different from baseline ( $p < 0.008$ ) except for metabolites C and E. There was an increase in the concentration of metabolite D: 181.3 ng/mL  $\pm$  284.4, 1325.9 ng/mL  $\pm$  1425.3, ( $p = 0.005$ ) and metabolite F: 155.0 ng/mL  $\pm$  311.4, 1926.5 ng/mL  $\pm$  2365.9 ( $p = 0.005$ ) between 30 and 60 minutes. Significant increases from 30 to 90 min were seen for metabolite B (438.4 ng/mL  $\pm$  756.3 to 1634.1ng/mL  $\pm$  1327.4,  $p = 0.006$ ), metabolite D (181.3 ng/mL  $\pm$  284.4 to 1748.1 ng/mL  $\pm$  1578.0,  $p = 0.005$ ), metabolite F (155.0 ng/mL  $\pm$  311.4 to 2783.7 ng/mL  $\pm$  2174.3,  $p < 0.001$ ) and resveratrol ( $p < 0.001$ ). No differences were seen in resveratrol or any of its metabolites from 60 to 90 minutes ( $p > 0.008$ ).

**CONCLUSIONS:** Resveratrol has been shown to have low bioavailability as well as being lower than its metabolites and as such future research should focus not only on resveratrol bioavailability but also that of its metabolites.

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**1399** Board #180 MAY 30 11:00 AM - 12:30 PM

**Effects of High Antioxidant Foods on Antioxidant Capacity in Post-Menopausal Women**

Shelby Kloiber<sup>1</sup>, Robert Sawyer<sup>2</sup>, Melanie Hart<sup>1</sup>, Jacalyn McComb<sup>1</sup>. <sup>1</sup>Texas Tech University, Lubbock, TX. <sup>2</sup>Utah Valley University, Orem, UT.

(No relationships reported)

Oxidative stress brought on by free radicals can lead to an increased risk of certain diseases such as heart disease and some cancers. Oxidative stress mediated damage can be reduced by scavengers, or antioxidants that can eliminate the high reactivity of free radicals by turning them into non-radical and nontoxic metabolites. Many scientists have investigated the effects of different kinds of foods (whole, liquid, or supplement) to measure the change in oxidative damage and antioxidant capacity.

**PURPOSE:** To examine the effects of two types of foods high in antioxidants on antioxidant capacity in postmenopausal women.

**METHODS:** Healthy post-menopausal women without hormone replacement, (N=16) were randomly divided into four groups: fruits (F), soymilk (S), fruits and soymilk (S+F) and control (C). The intervention included a one week wash-out period where participants refrained from a list of foods high in antioxidants. The next four weeks involved a diet intervention. The S group was instructed to consume a total of 706 ml of approved soymilk throughout the day. The F group was instructed to consume 5 or more servings of fruit per day. The S+F group followed both the soymilk and fruit instructions. Subjects in the C group were instructed to maintain their normal diet. Fasting blood samples were drawn before and after the intervention. Spectrophotometric assays were conducted for antioxidant capacity by SOD (Cayman Chemical).

**RESULTS:** SOD showed a significant main effect for Test with the mean for the pre-test (M = 0.28 units/ml, SD = 0.15) being significantly lower than the mean for the post-test (M = 0.39 units/ml, SD = 0.23). There were no significant between group differences in SOD.

**CONCLUSION:** The results of a diet high in antioxidant rich food, specifically fruits and/or soymilk, after a 4 week time period, did significantly increase antioxidant levels. Both diets appear effective in increasing antioxidant capacity, with no diet being more effective than the other.

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**1400** Board #181 MAY 30 11:00 AM - 12:30 PM

**Impact Of Intermittent And Continuous Physical Exercise On Endothelial Function And Oxidative Stress Postprandially**

Robinson Ramirez-Velez<sup>1</sup>, Jose G. Ortega<sup>1</sup>, Ana C. de Plata Aguilar<sup>1</sup>, Cristina Araujo, Nut<sup>1</sup>, Celia Escobar Hurtado<sup>1</sup>, Ricardo A. Agredo Zuñiga<sup>1</sup>, Jorge H. Ramirez<sup>2</sup>.

<sup>1</sup>University of Valle, Cali, Colombia. <sup>2</sup>University ICESI, Cali, Colombia.

(No relationships reported)

**PURPOSE:** To evaluate the impact of intermittent and continuous physical exercise on endothelial function and blood oxidative stress postprandially after a high-fat meal.



**METHODS:** Crossover trial in 14 healthy male subjects, 20 years of age, randomized to three experimental groups: (i) no exercise, (ii) 1 hour of moderate intensity continuous physical exercise, and (iii) 1 hour of moderate intensity intermittent physical exercise. Endothelium dependent flow mediated dilatation (FMD%) and plasmatic levels of nitrites and nitrates (NO<sub>2</sub>/NO<sub>3</sub>) were used to assess vascular endothelial function. Oxidative stress was evaluated using the total antioxidant capacity (TAC) test. Endothelial function and oxidative stress were assessed after 14 to 18 hours of physical inactivity (baseline); posterior measurements were performed 1h and 2h after the consumption of a high-fat meal.

**RESULTS:** No statistically significant differences were found on baseline FMD% in the three experimental groups. However, NO<sub>2</sub>/NO<sub>3</sub> levels were significantly higher in the intermittent and continuous exercise groups compared to the control group (P<0.01). After the high-fat meal ingestion the FMD% decreased in the no-exercise and continuous exercise group but significantly increased in the intermittent exercise group. Furthermore, intermittent exercise was associated with increased TAC compared to no exercise and continuous exercise.

**CONCLUSIONS:** Moderate intensity intermittent physical exercise was found to be associated with beneficial effects on endothelial function and oxidative stress in the postprandial state. Randomized clinical trials assessing the effect of intermittent versus continuous physical exercise on hard outcomes of cardiovascular disease and metabolic syndrome are warranted.

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**1401** Board #182 **MAY 30** **11:00 AM - 12:30 PM**

**Antioxidant Supplementation To Prevent The Progression Of Microangiopathy In Hindlimb Unloading-induced Atrophied Soleus Muscle In Rats**

Hidemi Fujino<sup>1</sup>, Miho Kanazashi<sup>1</sup>, Hiroyo Kondo<sup>2</sup>, Shinichiro Murakami<sup>1</sup>, Naoto Fujita<sup>1</sup>, Fumiko Nagatomo<sup>3</sup>, Akihiko Ishihara<sup>3</sup>. <sup>1</sup>Kobe University Graduate School of Health Sciences, Kobe, Japan. <sup>2</sup>Nagoya Women's University, Nagoya, Japan. <sup>3</sup>Kyoto University, Kyoto, Japan.

(No relationships reported)

**PURPOSE:** Exposure of skeletal muscle to oxidative stress increases the expression of important components of the proteasome proteolytic system and induces the damage of endothelial cell. The aim of this study was to explore the effects of the antioxidant supplementation during the phase of unloading on capillary regression in atrophied soleus muscle.

**METHODS:** Four groups of Wistar rats were studied: control (Con), control with ASX (Con+ASX), hindlimb unloading (HU), hindlimb unloading with astaxanthin (HU+ASX) groups. In the Con+ASX and HU+ASX groups, astaxanthin (ASX) was orally administered twice in a day for seven consecutive days (50mg/kg). Hindlimb unloading was applied to animals by suspending their tails for seven days. Intracellular ROS generation was determined by use of the redox-sensitive probe dihydroethidium. The capillary network of the soleus muscle was visualized using confocal laser microscopy. The expression levels of SOD-1 and VEGF protein were measured by immunoblotting and the mRNA expression levels of angiogenic factors (VEGF, KDR, Flt-1, Ang-1, Ang-2, Tie-2, and HIF-1 alpha) in the soleus muscle were determined by TaqMan probe-based real-time PCR.

**RESULTS:** HU resulted in an increase of ROS and a decrease of the number of capillaries, capillary volume, and capillary luminal diameter. Namely, the capillary network of the soleus muscle regressed in HU. In addition, HU caused the overexpression of SOD-1 and decreased the expression level of VEGF. However, the capillary network of the soleus muscle prevented disuse-induced capillary regression in HU+ASX. Furthermore, ASX supplementation abolished the unloading-induced overexpression in SOD-1 and attenuated the decrease in VEGF expression, and other angiogenic factors.

**CONCLUSIONS:** These results revealed that astaxanthin is effective to attenuate the development of oxidative stress and maintain the architecture of capillary network in disused skeletal muscle.

Supported by Grants-in-Aid for Science Research from the Japanese Ministry.

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**1402** Board #183 **MAY 30** **11:00 AM - 12:30 PM**

**Uric Acid Is A Key Antioxidant Against Iron-mediated Oxidative Stress In Resistance/power Exercise.**

Marcelo P. Barros<sup>1</sup>, Leandro Lorenço-Lima<sup>1</sup>, Douglas Ganini<sup>2</sup>, Cristina V. Vardaris<sup>1</sup>, Etelvino J.H. Bechara<sup>3</sup>, Rui Curi<sup>4</sup>, Tacito P. Souza-Junior<sup>5</sup>. <sup>1</sup>Universidade Cruzeiro do Sul, Sao Paulo, SP, Brazil. <sup>2</sup>National Institute of Environmental Health Sciences, NIH, Research Triangle Park, NC 27709, NC. <sup>3</sup>Universidade Federal de Sao Paulo (UNIFESP), Diadema, SP, Brazil. <sup>4</sup>Universidade de Sao Paulo, Sao Paulo, SP, Brazil. <sup>5</sup>Universidade Federal do Parana, Curitiba, PR, Brazil. (Sponsor: Tania Pithon-Curi, FACSM)

(No relationships reported)

Reactive oxygen species (ROS) are normally produced in humans during endurance (mainly by mitochondrial electron transport system) or resistance exercise (augmented xanthine oxidase activity in cytosol). Drastic drops in performance, precocious fatigue, exacerbated inflammation processes, and injury risk are regular outcomes of the excessive production of ROS in athletes. Paradoxically, balanced ROS production is also essential to provide the desired physiological adaptations of training and also the health benefits from exercise. Furthermore, iron homeostasis is recognized as a key factor in controlling oxidative stress during exercise.

**PURPOSE:** This work aims to evaluate key biomarkers of iron-related oxidative stress in plasma of young athletes after an anaerobic power test.

**METHODS:** Young male college athletes (n = 17; age, 23.1 ± 5.8 years; height, 175.4 ± 2.3 cm; weight, 81.1 ± 9.3 kg; from Universidade Metodista de Santos, Brazil) were selected. A Wingate Test was carried out using a Cybex cycle ergometer with increasing loads up to 10% BW (after familiarization and pre-heat procedure for 5 min). Blood samples (5 mL) were collected before (t0) and 5/60 min after (t5 and t60) the Wingate test, and total iron, heme-iron, uric acid, xanthine oxidase activity (XO), ferric-reducing activity (FRAP), and malondialdehyde (MDA, biomarker of lipid oxidation) were measured in plasma. **RESULTS:** Plasma iron content was increased immediately after Wingate (up to 3-fold, at t5), whereas heme-iron content only varied slightly (25% maximum). However, total FRAP levels varied consistently with total iron (R<sup>2</sup> = 0.939) in order to limit iron-mediated lipid oxidation in plasma. Remarkably, uric acid - a major purine catabolite from energy(ATP)-depleted muscles - accumulated in plasma lately (25% higher at t60) to adequately provide an extended antioxidant capacity, as shown by its high correlation with FRAP (R<sup>2</sup> = 0.788).

**CONCLUSIONS:** Even under exhaustive conditions, there is a tight control of iron homeostasis in plasma of athletes, and uric acid, massively produced by exhausting muscles during resistance/power exercise, contributes to restrain oxidative stress in plasma based mostly on its iron-chelating capacity, identified here by FRAP activity. Financial support: FAPESP, CAPES & CNPq (Brazil).

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**1403** Board #184 **MAY 30** **11:00 AM - 12:30 PM**

**The Effect of Quercetin Supplementation on Volitional Fatigue and Skeletal Muscle Mass Retention During Cancer Cachexia**

Justin P. Hardee, Kandy T. Velazquez, Melissa J. Puppa, Johannes D. Aartun, Aditi A. Narsale, Shuichi Sato, J Mark Davis, FACSM, James A. Carson, FACSM. University of South Carolina, Columbia, SC.

(No relationships reported)

Cancer cachexia (CC) has been defined as an unintentional 10% loss of body weight (BW) over a 12-month period that occurs in the presence of an underlying disease. Two common hallmarks of CC are decreased muscle mass and hypogonadism. The APC<sup>Min/+</sup> mouse is an IL-6 dependent model of CC.

**PURPOSE:** To determine the effects of quercetin supplementation on volitional grip strength, muscle mass, and testes size during the progression of CC.

**METHODS:** At 15 weeks of age, male C57BL/6 and APC<sup>Min/+</sup> mice were randomly assigned to vehicle (B6 and Min-V) or quercetin supplementation (Min-Q) for 3 weeks. Quercetin was administered via oral gavage daily at a dose of 25 mg/kg of BW. Grip strength was measured pre- and post-supplementation.

**RESULTS:** Cachexia decreased grip strength 19% (B6: 2.42 ± 0.07 N vs Min: 2.01 ± 0.08 N; p < 0.001); however, quercetin maintained grip strength over 3 weeks (Min-V: 1.67 ± 0.08 N vs Min-Q: 2.09 ± 0.13 N). Bodyweight decreased 13% (p < 0.001) with cachexia; while quercetin attenuated BW loss (Min-Q: -7%). Cachexia decreased gastrocnemius (GAS) muscle mass 33% and rectus femoris (RF) muscle mass 37% (p < 0.05); whereas quercetin attenuated muscle mass loss. Cachexia reduced testes size 29% (p < 0.01) and quercetin attenuated the loss (Min-Q: 12%). Min GAS and RF muscle mass were correlated with testes size (R<sup>2</sup> = 0.68 and 0.62, p < 0.05, respectively).

**CONCLUSION:** Quercetin supplementation for 3 weeks maintained volitional grip strength in mice undergoing cachexia, which may be due to the retention of muscle mass and testes size. Funded by NCI R01-CA121249

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## A-37 Free Communication/Poster - Occupational Physiology

MAY 30, 2012 7:30 AM - 12:30 PM  
ROOM: Exhibit Hall

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### 1404 Board #185 MAY 30 11:00 AM - 12:30 PM

#### Daily Aspirin Therapy Does Not Increase Body Core Temperature Responses in Firefighters During Exertion in Thermal Protective Clothing

Serina J. McEntire, Steven E. Reis, Diane Comer, Charity G. Moore, Riana R. Pryor, Jennifer Erin, Priya Khorana, Joe Suyama, Francis X. Guyette, David Hostler.  
*University of Pittsburgh, Pittsburgh, PA.* (Sponsor: Robert Robertson, PhD, FACSM)  
(No relationships reported)

Heart attack is the most common cause of line-of-duty deaths in the fire service. Daily aspirin therapy is a common preventative measure used to reduce the morbidity of heart attacks in the general population. However, the mechanism of aspirin can hypothetically impair thermoregulation and anecdotal reports have suggested aspirin use increases the risk of heat illness. In spite of these observations, the safety profile of aspirin during uncompensable heat stress has not been well described.

**PURPOSE:** Determine if fourteen days of daily aspirin therapy (81mg PO) alters body core temperature responses during exertion in the heat while wearing thermal protective clothing (TPC).

**METHODS:** In this double-blind, placebo controlled study, 102 firefighters were randomized to receive either 14 days of aspirin (N=54) or a placebo (N=48) prior to completing a 50 minute bout of treadmill exercise in the heat (38.9±1.1°C; 24±7% RH) while wearing TPC and self contained breathing apparatus. Heart rate, weighted mean skin temperature, and body core temperature were monitored throughout the 50 minutes of exercise.

**RESULTS:** There were no differences in age, height, mass, BMI, or VO<sub>2</sub>max between groups. Heart rate at the end of exercise did not differ between aspirin and placebo groups (174±17 vs. 171±17 bpm, respectively). In the aspirin group, baseline core body temperature was 37.1±0.3°C, which was similar to the placebo group (37.2±0.5°C; p=0.55). Maximal body core temperature was 38.7±0.5°C in the aspirin group and 38.6±0.5°C in the placebo group (p=0.39). The percent change in core temperature from baseline was 4.3±1.2% in the aspirin group and 3.9±1.6% in the placebo group (p=0.20). Upon completion of exercise, maximal weighted skin temperature was 38.3±0.5°C in the aspirin group and 38.1±0.6°C in the placebo groups. Skin temperature rose 12.5±2.3% from baseline in the aspirin group and 12.2±2.6% with the placebo (p=0.55).

**CONCLUSIONS:** Fourteen days of aspirin therapy does not alter temperature responses among firefighters performing exertion in the heat.

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### 1405 Board #186 MAY 30 11:00 AM - 12:30 PM

#### Physiological and Thermoregulatory Responses to Wearing N95 Filtering Facepiece Respirators

Jung-Hyun Kim, Raymond J. Roberge, Stacey M. Benson. *CDC/NIOSH/NPPTL, Pittsburgh, PA.*  
(No relationships reported)

The use of filtering facepiece respirators (FFR) has increased enormously in both public and occupational sectors for respiratory protection from infectious airborne particles. The N95 class of FFR, which filters out at least 95% of airborne particles >0.3 µm, is the most common type of FFR; however, there has been a lack of scientific information on physiological and thermal burdens of wearing N95 FFR.

**PURPOSE:** To investigate physiological and thermoregulatory responses to wearing N95 FFRs while performing low-moderate intensity exercise.

**METHODS:** Twenty healthy subjects (13 men, 7 women), who passed a physical examination and a respirator quantitative fit test, performed three trials of treadmill exercise (5.6 km/h, 0% grade, 60min duration) in a thermoneutral environment (21.4±0.7°C, 23.5±7.9%) while wearing two popular styles (cup-shaped and flat fold) of N95 FFR or not wearing FFR for control (CON). Study variables included core body temperature (T<sub>co</sub>), skin temperature at the cheek (T<sub>cheek</sub>) and abdomen (T<sub>abdomen</sub>), heart rate (HR), respiratory rate (RR), transcutaneous carbon dioxide (tcPCO<sub>2</sub>), and oxygen saturation (SpO<sub>2</sub>). Dead-space microclimate temperature and humidity were also measured in FFR trials. Data were analyzed by two-way (Trials × Time) repeated measures ANOVA.

**RESULTS:** T<sub>co</sub>, T<sub>cheek</sub>, and T<sub>abdomen</sub> rose significantly by time in all trials (p<0.001) and the final dead-space microclimate temperature and humidity reached up to 33°C and 90%, respectively. However, there was no statistical difference in these temperature variables between CON and the FFR trials. HR and RR increased significantly by time in all trials (p<0.001), but at a greater rate in the FFR trials than in CON (HR; P<0.001, RR; P<0.01). There was no statistical difference in SpO<sub>2</sub> levels between CON and FFR trials, however, tcPCO<sub>2</sub> levels were significantly higher in the FFR trials than in CON (p<0.001).

**CONCLUSION:** Wearing N95 FFR while performing low-moderate work for 60 min in a thermoneutral environment did not impose a significant thermal burden on the wearer. However, significantly elevated HR and RR in the FFR trials indicated that wearing N95 FFR may add additional metabolic demands. Also, breathing through N95 FFR did not interfere with SpO<sub>2</sub>, but caused some mild degree of CO<sub>2</sub> retention (tcPCO<sub>2</sub> ≥ 45 mmHg).

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### 1406 Board #187 MAY 30 11:00 AM - 12:30 PM

#### Increased Salivary Cortisol and State Anxiety Levels in Firefighter Candidates during Repeated Fire Suppression Tasks

Deena Campbell<sup>1</sup>, Heather E. Webb<sup>2</sup>, Christopher J. Jackson<sup>1</sup>, Daniel Cross<sup>3</sup>. <sup>1</sup>University of New South Wales, Sydney, Australia. <sup>2</sup>Mississippi State University, Starkville, MS. <sup>3</sup>Mississippi State Fire Academy, Jackson, MS.  
(No relationships reported)

Research suggests that the combined psychological and physiological stress load of firefighting may contribute to an exacerbated cortisol response during fire suppression.

**PURPOSE:** The purpose of this study was to examine the salivary cortisol (SCORT) response in firefighter candidates during simulated fire suppression tasks.

**METHODS:** Twelve firefighter candidates (age = 25.25 ± 5.69) participated in two research sessions, an informational session during which consent and demographic/psychometric data were obtained, and a second session in which the candidates completed two fire suppression evolutions. In each evolution, the participants entered the burn building in pairs and undertook fire suppression tasks. Baseline measures of SCORT and state anxiety (SAI) were collected immediately prior to each evolution, and collected again within 5 minutes of completion of each evolution.

**RESULTS:** The fire suppression tasks resulted in elevated SCORT levels (when controlling for participant order) compared to baseline in both evolution 1 and 2 (t = 11.27, p = 0.004 and t = 44.07, p = 0.000 respectively). Anxiety levels also increased but did not reach significance in evolution 1, and increased significantly in evolution 2 (t = -2.66, p = 0.026).

**CONCLUSIONS:** These findings suggest that the candidates experienced both physical and psychological stress in both evolutions. Further, findings suggest that the experience of the first evolution did not reduce the psychological stress and the resultant physiological load of the second evolution.

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### 1407 Board #188 MAY 30 11:00 AM - 12:30 PM

#### Review of Current Minimum Riding Weights in Australian Horse Racing - Implications for Jockey Health and Wellbeing

Caron B. Jander<sup>1</sup>, David A. Greene<sup>2</sup>, Helen O'Connor<sup>3</sup>, Giles D. Warrington, FACSM<sup>4</sup>. <sup>1</sup>Australian Racing Board, Freshwater, Australia. <sup>2</sup>Australian Catholic University, Strathfield, NSW, Australia. <sup>3</sup>University of Sydney, Lidcombe, NSW, Australia. <sup>4</sup>Dublin City University, Dublin, Ireland.  
(No relationships reported)

Despite the international popularity of horse racing there is a dearth of population specific research available describing the physiological demands and health and lifestyle characteristics of jockeys. Given the weight-restricted nature of horse racing, jockeys often engage in extreme and unhealthy weight-loss practices, which are likely to place riders at an increased risk of injury. As a consequence, the Australian Racing Board (ARB) commissioned a scientific review of the minimum riding weight for flat jockeys.

**PURPOSE:** The purpose of this review was to identify potential health issues associated with jockeys complying with current stipulated weight standards operating in Australian horse racing. **METHODS:** The review comprised (i) a comprehensive review of national height and weight statistics, (ii) a review of the international scientific literature on population specific normative data, (iii) evaluations of race-day jockey urine samples collected on 875 jockeys over the past 3 years in New South Wales for determination of urine specific gravity (Usg) (iv) and the comparison of the results of Usg samples collected for the purpose of drug testing in the work place in the state of Victoria on 452 petrochemical workers (control group) and 305 jockeys at the race course.

**RESULTS:** Jockeys were found to have 8 key health issues associated with race riding. Issues included: 'Making weight'; poor dietary practices; compromised bone health; dehydration; smoking; engaging in a high risk sport; lifestyle challenges; and mood disorders. Disturbing levels of consistent and pervasive dehydration were found in jockeys both on race day and non-race days. Results indicate that on race day 48.4% of 875 samples indicated significant dehydration, (Usg  $\leq 1.025$ ), 27% had moderate to high levels of dehydration (Usg  $\leq 1.025$  and  $\geq 1.02$ ), 24.5% within the dehydration threshold as defined by Sawka et al., 2007 (Usg  $\leq 1.020$ )

**CONCLUSION:** Based on these findings, the following recommendations were presented to the ARB: (i) increase the minimum riding weight by 1 kg to 54 kg; and (ii) increase the median and maximum riding weight by 1 kg. It is anticipated that immediate health outcomes will result in a decrease in the extreme dehydrating practices currently employed by many jockeys.

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**1408** Board #189 MAY 30 11:00 AM - 12:30 PM

**Anthropometric Measurements of Obesity and Their Link to Lifestyle and Cardiovascular Risk in Colorado Firefighters**

Tiffany Lipsey, Lorin O'Toole, Tracy Nelson, Jennifer Peel, Richard G. Israel, FACSM. *Colorado State University, Fort Collins, CO.*

(No relationships reported)

Cardiovascular disease (CVD) is the leading cause of death in firefighters as it is in the general population. Despite data promoting Colorado as the leanest state in the nation and the image of firefighters as healthy and physically fit, obesity is evident in Colorado firefighters and continues to be an important CVD risk factor. Job performance and health outcomes among those in public safety are greatly impacted by obesity despite the perception of the general public that firefighters are healthy and fit.

**PURPOSE:** To determine obesity prevalence, depending on measurement and classification, and its association with lifestyle factors and cardiovascular (CV) risk in a cohort of Colorado firefighters.

**METHODS:** Analyses were conducted on data from 466 Colorado firefighters (41 females; 425 males; mean age 38 y). Using standard classification cut-points, rates of obesity were determined using body mass index (BMI), waist circumference (WC), sagittal abdominal diameter (SAD), and percent body fat (%BF) from skin fold (SF) and hydrodensitometry (H) measurements. Lifestyle factors used in the analysis included diet, physical activity, sleep, and stress. Lipids, C-reactive protein (CRP), predicted maximal oxygen consumption and strength measures were also included. CV risk was also assessed using the Cooper Risk Profile. Correlation statistics were run for each anthropometric measure with the above variables.

**RESULTS:** Obesity prevalence varied by measurement in females and males respectively: BMI=9.8%, 19.1%; WC=19.5%, 19.8%; SAD=31.6%, 43.5%; %BF(SF)=17.1%, 15.1%; and %BF(H)=23.7%, 28.6%. In both sexes, anthropometric measures were positively correlated with triglycerides and CRP but inversely associated with high-density lipoprotein cholesterol, sit & reach, and estimated maximal oxygen consumption ( $VO_{2max}$ ) (besides BMI in females) ( $p \leq 0.05$ ). All anthropometric measures were significantly correlated with CV risk ( $p \leq 0.05$ ) except WHR in females. The strongest link to CV risk was %BF(SF) in females and WHR in males.

**CONCLUSIONS:** The rate of obesity in Colorado firefighters varies depending on the measure used. There are significant associations between obesity, lifestyle factors and CV risk that should be further explored in light of the already increased risk for CVD in firefighters.

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**1409** Board #190 MAY 30 11:00 AM - 12:30 PM

**The Beneficial Effects Of Walking Following Repeated Bouts Of Sustained Static Postures**

François Taillefer, Jean P. Boucher, FACSM, M Zummo, R Savard, A S. Comtois. *University of Quebec in Montreal, Montreal, QC, Canada.*

(No relationships reported)

**PURPOSE:** We have shown that 20 min of various sit, sit-stand and stand static postures interspersed by 5 min walking periods was beneficial for lower limb muscle blood flow and oxygenation (Taillefer et al., 2011). However, the physiological impact of walking on the lower limbs following static postures remains to be shown, especially in individuals confronted with varicose veins. Thus, the present study measured the physiological effects of a 5' walk following repeated bouts of 20' static periods.

**METHODS:** Two groups (n = 10 per group) of women (without varicose veins, C0 and with varicose veins, C2) were studied during the maintenance of 6 twenty minute periods of different static postures all interspersed by 5 min walking periods. The following measurements were continuously recorded on the left lower limb during each static and walking periods: blood perfusion (foot), transcutaneous partial pressure (TcP) of O<sub>2</sub> and CO<sub>2</sub> (foot), cutaneous temperature (Ct, medial malleola), EMG of the gastrocnemius muscle, VO<sub>2</sub>, and heart rate (HR).

**RESULTS:** Physiological variables were pooled since no significant differences were observed between both groups (C0 vs C2). The variables were significantly ( $p < 0.05$ ) modified during walking when compared to the static postures (blood perfusion,  $120.0 \pm 35.31$  vs  $5.7 \pm 1.79$  perfusion units; TcPO<sub>2</sub>,  $75.7 \pm 19.56$  vs  $59.4 \pm 16.77$  mmHg; TcPCO<sub>2</sub>,  $27.48 \pm 5.83$  vs  $33.1 \pm 5.82$  mmHg; Ct,  $28.4 \pm 1.60$  vs  $27.8 \pm 1.34$ ; EMG,  $23.4 \pm 9.50$  vs  $2.3 \pm 2.50$  mV; VO<sub>2</sub>,  $629.9 \pm 195.50$  vs  $219.9 \pm 40.10$  ml\*min<sup>-1</sup>; HR,  $84.7 \pm 10.40$  vs  $72.5 \pm 10.60$  b\*min<sup>-1</sup>, respectively).

**CONCLUSIONS:** The varicose vein group (C2) responded very similarly to the non varicose vein group (C0) during walking. These results indicate the importance of walking to maintain lower limb oxygenation to possibly minimize the cascade of physiological events leading to the appearance of varicose veins, especially when these individuals have to maintain prolonged static postures.

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**1410** Board #191 MAY 30 11:00 AM - 12:30 PM

**The Effect of Pre-cooling on Cardiovascular and Metabolic Strain During Incremental Exercise**

Eric M. Hultquist<sup>1</sup>, Logan Arena<sup>1</sup>, Welsey K. Lefferts<sup>1</sup>, Thomas W. Storer<sup>2</sup>, Christopher B. Cooper, FACSM<sup>2</sup>, Patricia C. Fehling, FACSM<sup>1</sup>, Denise L. Smith, FACSM<sup>1</sup>. <sup>1</sup>Skidmore College, Saratoga Springs, NY. <sup>2</sup>UCLA, Los Angeles, CA.

(No relationships reported)

Pre-cooling has been shown to improve endurance performance and to lessen heart rate (HR) for a given level of work. However, the effect of pre-cooling on the relationship between HR and oxygen uptake (VO<sub>2</sub>) has not been well studied.

**PURPOSE:** To investigate the relationship between cardiovascular and metabolic responses during maximal exercise performed at either normal or depressed core temperature (T<sub>co</sub>).

**METHODS:** Ten men (age,  $21 \pm 1$  yr; VO<sub>2max</sub>,  $60.2 \pm 6.9$  ml·kg<sup>-1</sup>·min<sup>-1</sup>) performed a maximal treadmill test following two conditions: (a) control (CON), in which participants rested in a thermoneutral laboratory ( $21.6 \pm 4.8$  °C), and (b) pre-cooling (PC), during which participants were submerged up to their armpits in  $23.1 \pm 0.2$  °C water for 24 min. The chronotropic index (CI) was derived from the slope of the regression line between HR and VO<sub>2</sub>. A repeated measures ANOVA was employed to examine differences in T<sub>co</sub>, HR, and VO<sub>2</sub> and the CI. Significance was set at  $P < 0.05$ .

**RESULTS:** Prior to the onset of exercise T<sub>co</sub> was significantly lower for PC ( $36.69 \pm 0.32$  °C) compared to CON ( $37.12 \pm 0.39$  °C;  $P < 0.05$ ). Time to fatigue was significantly longer in the CON ( $914 \pm 97$  s) compared to the PC condition ( $889 \pm 97$  s). T<sub>co</sub> during exercise remained consistently lower for PC compared to CON ( $P < 0.05$ ). Furthermore, there was a significant condition x time interaction for T<sub>co</sub> between conditions ( $P < 0.05$ ). VO<sub>2</sub> was not significantly different between conditions. PC resulted in an  $8-10$  b·min<sup>-1</sup> lower HR than the CON condition at any given time point during the exercise protocol and at peak (PC,  $178 \pm 9$  b·min<sup>-1</sup>; CON,  $188 \pm 6$  b·min<sup>-1</sup>). The CI did not differ between conditions; however, the y-intercept was significantly lower for PC compared to CON (PC,  $53.6 \pm 11.0$ ; CON,  $67.3 \pm 11.0$ ).

**CONCLUSION:** Reductions in T<sub>co</sub> significantly reduced cardiovascular strain (HR) at any given workload and decreased time to fatigue. However, pre-cooling did not change VO<sub>2</sub> or alter the relationship between HR and VO<sub>2</sub> (CI). Although there was no change in the CI, pre-cooling decreased the HR response, shifting the regression line down. These results suggest potential use of pre-cooling to mitigate cardiovascular strain in firefighters.

Supported by contract from DHS Science and Technology (UCLA contractor).

1411 Board #192 MAY 30 11:00 AM - 12:30 PM

**Cardiovascular and Metabolic Responses During Maximal Incremental Exercise in Firefighter's Personal Protective Equipment**

Wesley K. Lefferts<sup>1</sup>, Eric M. Hultquist<sup>1</sup>, David A. Barr<sup>1</sup>, Thomas W. Storer<sup>2</sup>, Christopher B. Cooper, FACSM<sup>2</sup>, Patricia C. Fehling, FACSM<sup>1</sup>, Denise L. Smith, FACSM<sup>1</sup>. <sup>1</sup>Skidmore College, Saratoga Springs, NY. <sup>2</sup>UCLA, Los Angeles, CA.  
(No relationships reported)

Personal protective equipment (PPE) is worn by firefighters to protect them from work related hazards. Work in PPE increases the metabolic cost of a given work load. Due to added weight, restrictive properties and the circulatory effects of full encapsulation, working in PPE may affect the relationship between heart rate (HR) and oxygen uptake (VO<sub>2</sub>) as expressed as the chronotropic index (CI) (slope of the regression line for HR vs. VO<sub>2</sub>); however, the extent to which the physiological stress imposed by PPE impacts the CI is unknown.

**PURPOSE:** To investigate the effects of PPE on cardiovascular and metabolic responses during incremental exercise and to determine if PPE affects the CI.

**METHODS:** HR and VO<sub>2</sub> were measured in 10 male participants (age, 21 ± 2 yr; height, 178 ± 8 cm; weight, 76.2 ± 3.1 kg; VO<sub>2max</sub>, 51.9 ± 5.0 ml·kg<sup>-1</sup>·min<sup>-1</sup>) when performing graded exercise tests across 3 conditions: control (CON; wearing athletic attire), wearing PPE (PPE) and weighted vest (WV) (weight equal to PPE).

**RESULTS:** Time to exhaustion was significantly different across all 3 conditions (CON, 866 ± 121 s; PPE, 582 ± 92 s; WV, 671 ± 105 s; (P < 0.01). Over time, submaximal VO<sub>2</sub> and HR were significantly lower in the CON condition (P < 0.01) compared to the PPE and WV conditions, which were similar to each other. Peak HR was significantly higher in the CON (191 ± 11 b·min<sup>-1</sup>) condition compared to the WV (187 ± 10 b·min<sup>-1</sup>) and PPE (183 ± 9 b·min<sup>-1</sup>) conditions (P < 0.01). There was a tendency for peak HR in the PPE condition to be lower than the WV condition (P = 0.07). VO<sub>2max</sub> was significantly different among all 3 conditions (P < 0.01). VO<sub>2max</sub> was 9.4% higher in the CON (3.96 ± 0.5 l·min<sup>-1</sup>) condition compared to the PPE (3.62 ± 0.4 l·min<sup>-1</sup>) condition (P < 0.01). VO<sub>2max</sub> was 4.8% higher in the CON condition compared to the WV (3.78 ± 0.4 l·min<sup>-1</sup>) condition; however, this was not statistically significant (P = 0.07). The CI (CON, 31.8 ± 4.4; PPE, 31.7 ± 5.4; WV, 32.6 ± 4.6) and y-intercept (CON, 72.1 ± 20.7; PPE, 74.6 ± 23.8; WV, 72.0 ± 18.8) were similar across all conditions.

**CONCLUSION:** The present study has shown that increasing the physiological strain with PPE or equivalent weight increases HR and VO<sub>2</sub>; however, the tight linear relationship between HR and VO<sub>2</sub> (CI) remains unaffected.

Supported by contract from DHS Science and Technology (UCLA contractor).

1412 Board #193 MAY 30 11:00 AM - 12:30 PM

**The Relationship Between Bmi And A Graded Maximal CPR Compression Test**

Patrick W. Davidson<sup>1</sup>, Christopher C. Dunbar, FACSM<sup>2</sup>, Robert Curran<sup>3</sup>, Paul F. Martinowicz<sup>2</sup>. <sup>1</sup>Springfield College, Springfield, MA. <sup>2</sup>Brooklyn College, Brooklyn, NY. <sup>3</sup>Brooklyn College, Brooklyn College, NY.  
(No relationships reported)

**PURPOSE:** To determine if there was a relationship between subject BMI and VO<sub>2peak</sub> during an Incremental Work Test using a CPR simulator (IWT)

**METHODS:** Eleven male subjects (age: 23 ± 4 yrs; body mass: 81.06 ± 11.40 kg; BMI: 25.86 ± 3.03 kg/m<sup>2</sup>) underwent the following conditions: 1) Incremental Work Test (IWT): using a CPR simulator where the cadence of CPR compressions increased every 30 sec to volitional fatigue 2) Treadmill VO<sub>2max</sub> (TM): incremental oxygen consumption (VO<sub>2</sub>) test using the Bruce Protocol. During all conditions VO<sub>2</sub> and Heart Rate (HR) were measured using a Parvo-Medics True One 2400 Metabolic Measurement System (Sandy, Utah).

**RESULTS:** The VO<sub>2peak</sub> measured during maximal graded treadmill testing using the Bruce Protocol averaged 38.13 mL/kg/min ± 5.98. The VO<sub>2peak</sub> measured during maximal graded CPR compression testing averaged 14.76 mL/kg/min ± 3.46. There was no relationship found between subject BMI and TM; however, a significant (p < .05) inverse relationship was found between subject BMI and IWT

**CONCLUSION:** A significant inverse relationship was found between BMI and IWT. The results indicate that the larger an individual is relative to height, the poorer the performance during repeated CPR compressions irrespective of cardiorespiratory fitness as measured by treadmill exercise.

1413 Board #194 MAY 30 11:00 AM - 12:30 PM

**Changes in Physical Fitness and Anthropometry of Police Academy Cadets During a 16-Week Physical Training Program**

Ross A. Sherman, Amy A. Crawley, William R. Crawley, William J. Burgess, III. Grand Valley State University, Allendale, MI. (Sponsor: Jeffrey A. Potteiger, FACSM)  
(No relationships reported)

Law-enforcement organizations require their employees to attain and maintain a threshold level of physical fitness so they are 'fit to work'. As part of a college-run police academy, cadets undertake a structured 16-week physical training program.

**PURPOSE:** To describe changes in physical fitness and anthropometry of police academy cadets during their 16-wk physical training program.

**METHODS:** 15 cadets (24±4 yrs; 1.80±0.08 m), thirteen males and two females, were tested in Wks 1, 8, and 16 of their 3-day per wk police academy training program. A battery of tests was used to assess physical fitness (flexibility, vertical jump, grip strength, sprint speed, and agility) and anthropometrical characteristics (body mass and body fat) and . Time-related changes in each test are shown as mean difference and 95% confidence interval (CI).

**RESULTS:** Only 40-yd sprint time substantially improved during the 16-wk program; specifically between Wk 1 and Wk 8 (-0.45 [-0.78 to -0.12] s). However, flexibility was found to marginally decrease during the 16-wk program (Wk 1-16: -5.4 [-10.9 to 0.1] cm). The remaining markers of physical fitness did not change (see Table 1.).

**Table 1. Mean differences (95% CI) in police cadet physical fitness during a 16-wk academy.**

|                               | Wk 1-8                | Wk 8-16               |
|-------------------------------|-----------------------|-----------------------|
| T-test run time (s)           | -0.18 (-0.93 to 0.58) | -0.21 (-0.98 to 0.56) |
| 1-rep max bench press (kg)    | 7.8 (-19.7 to 35.2)   | 3.2 (-30.1 to 23.8)   |
| Left hand grip strength (kg)  | 8.2 (-0.4 to 16.8)    | -3.2 (-11.8 to 5.4)   |
| Right hand grip strength (kg) | 7.5 (-1.1 to 16.2)    | -5.2 (-13.9 to 3.4)   |
| Vertical jump (cm)            | 1.0 (-6.3 to 8.4)     | 2.4 (-5.0 to 9.7)     |

Neither body mass (Wk 1-16: -1.9 [-15.0 to 11.1] kg) nor body fat (Wk 1-16: -0.6 [-4.6 to 3.3]%) changed during the course of the 16-wk training program.

**CONCLUSION:** The 16-wk physical training program currently used had little or no impact on pre-academy physical fitness or anthropometric characteristics. Only 40-yd sprint performance improving during the first eight week block, and there were no improvements in any test during the second eight week block.

1414 Board #195 MAY 30 11:00 AM - 12:30 PM

**Wildland Firefighters Demonstrate Seasonal Acclimatization to the Heat Despite No Changes in Aerobic Fitness**

Brianna Lui, Walter S. Hailes, John S. Cuddy, Brent C. Ruby, FACSM. Montana Center for Work Physiology and Exercise Metabolism, The University of Montana, Missoula, MT.  
(No relationships reported)

Wildland fire suppression involves long hours of strenuous work across rugged terrain with frequent exposure to high ambient temperatures. These physical demands of the job, coupled with the environmental conditions, increase the probability of heat related injury (HRI). Although heat acclimatization may mitigate the risk of HRI, the degree to which wildland firefighter's (WLF) demonstrate seasonal acclimatization is unknown.

**PURPOSE:** To determine the physiological changes associated with heat acclimatization across the 4-month fire season in the western United States.

**METHODS:** (n=26 males) 12 WLFF (27 ± 7 yrs; 179 ± 7 cm; 79 ± 10 kg) and a comparison group of 14 non-WLFF (25 ± 4 yrs; 180 ± 7 cm; 77.7 ± 8.8 kg) completed a 60-min heat stress trial (treadmill walking at 50% VO<sub>2</sub>max) in a climate controlled chamber (43.3°C, 33% RH) prior to and following the western Montana fire season (May and September, respectively). VO<sub>2</sub>max and body composition was also measured pre- and post-season. Core temperature, heart rate, and physiological stress index (PSI) was continuously monitored and analyzed using repeated measures ANOVA. A significance level was set at p<0.05.

**RESULTS:** VO<sub>2</sub>max did not change for the WLFF across the season. In contrast, non-WLFF demonstrated a significant increase in VO<sub>2</sub> max (55.9 ± 7.8 ml/kg/min vs. 58.7 ± 8.6 ml/kg/min pre and post season, respectively, p<0.05). Neither group demonstrated significant seasonal differences in the heart rate response to the heat stress trials. In contrast, WLFF demonstrated a significant seasonal reduction in core temperature during the heat stress trials at 45-min (38.1 ± 0.31°C vs. 38.2 ± 0.30°C, p=0.032) and 60-min (38.2 ± 0.39°C vs. 38.5 ± 0.34°C, p=0.022). WLFF PSI also demonstrated a significant seasonal decrease from 5.84 ± 1.3 to 5.13 ± 1.2 (p<0.05, main effect of season). There were no differences in core temperature or PSI for the non-WLFF.

**CONCLUSIONS:** WLFF demonstrate significant changes in seasonal acclimatization to exercising in the heat independent of changes in aerobic capacity. This suggests that long-term exposure to the environment strongly drives adaptation to hot environments.

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1415 Board #196 MAY 30 11:00 AM - 12:30 PM

**Deployment of an Advanced Electrocardiographic Analysis (A-ECG) to Detect Cardiovascular Risk in Career Firefighters**

Brett A. Dolezal<sup>1</sup>, Tom Storer<sup>1</sup>, Marlon Abrizado<sup>1</sup>, Reed Watne<sup>1</sup>, Todd Schlegel<sup>2</sup>, Maxim Batalin<sup>1</sup>, William Kaiser<sup>1</sup>, Denise Smith, FACSM<sup>3</sup>, Christ Cooper, FACSM<sup>1</sup>. <sup>1</sup>UCLA, Los Angeles, CA. <sup>2</sup>NASA Johnson Space Center, Houston, TX. <sup>3</sup>Skidmore College, Saratoga Springs, NY.

(No relationships reported)

**INTRODUCTION:** Sudden cardiac death is the leading cause of line of duty death among firefighters, accounting for approximately 45% of fatalities annually. Firefighters perform strenuous muscular work while wearing heavy, encapsulating personal protective equipment in high ambient temperatures, under chaotic and emotionally stressful conditions. These factors can precipitate sudden cardiac events like myocardial infarction, serious dysrhythmias, or cerebrovascular accidents in firefighters with underlying cardiovascular disease.

**PURPOSE:** The purpose of this study was to deploy and then evaluate the contribution of resting advanced ECG (A-ECG) in addition to other screening tools (family history, lipid profiles, and cardiopulmonary exercise tests, XT) in assessment of an individual's cardiac risk profile.

**METHODS:** Forty-four career firefighters were recruited to perform comprehensive baseline assessments including tests of aerobic performance, fasting lipids and glucose. Five-min resting 12-lead A-ECGs were obtained in a subset of firefighters (n=21) and transmitted over a secure networked system to a NASA physician collaborator. Using myocardial perfusion and other imaging as the gold standard, A-ECG scoring has been proven useful in accurately identifying a number of cardiac pathologies including coronary artery disease (CAD), left ventricular hypertrophy, hypertrophic cardiomyopathy, and non-ischemic and ischemic cardiomyopathy.

**RESULTS:** Subjects' mean (SD) age was 43 (8) years, weight 91 (13) kg, and BMI 28 (3) kg/m<sup>2</sup>. Fifty-one percent of subjects had ≥3 cardiovascular risk factors. One subject had ST depression on XT ECG, at least one positive A-ECG score for CAD, and documented CAD based on cardiology referral. While all other subjects, including those with fewer risk factors, higher aerobic fitness, and normal exercise ECGs, were classified as healthy by A-ECG, there was no trend for association between risk factors and any of 20 A-ECG parameters in the grouped data.

**CONCLUSIONS:** We have demonstrated that remote capture of a standard resting 12-lead ECG analyzed with advanced algorithms is a simple, time and cost-effective approach that offers the prospect of early identification of individuals potentially at risk for line-of-duty death from cardiovascular incidents.

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**A-38 Free Communication/Poster - Older Adults**

MAY 30, 2012 7:30 AM - 12:30 PM

ROOM: Exhibit Hall

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1416 Board #197 MAY 30 9:30 AM - 11:00 AM

**The Practice of Physical Exercise is a Modifiable Factor for Urge Urinary Incontinence in Older**

Giovana Zarpellon Mazo, Virtuoso Franck Janeisa. UDESC, Florianópolis, Brazil.

(No relationships reported)

The symptoms of urinary urgency tend to increase with advancing age. The literature suggests a number of risk factors that can be modified by an active lifestyle through healthy eating and physical exercise.

**PURPOSE:** To examine the modifiable risk factors of urge urinary incontinence (UUI) in older women.

**METHODS:** The sample consisted of 200 elderly (60 years or older) with a mean age of 69.06 ± 6.26 years. We identified the presence of UUI and behavioral risk factors (consumption of coffee, alcohol consumption, smoking and presence of constipation). Was also applied to the Domain 4 for International Physical Activity Questionnaire (IPAQ) to identify the level of physical activity and measured body mass index and waist circumference. The data were processed using descriptive and inferential statistics with a significance level of 5%.

**RESULTS:** The prevalence of UUI in the sample was 15.5%. Among the modifiable factors, only the level of physical activity was associated with the occurrence of UUI, and the physical exercise appeared as a protective factor among very active women (OR = 0.288) and less active (OR = 0.356).

**CONCLUSIONS:** The symptoms of urgency can be softened by regular physical exercise. Through a healthy lifestyle can minimize a number of modifiable factors in the genesis of urge urinary incontinence.

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1417 Board #198 MAY 30 9:30 AM - 11:00 AM

**Intermuscular Adipose Tissue Change is Related to Improved Physical Performance in Older Adults**

Adam J. Santanasto, Anne B. Newman, Robert M. Boudreau, Mark A. Newman, Bret H. Goodpaster, Nancy W. Glynn. University of Pittsburgh, Pittsburgh, PA.

(No relationships reported)

Obesity exacerbates age-related declines in physical function, but there is controversy about the whether older adults should lose weight and whether weight or particular aspects of body composition should be targeted.

**PURPOSE:** To determine the relationship between changes in body composition and physical function in older adults, who participated in a 1 yr intervention study of physical activity + weight loss (PA+WL) compared to physical activity (PA).

**METHODS:** Thirty-six overweight to moderately obese (body mass index (BMI) 28-39.9 kg/m<sup>2</sup>) sedentary older adults mean age 70.3±5.9 yrs were randomized (GRP) to a 12 month program. PA program had a goal of 150 min/wk treadmill walking plus lower limb resistance and balance. The PA+WL group also underwent a weight loss intervention promoting 7% weight loss. Calorie and fat gram goals were based on the Diabetes Prevention Program. At baseline (BL) and 12-months (12) computerized tomography (CT) for intermuscular adipose tissue (IMAT) area of the thigh, visceral adipose tissue (VAT) area, thigh muscle area, muscle density, an indirect measure of intramuscular fat, in Hounsfield units (HU), subcutaneous adipose tissue area, BMI and short physical performance battery (SPPB) were assessed. The relationship between concurrent changes in body composition and physical function were determined using multivariate linear regression. Intervention groups were combined in these analyses.

**RESULTS:** SPPB score increased by an average of 0.53 ± 1.52 in both groups combined. Changes (BL-12) in several fat depots were associated with change in function. Change in IMAT was significantly related to change in SPPB after adjusting for BL IMAT, GRP and BL SPPB score,  $\beta_{adj} = -0.29$ , SE = 0.12, p=0.02; this was not explained by adjustment for change in BMI ( $\beta_{adj-bmi} = -0.24$ , SE = 0.12, p=0.05). HU and VAT were each associated with change in SPPB after adjusting for GRP and BL HU or VAT (p=0.06 and 0.05), respectively but these associations were completely attenuated by change in BMI. Change in muscle area was not related to change in SPPB.

**CONCLUSION:** Change in IMAT was the body composition parameter most strongly related to change in function. Interventions that target IMAT in older adults may be of particular importance for improving function.

Supported by CDC cooperative agreement 1 U48 DP000025

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**1418**    *Board #199*    **MAY 30**    **9:30 AM - 11:00 AM**  
**Association Between Sociodemographic, Neighborhood Environment And Domain Of Physical Activity Among Middle-aged And Elderly Japanese.**  
Yoshinobu Saito<sup>1</sup>, Yuko Oguma<sup>2</sup>, Shigeru Inoue<sup>3</sup>, Ayumi Tanaka<sup>4</sup>, Yoshitaka Kobori<sup>4</sup>. <sup>1</sup>Fujisawa City Health and Medical Center, Fujisawa, Kanagawa, Japan. <sup>2</sup>Keio University, Yokohama, Japan. <sup>3</sup>Tokyo Medical University, Shinjuku, Japan. <sup>4</sup>Fujisawa City Health and Medical Center, Fujisawa, Japan.  
(No relationships reported)

Recent studies suggested the importance of neighborhood environment as physical activity determinants. However, few studies have been investigated in Japan.

**PURPOSE:** To examine the association of moderate-to-vigorous intensity leisure-time physical activity (LTPA), walking for recreation, walking for transportation with sociodemographic/health and neighborhood environmental factors among community dwelling middle-aged and elderly Japanese.

**METHODS:** The study included 2,449 adults aged 40-69 years living in Fujisawa city, located at 40km southwest of Tokyo, who had taken the Specific Health Checkups in 2009 and responded to the additional survey by mail in 2010. Sociodemographic/health factors (gender, age, education, working, economic, children in household, self-rated health, orthopedic disorders, body mass index), the long version of International Physical Activity Questionnaire and its Environmental Module were obtained. The adjusted odds ratios (OR) of high levels of LTPA, walking for active transportation/recreation were calculated in relation to these sociodemographic/health and neighborhood environmental factors using multiple logistic regression models.

**RESULTS:** Higher age and good self-rated health were significantly associated with high level of each physical activity outcome ( $P < 0.05$ ). Having work (OR=0.74), presence of children in household (OR=0.65), higher educational attainment (OR=1.58), higher economic status (OR=1.38), good access to recreational facilities (OR=1.26), and not owing household motor vehicles (OR=0.65) were associated with longer LTPA time. Women (OR=0.68), having work (OR=0.52), presence of children in household (OR=0.62), not having strong pain by orthopedic disorders (OR=1.58), seeing people being active (OR=1.41), and good aesthetics (OR=1.37) were associated with longer walking time for recreation. Higher economic status (OR=0.81), not owing household motor vehicles (OR=2.18), good access to shops (OR=1.35), and presence of sidewalks (OR=1.24) were associated with longer walking time for transportation.

**CONCLUSION:** The results suggest that different individual and neighborhood environmental variables are associated with different physical activity outcomes among community-dwelling middle-aged and elderly Japanese.

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**1419**    *Board #200*    **MAY 30**    **9:30 AM - 11:00 AM**  
**Assessment of a Physical Activity Program in Low-Income Seniors Living in Independent Community Residences**  
Leticia Malavasi, Cathy Inouye. *California State University, East Bay, Hayward, CA.* (Sponsor: Calvin Caplan, FACSM)  
(No relationships reported)

The Nutrition and Fitness program offered through the Senior Support Program of the Tri-Valley provides on-site free of charge physical activity classes for low-income seniors living in community residences. Their primary goal is to improve the quality of life in part by helping participants maintain their independence, of which fitness is a pivotal component. The following analysis of senior fitness assessments was conducted on data gathered from five community sites over a 9-18 month time period. Based on those findings, recommendations for programmatic changes will be implemented with oversight from the investigators and following the securement of grant funding.

**PURPOSE:** To analyze the effect of an on-site physical activity program for independent-living seniors and implement subsequent programmatic changes.

**METHODS:** Forty-two female (75±4.6 years) and 9 male (81±4 years) participants attended two 60-minute exercise classes per week. Classes were led by 3 different instructors and followed a program template that included a 5-10 min warm-up, 20-30 min aerobic, strength, and balance exercises, 5-10 min cool-down, and 5 min relaxation session. Pre to post-fitness assessments of balance, strength, muscular endurance, agility, and flexibility were analyzed using dependent t-tests. Post-test scores between sites was analyzed using independent t-tests.

**RESULTS:** Pre to post-strength (bicep curls/30 sec, 16.7±4.9 vs. 19.8±5.1 repetitions,  $p < 0.05$ ) and agility (8' Up & Go, 7.3±2.2 vs. 7.8±2.6 seconds,  $p = 0.05$ ) increased when data was combined for all sites. Comparison of post-strength scores between one versus multi-instructor sites was also significant (22.6±5.8 vs. 18.8±4.6 repetitions,  $p = 0.02$ )

**CONCLUSION:** The lack of change in several fitness parameters and on-site observation of individual classes has led to a number of programmatic recommendations including standardization of instruction, implementation of balance courses, incorporation of activities that utilize large muscle groups, and closer monitoring of exercise intensity.

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**1420**    *Board #201*    **MAY 30**    **9:30 AM - 11:00 AM**  
**Habitual Physical Activity is Associated With Cognitive Function And The Risk Factors For Hip Fracture In Older Adults**  
Hyuntae Park<sup>1</sup>, Youchan Kwon<sup>2</sup>, Eunhee Kim<sup>2</sup>, Jinkee Park<sup>2</sup>, Sangkab Park<sup>2</sup>. <sup>1</sup>National Center for Geriatrics and Gerontology, Aichi, Japan. <sup>2</sup>Dong-A University, Busan, Korea, Republic of.  
(No relationships reported)

Regular physical activity is an important component of a healthy lifestyle, conferring many physical health benefits, including protection against, osteoporosis, sarcopenia and cognitive impairment. However, only a few studies have reported actual daily physical activity levels in relation to the reduction of cognitive function and risk factors of hip fracture.

**PURPOSE:** In this prospective study, we examined the association between baseline physical activity and cognitive decline and risk factor for hip fracture in order adults.

**METHODS:** Using the KMMSE, we tested the cognitive function, and participants reported all previous hip fracture with circumstances leading to fracture between baseline and 2 year follow-up. Using an electronic accelerometer calculated total number of steps during a month. Body sway was measured by using the Dynamic Posturography (AMTI OR 6-7-2000, Massachusetts, U.S.A.). Each subject performed 10 m maximal walk speed, maximal step length, one-legged-stand, 40cm step up and down test, and functional reach and trunk flexion tests.

**RESULTS:** The risk of cognitive decline in the lowest two quartiles (lowest and low activity group, with respectively means of counts of about 3400 and 6800 steps/day) was 1.6-2.6 times higher than in the top quartile (highest group, taking means of about >10000 steps/day). We founded significant lineal associations between physical activity levels and the gait velocity.

Compared with a lowest and low activity group, older adults reporting a high activity group (> 7000 steps/day) had a significantly lower risk of hip fractures such as a lateral body sway, functional reach and maximal step length.

**CONCLUSIONS:** In this study, we suggest that to improve cognitive decline and the risks of hip fracture older adults should be encouraged to undertake > 7000 steps/day.

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**1421**    *Board #202*    **MAY 30**    **9:30 AM - 11:00 AM**  
**Evaluating Moderate Intensity Walking With A Hip-worn Accelerometer In Elders**  
Todd Manini, Jeff Knaggs. *University of Florida, Gainesville, FL.*  
(No relationships reported)

**PURPOSE:** The National Health and Nutrition Examination Survey (NHANES) uses activity counts from accelerometers to objectively categorize the population's physical activity level. It is unclear activity counts correspond to metabolic effort in older adults. This study set out to examine the association between activity counts derived from a hip-worn accelerometer and metabolic effort in older adults performing usual and rapid paced walking.

**METHODS:** Forty-five community-dwelling older adults (70-90 years) performed long-distance walking tasks at a self-selected usual and rapid pace in a laboratory setting. During each walking test, participants wore a portable metabolic unit to measure pulmonary gas exchange and a hip-worn accelerometer (Actigraph GT1M) to measure activity counts. Metabolic equivalents (MET) were calculated as ventilation of oxygen (VO<sub>2</sub>) / 3.5 ml·kg<sup>-1</sup>·min<sup>-1</sup>. Values that surpassed 3.0 METs and 2020 counts/min were considered walking at or greater than moderate intensity. Participants were categorized as a "slow walker" if they had a usual pace < 1.0 meters/sec\_ a common cutoff used to designate an older person with functional impairments.

**RESULTS:** Activity counts recorded while walking at rapid ( $r = 0.62$ ,  $p < 0.01$ ), but not usual pace ( $r = 0.24$ ,  $p = 0.11$ ) was significantly associated with METs. Slow walkers attained only half the amount of activity counts during each walk condition (usual: 1125 ± 132 vs. 2242 ± 121; rapid: 1534 ± 214 vs. 3117 ± 219 counts/min,  $p < 0.01$ ) while at the same time achieving between 82-

90% of MET level of individuals who walked  $\geq 1.0$  m/sec. When using the NANES cutoff of 2020 counts/min, 75% of slow walkers were misclassified as not achieving a moderate intensity MET level (18 out of 24 occurrences,  $p = 0.09$ ). Walking above 1.0 m/sec misclassified 25% of the individuals as not achieving a moderate intensity MET level (13 out of 52 occurrences,  $p < 0.01$ ).

**CONCLUSIONS:** Activity counts from a hip-worn accelerometer are marginally correlated with walking metabolic rate in older adults. Accelerometers might misclassify functionally impaired older adults with slow walking speed as not achieving the recommended physical activity intensity to produce health benefits. Additional research is needed to derive better accelerometer activity count thresholds for older adults.

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**1422** Board #203 MAY 30 9:30 AM - 11:00 AM  
**Exploring Physical Activity Patterns on Body Composition Phenotypes of Sarcopenia and Obesity in Older Adults**

Mi-Ji Kim, Hunkyung Kim, Narumi Kojima. *Tokyo Metropolitan Institute of Gerontology, Tokyo, Japan.*  
(No relationships reported)

Along with sarcopenia, obesity is an important cause of the development of functional impairment and frailty in older adults. Physical inactivity or low physical activity (PA) has been reported to be independently associated with sarcopenia and obesity. However, little is known about the impact of PA patterns on body composition phenotypes based on sarcopenia and obesity in older adults.

**PURPOSE:** This study examined the association between objectively measured PA patterns and body composition phenotypes based on sarcopenia and obesity in frail older women.

**METHODS:** A cross-sectional analysis was conducted on 109 community-dwelling frail older women with a mean age of 80.3 years (SD = 2.7, range = 75-88). Measurements of appendicular skeletal muscle mass and body fat percentage were assessed by dual energy X-ray absorptiometry, which were used to characterize normal (N), sarcopenic (S), obese (O), and sarcopenic/obese (SO) body composition phenotypes. The objective assessment of physical activity was obtained for a 1-week period using a triaxial accelerometer (Activity Style pro). With intensity as sedentary (1.0-1.5 metabolic equivalent units, METs), light PA (1.6-2.9 METs), and moderate to vigorous PA (MVPA,  $\geq 3$  METs), average daily time spent being each PA was examined.

**RESULTS:** The O group was the most prevalent 36.7% in frail older women, followed by the S (29.4%), N (22.0%), and SO (11.9%) groups. On average, participants wore the accelerometer for  $766.3 \pm 102.8$  min/day. Overall, participants spent 57.6% of their daily time being sedentary behavior, 39.7% in light PA, and 2.7% in MVPA. The time spent in sedentary behavior was significantly more in the O and SO groups than the normal group ( $p < 0.05$ ). Time spent in light PA was similar between the O ( $292.7 \pm 91.8$  min/day) and SO ( $243.6 \pm 88.1$  min/day) groups but significantly less than the N ( $357.5 \pm 97.1$  min/day) group ( $p < 0.05$ ), but not the S group. There was no difference in time spent in MVPA among body composition phenotypes.

**CONCLUSIONS:** These findings suggest that majority of daily time in frail older women spend being sedentary lifestyle, and obesity phenotypes are more strongly related to the light PA level, independent of sarcopenia.

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**1423** Board #204 MAY 30 9:30 AM - 11:00 AM  
**5-year Changes In Functional Fitness of Brazilian Elderly Women**

Maressa P. Krause<sup>1</sup>, Hassan M. Elsangedy<sup>2</sup>, Kleverton Krinski<sup>2</sup>, Fredric L. Goss, FACSM<sup>3</sup>, Sergio G. DaSilva<sup>2</sup>. <sup>1</sup>Universidade Tecnológica Federal do Parana, Curitiba, Brazil. <sup>2</sup>Universidade Federal do Parana, Curitiba, Brazil. <sup>3</sup>University of Pittsburgh, Pittsburgh, PA.  
(No relationships reported)

Functional fitness tests have been used to evaluate functional components associated with physiological parameters, which are necessary for older adults to perform activities of daily living independently. Aging can decrease functional fitness; however, evidence had indicated that exercise can reverse or attenuate this process.

**PURPOSE:** To verify changes on functional fitness of Brazilian elderly women, classified according to their physical activity status.

**METHODS:** On 2011, 78 women (mean: 73.2yrs) were evaluated with the same procedures of the first assessment, conducted on 2005-2006. Functional fitness components were evaluated by body mass index (BMI), cardiorespiratory fitness (CRF) using the 6-min walk test (6WT), flexibility using the chair sit-and-reach (CSR), strength using the arm curl (AC) and chair stand (CS), and dynamic balance and agility using the 8-ft up-and-go (8ft). Regular physical activity was evaluated by the *Modified Baecke Questionnaire for older adults*.

**RESULTS:** MANOVA determined time ( $F_{1,140}=5.950$ ;  $p<0.05$ ) and groups main effect ( $F_{2,140}=1.850$ ;  $p0.05$ ). There was a significant decrease on CRF over time in the active group (-9.2%); on muscle strength of upper body in the inactive (-35.2%) and active (-25.5%) groups; and, on muscle strength of lower body in the active group (-11.8%). Active women had a greater CRF ( $480.3 \pm 72.3$ m) than inactive women ( $409.5 \pm 119.9$ m) on the second assessment; also, active women had a better performance on the dynamic balance and agility test ( $5.86 \pm 0.98$ s) than inactive women ( $7.11 \pm 1.41$ s) on the first assessment, and on the second assessment ( $5.91 \pm 1.01$ s; and  $7.50 \pm 2.80$ s, respectively) (all  $p<0.05$ ).

**CONCLUSIONS:** Active elderly women showed a lower decrease on functional fitness than inactive women. Also, the active group had a better cardiorespiratory fitness and dynamic balance and agility than inactive women. These results highlight the benefits of regular exercise practice on functional fitness of older women.

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**1424** Board #205 MAY 30 9:30 AM - 11:00 AM  
**Recruitment Of Frail Older Adults Residing At Assisted Living Facilities Into An Exercise-nutrition Field Trial.**

Michael P. Corcoran, Miriam E. Nelson, FACSM, Roger A. Fielding, Jennifer M. Sacheck, Sara C. Folta. *Tufts University, Boston, MA.*  
(No relationships reported)

Exercise-nutrition programs designed to improve functional mobility in older adults are essential. Researching the efficacy of such programs in this population presents unique challenges, particularly with respect to study recruitment.

**PURPOSE:** To describe the challenges to recruitment of mobility limited older adults in assisted living facilities, and to compare the relative resource requirements and efficacy of two recruitment methods.

**METHODS:** Fifteen facilities in the greater Boston area were selected for this study. Residents were eligible if they were  $\geq 65$  years old, exhibited moderate mobility limitations, no severe memory impairment, and were not severely obese. At eight sites, "informational sessions", which were heavily advertised through facility channels and included a brief presentation about the study, were the only type of recruitment activity conducted. At seven sites, informational sessions were preceded by a researcher attending an activity offered by the facility ("activity attendance"), such as dances and bingo games. Staff time for both recruitment types was documented, as was number screened, number eligible, and number enrolled (eligible minus withdrawals) for each facility.

**RESULTS:** Severe memory impairment (38.7%) followed by severe mobility limitations (14.5%) were the leading causes of ineligibility, indicating the population was more functionally limited than anticipated. Other challenges included apathy due to institutionalized status and high facility staff turnover making it difficult to obtain support for recruitment activities. The addition of activity attendance resulted in 4-11 additional research staff hours spent on recruitment per facility. Compared with an informational session alone, attendance at activities resulted in better targeting: slightly more of those screened were eligible (51.7% vs 43.9% respectively), and significantly more of those who were eligible remained in the study (70.0% vs 12.0%,  $p<0.01$ ). The two leading causes of withdrawal overall were loss of interest and/or time constraints (40%) and illness (40%).

**CONCLUSION:** Increased interaction with older adults residing at assisted living facilities results in improved recruitment and retention in an exercise-nutrition study, and is likely worth the additional resources required.

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**1425** Board #206 MAY 30 9:30 AM - 11:00 AM  
**Prediction of Maximal Oxygen Pulse without Exercise Testing in Older Adults**

Geraldo A. Maranhao Neto<sup>1</sup>, Ricardo B. Oliveira<sup>2</sup>, Paulo T.V. Farinatti<sup>2</sup>, Jonathan N. Myers, FACSM<sup>3</sup>. <sup>1</sup>Gama Filho University, Rio de Janeiro, Brazil. <sup>2</sup>Rio de Janeiro State University, Rio de Janeiro, Brazil. <sup>3</sup>Palo Alto/Stanford University, Palo Alto, CA. (Sponsor: Jonathan N. Myers, FACSM)  
(No relationships reported)

Maximal Oxygen Pulse ( $O_2P_{max}$ ) has been considered a surrogate for cardiovascular function and has demonstrated to be an independent predictor of all cause mortality in healthy subjects

and patients with cardiovascular disease. Although readily available from cardiopulmonary exercise testing, the O<sub>2</sub>Pmax depends on maximal volitional effort which may limit its measurement in older subjects with physical limitations.

**PURPOSE:** The aim of this study was to develop a model to estimate the maximal O<sub>2</sub> pulse without exercise in elderly subjects.

**METHODS:** The equation was derived from a sample of 67 older adults (69.4 ± 7.1 yrs; 41 men) through a hierarchical linear regression that included body weight, Veterans Specific Activity Questionnaire (VSAQ) score, gender, beta-blocker usage and resting heart rate. The model was cross-validated against an independent sample (67.7 ± 6.4 years; N=30; 17 men). In order to detect the classification accuracy of the model, the estimated and actual O<sub>2</sub>Pmax were ranked in tertiles and treated by the gamma (γ) nonparametric correlation in both groups (validation and cross-validation).

**RESULTS:** The model resulted in a R<sup>2</sup>=0.83 and standard error of estimate=1.68ml/beat. The comparison of the estimated against the actual O<sub>2</sub>Pmax in the independent sample was r=0.80. A high probability for the model to rank the values in the same tertile in both validation and cross-validation groups was observed (γ=0.98; γ=0.92, respectively).

**CONCLUSION:** Our findings suggest that O<sub>2</sub>Pmax can be estimated with reasonable precision without aerobic effort, being an alternative option for older subjects not able to perform maximal exercise testing.

**Commercial Relationship:** Paulo T.V. Farinatti, CNPq Research Grant Recipient.

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**1426** Board #207 **MAY 30 9:30 AM - 11:00 AM**

**Group Pilates Program And Muscular Strength And Endurance Among Elderly Woman**

Ina Shaw<sup>1</sup>, Marinda Fourie<sup>2</sup>, Gertrude M. Gildenhuis<sup>2</sup>, Brandon S. Shaw<sup>2</sup>, Gregory A. Brown, FACSM<sup>3</sup>. <sup>1</sup>Monash South Africa, Johannesburg, South Africa. <sup>2</sup>Tshwane University of Technology, Pretoria, South Africa. <sup>3</sup>University of Nebraska at Kearney, Kearney, NE.  
(No relationships reported)

Muscular strength and peak power output substantially decline with age and can lead to impairments in neuromuscular function, degradation of the hormonal system and intrinsic factors such as age-related alterations in calcium homeostasis.

**PURPOSE:** The purpose was to determine the effects of mat Pilates on muscular strength using dumbbell biceps curls and squats, and muscular endurance using chair squats in elderly woman.

**METHODS:** Fifty sedentary, apparently healthy females aged 60 and older were randomly assigned into a control (CON, n = 25) or an intervention (INT, n = 25) group. The INT took part in an eight-week supervised progressive Pilates exercise program with sessions being conducted by a qualified Pilates instructor. The programme consisted of three non-consecutive 60 minute sessions that were repeated for the eight-week period only increasing in intensity. All sessions commenced with breathing, followed by a flowing system from standing, to sitting, to lying down exercises and ended in the rest position. The CON did not take part in any structured exercises throughout the eight-week period and were instructed to continue their usual activities.

**RESULTS:** Significant (p ≤ 0.05) improvements in upper-body muscular strength (19.12 ± 5.13 repetitions (reps) - 27.84 ± 5.68 reps; p = 0.000), lower-body muscular strength (13.24 ± 3.23 reps - 7.52 ± 3.81 reps; p = 0.000) and muscular endurance (24.48 ± 11.62 reps to 44.16 ± 18.97 reps; p = 0.000) were observed following Pilates training.

**CONCLUSIONS:** Programs utilizing Pilates can improve muscular strength and endurance in the elderly and may assist in decreasing dependency and possibly lead to an improved quality of life in the elderly.

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**1427** Board #208 **MAY 30 9:30 AM - 11:00 AM**

**Past Year Leisure Moderate to Vigorous Physical Activity is Associated with Calcaneal Bone Density and Stiffness in Perimenopausal and Postmenopausal Women**

Heather C. Medema-Johnson<sup>1</sup>, Kathleen F. Janz, FACSM<sup>2</sup>. <sup>1</sup>St. Ambrose University, Davenport, IA. <sup>2</sup>University of Iowa, Iowa City, IA.  
(No relationships reported)

Along with calcium intake, weight-bearing moderate to vigorous physical activity (MVPA) has been shown to decrease the rate of bone loss in peri- and postmenopausal women. However, the importance of domain- and time-specific characteristics of MVPA to bone remains unclear.

**PURPOSE:** To evaluate relationships among domain-specific long term (past year) and short term (past week) MVPA, calcium and vitamin D intakes, and calcaneal BMD and stiffness (QUI).

**METHODS:** For this cross-sectional-study, 87 peri- and postmenopausal women (43-65 years) completed demographic/health questionnaires and the Block calcium and vitamin D screener. Participants wore a NL-1000 pedometer for one week to assess short-term MVPA (total steps/day and MVPA-min/day). Past year MVPA, past year leisure MVPA, past year occupational/household MVPA, past week leisure MVPA, and past week occupational/household MVPA were assessed with the Modifiable Activity Questionnaire. Calcaneal BMD and QUI were measured with a Sahara Quantitative Ultrasound (Hologic, Inc.). Pearson correlation coefficients and stepwise linear regression analyses were used to examine the relationships among measures of MVPA, calcium and vitamin D intakes, calcaneal BMD and QUI. Income and education entered as control variables in stepwise regression analyses.

**RESULTS:** Bivariate analyses revealed significant relationships between BMD and pedometer-measured MVPA-min/day (r = 0.23, p < 0.05). Past year MVPA (r = .25, p < 0.05), and past year leisure MVPA (r = 0.35, p < 0.01) measured via survey were associated with BMD. Significant relationships were found between QUI and past year MVPA (r = 0.23, p < 0.05) and past year leisure MVPA (r = 0.34, p < 0.01). For stepwise linear regression analyses, income, education, and past year leisure MVPA entered the models, collectively explaining 19% and 18% of the variance in BMD and QUI.

**CONCLUSION:** Past year MVPA performed in the leisure domain is associated with calcaneal BMD and QUI in peri- and postmenopausal women. Our results suggest the value of long-term measures of PA when considering bone health and the likelihood that women engage in more osteogenic activity during leisure when compared to other domains. These findings can be used to support future interventions and the continued need for multi-dimensional PA measures.

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**1428** Board #209 **MAY 30 9:30 AM - 11:00 AM**

**Lumbar Lordosis Angle Predicts Walking Ability In Community-dwelling Elderly Men**

Junya Miyazaki<sup>1</sup>, Shin Murata<sup>2</sup>, Jun Horie<sup>1</sup>, Tibor Hortobagyi, FACSM<sup>3</sup>, Shuji Suzuki<sup>4</sup>. <sup>1</sup>Kobe International University, Kobe, Japan. <sup>2</sup>Nishikyushu University, Kanzaki, Japan. <sup>3</sup>University of Groningen, Groningen, Netherlands. <sup>4</sup>Waseda University, Tokorozawa, Japan.  
(No relationships reported)

**PURPOSE:** Aging modifies the sagittal plane structural alignment of the human spine as measured with the gravity line method (Schwab F et al., 2006). At the 2010 ACSM meeting we reported that the physical function of elderly males correlated with the lumbar lordosis angle (LLA) but not with the thoracic kyphosis angle (TKA) measured in the sagittal plane. Here we examine the possibility that a structural measure of the spine, the LLA, predicts gait speed and distance in old adults.

**METHODS:** Subjects were 103 elderly male community residents (72.9 ± 7.2 yr, 1.59 ± 0.15m, 59.4 ± 8.7 kg). To characterize sagittal plane spinal alignment, we measured LLA in all participants using the Spinal Mouse (Idiag AG, Switzerland). The LLA (deg) was measured as the sum of the angles between each of the five lumbar vertebral bodies relative to the 1st sacral vertebral body. We also measured quadriceps femoris muscle strength (QMF) with a hand-held dynamometer (Anima Corp., Japan), one-leg standing (OLS) time with eyes open, maximum walking speed (MWS), and distance in the 6-min walking test (6MWT). In regression analyses we predicted MWS and 6MWT from LLA, QMS and OLS and used p < 0.05 for all analyses.

**RESULTS:** Mean (± SD) LLA was -13.1° (± 9.2). Mean QMF, OLS time, MWS, and 6MWT distance was, respectively, 39.9 kg (± 11.6), 34.1 s (± 36.8), 2.6 m/s (± 1.0), and 477.4 m (± 90.2). The regression analysis showed that LLA (p < 0.01, β = -0.43) and QMF (p < 0.01, β = 0.46) predicted strongly MWS. QMF (p < 0.01, β = 0.63) was also a strong predictor of walking distance.

**CONCLUSION:** Gait speed predicts mortality (Studenski et al., 2011)

and here we show that not only a functional (muscle strength) but a structural factor (LLA) may also play a role in the regulation of gait in old age. Thus, interventions should target muscle strength and postural alignment to be most effective in preserving gait speed in old adults.



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1429 Board #210 MAY 30 9:30 AM - 11:00 AM

**Effects of Fall Prevention PNF Program on Body Function and Fall Efficacy in Elderly Women**

Seokhwan Kim<sup>1</sup>, Michael G. Bembem, FACSM<sup>2</sup>, Daeyeol Kim<sup>2</sup>, Donghee Kim<sup>3</sup>, Youngkwan Kim<sup>3</sup>, Hayan Lee<sup>3</sup>, Doohong Kuk<sup>3</sup>, Meehyun Yang<sup>4</sup>, Gieun Jang<sup>5</sup>.  
<sup>1</sup>Seoyeong University, Gwangju, Korea, Republic of. <sup>2</sup>University of Oklahoma, Oklahoma, OK. <sup>3</sup>Chonnam National University, Gwangju, Korea, Republic of.  
<sup>4</sup>University of Gwangju Women's, Gwangju, Korea, Republic of. <sup>5</sup>Dongshin University, Naju, Korea, Republic of. (Sponsor: Michael G. Bembem, FACSM)  
(No relationships reported)

**PURPOSE:** To investigate the effects of a fall prevention program with proprioceptive neuromuscular facilitation (PNF) on body functions (gait, balance, lower extremity power and instrumental activities daily living) and fall efficacy in elderly women.

**METHODS:** Subjects (n = 38, 65 - 70 years) participated in this study and were randomly assigned to an experimental (n = 18, EXP) or a control (n = 20, CON) group. The subjects in both EXP and CON performed the fall prevention training three times at pre, 6<sup>th</sup> and 12<sup>th</sup> week. Only subjects in the EXP completed PNF sprint & skate program (40 - 60 min, 60 - 80% HR<sub>max</sub>) three times per week for 12 weeks. The body function (Time up & go test, 2 min step test, balance by TetraX and Berg balance scale, sit to stand test, one leg standing test, and instrumental activities of daily living) and fall efficacy (fall efficacy scale) were determined at pre, 6<sup>th</sup> and 12<sup>th</sup> week. Two-way repeated measure ANOVA was utilized to compare groups and times with statistical significance set at p<0.05.

**RESULTS:** The Gait, balance, lower extremity power functions in the EXP were significantly higher than CON. The balance function in the EXP was significantly higher than CON. Also, the Instrumental activities of daily and fall efficacy in the EXP were significantly greater than CON.

**CONCLUSIONS:** These results indicate that the fall prevention program with PNF was effective to prevent fall and to increase fall efficacy. Thus, the fall prevention program with PNF is considered to be helpful to prevent fall and the quality of life for elderly people by strengthening their body functions and fall efficacy.

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1430 Board #211 MAY 30 9:30 AM - 11:00 AM

**Increased Sitting Time is an Independent Risk Factor for All-cause Mortality in Community-Dwelling Older Adults**

Steven N. Blair, FACSM<sup>1</sup>, Xuemei Sui<sup>1</sup>, Ali Ahmed<sup>2</sup>. <sup>1</sup>University of South Carolina, Columbia, SC. <sup>2</sup>University of Alabama at Birmingham, Birmingham, AL.  
(No relationships reported)

**PURPOSE:** Older adults often assume a sedentary lifestyle and spend more time sitting or lying, than younger adults. Sedentary lifestyle has been shown to be associated with increased risk of poor clinical outcomes. However, the association of sedentary lifestyle as measured by time spent sitting and lying with mortality has not been well studied in community-dwelling older adults.

**METHODS:** Participants were 5060 community-dwelling older adults from the Cardiovascular Health Study, age ≥65 years, with data on baseline history of hours spent sitting or lying. Participants were categorized into tertiles of hours per day spent sitting or lying: <11, 11-13, and ≥14 (reference). Cox regression models were used to estimate association of the 2 lower tertiles with all-cause mortality adjusting for other confounders. To study association with incident heart failure, a second cohort of 4833 participants free of prevalent heart failure at baseline was assembled.

**RESULTS:** Participants had a mean (±SD) age of 73 (±6) years; 58% were women; and 16% were African American. Unadjusted, age-sex-race-adjusted, and multivariable-adjusted associations of the 2 lower tertiles of hours spent sitting or lying with all-cause mortality and incident HF during over 13 years of follow-up are displayed in the **Table** below.

**CONCLUSIONS:** Among community-dwelling older adults, those spending <14 hours sitting and lying, had lower risk of all-cause mortality but had no significant independent association with incident HF after multivariable adjustment for confounders.

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1431 Board #212 MAY 30 9:30 AM - 11:00 AM

**Development and Evaluation of a Health Empowerment Program to Improve Depression and Meaning in Life**

Sherry A. Barkley<sup>1</sup>, Tracey Hughes<sup>2</sup>, Nancy L. Fahrenwald<sup>3</sup>, Angie L. Larson<sup>3</sup>, Joyce Fjelland<sup>3</sup>, Patricia Shaver<sup>3</sup>, Mary Minton<sup>3</sup>, Jane Mort<sup>3</sup>. <sup>1</sup>Augustana College, Sioux Falls, SD. <sup>2</sup>Dow Rummel Village, Sioux Falls, SD. <sup>3</sup>South Dakota State University, Brookings, SD. (Sponsor: Matthew D. Vukovich, FACSM)  
(No relationships reported)

Older adults in residential settings are at risk for depression. Health empowerment, a dynamic process wherein residents purposefully connect to create environmental change and personal meaning, may help control depression and quality of life.

**PURPOSE:** To develop and evaluate Project MILE: Meaning in Life Enrichment for Older Adults, a theory-based program using resident-driven activities intended to decrease depression and increase quality of life.

**METHODS:** Residents and selected staff at a residential living community partnered with researchers in exercise science and healthcare to develop and implement Project MILE. A random sample of 20 older adult residents (16 female, 4 male), mean age = 86.7 years, participated in this pilot study. Needs assessment, conducted through structured interviews between residents and exercise science students, was used to inform Project MILE activities. A descriptive-correlational study was used to evaluate reliability of measurement instruments and to determine cross-sectional relationships between multi-item measures of depression (Geriatric Depression Scale [GDS]) and meaning in life (Personal Meaning Index [PMI]). A paired samples t-test was used to compare baseline and follow up scores in these measures. Feasibility and acceptability of the intervention was evaluated through written/oral review of strengths, weaknesses, and suggestions by and with residents.

**RESULTS:** Needs analysis identified themes that contribute to meaning and quality of life: learning new skills, volunteering, meaningful social engagement, and aesthetic experiences. Participants selected and planned weekly activities (e.g., computer class, reading to children, Mexican Day, cycling, going fishing) based on identified themes. GDS and PMI met acceptability criteria for reliability ( $\alpha > .70$ ) and construct validity. Baseline scores (mean + SD) for GDS and PMI (6.8 + 5.4, 86.2 + 10.3) respectively were not significantly different (p > .05) at follow up (7.7 + 5.1, 86.2 + 10.3). Intervention strategies (i.e., activities and measurement instruments) were found acceptable to residents.

**CONCLUSIONS:** Although we saw no significant change in GDS and PMI scores, evaluation of this pilot study generated evidence to support the use of this health empowerment approach in a future randomized trial.

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1432 Board #213 MAY 30 9:30 AM - 11:00 AM

**An Examination of the Survivability of Professional Wrestlers**

Christopher W. Herman<sup>1</sup>, Anna S.C. Conlon<sup>2</sup>, Andrew R. Burghardt<sup>1</sup>, Stephen J. McGregor<sup>1</sup>. <sup>1</sup>Eastern Michigan University, Ypsilanti, MI. <sup>2</sup>The University of Michigan, Ann Arbor, MI. (Sponsor: Christopher J. Womack, FACSM)  
(No relationships reported)

In recent years, much attention has been given to the occurrence of premature deaths in professional wrestling.

**PURPOSE:** The purpose of this study was to determine the survival estimates for professional wrestlers active between 1985 and 2011.

**METHODS:** Data required for this study was collected using public records and wrestling company publications. A comprehensive review of age, race, sex, BMI, cause of death (if applicable) and age at death (if applicable) of 625 wrestlers who were active between January 1, 1985 and September 30, 2011 was completed. Specifically, 557 males and 68 females were considered consistently active wrestlers during this time period. 2007 published mortality rates from the CDC were used to compare the general population to the wrestlers by age, race, BMI, time period, and cause of death for both males and females. Additionally, a Kaplan-Meier survival analysis and Cox Proportional Hazards Models for survival data were performed using the R statistical software package (Vienna, AT) to determine the degree of professional wrestlers' premature death.

**RESULTS:** 65 wrestlers (61 males and 4 females) died during the observation period. Wrestler mortality rates calculated for age groups 25-34, 35-44 and 45-54 were approximately 22.9, 16.5 and 7.6 times greater than the mortality rates for the same three age groups of the general population. After controlling for age at which the wrestlers started wrestling and number of years wrestled prior to 1985, survival estimates and 95% confidence limits from the Cox hazard regression models indicated that sex and BMI are significantly associated with the hazard of death

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from the time someone starts wrestling (Sex:  $p = 0.02$ ; BMI:  $p < 0.0001$ ). Specifically, the hazard of death for women was only 30% that of men and the hazard of death increased by 80% for each increase in BMI category. Kaplan-Meier survival estimates and Cox hazard estimates indicated that there was no significant difference in time to death between wrestler starting age groups ( $p = 0.31$ ).

**CONCLUSION:** Professional wrestlers are more likely to die prematurely compared to the general population. Morbidly obese and male wrestlers are especially at risk for premature death. Results from this study may be useful for future corporate wellness policy implementation among professional wrestling companies.

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## A-39 Free Communication/Poster - Pacing Strategies and Time Trials

MAY 30, 2012 7:30 AM - 12:30 PM

ROOM: Exhibit Hall

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### 1433 Board #214 MAY 30 11:00 AM - 12:30 PM

#### Accumulated Rpe: A Distance Independent Marker Of Effort During Cycle Time Trials

Carl Foster, FACSM, Jose Rodríguez-Marroyo, Annabel Splinter, Joyce van Tunen, Corey Speaker, Jana Hagen, Kayla Henslin, Blair Johnson, Trent Joseph, John P. Porcari, FACSM, Jos J. de Koning, FACSM. *University of Wisconsin-La Crosse, La Crosse, WI.*

(No relationships reported)

Decisions about whether to accelerate or decelerate during competitions are based on the Rating of Perceived Exertion in relation to the % distance remaining (e.g. the Hazard Score). However, the percent of distance remaining may not be an accurate representation of the % effort expended by the athlete (e.g. the classic expression that a marathon (42km) is 50% over at 32km (~75% distance)).

**PURPOSE:** This study compares the accumulated RPE during cycle time trials of different distances, to determine whether  $\Sigma$ RPE would be independent of distance.

**METHODS:** Well-trained and task habituated cyclists performed freely paced (FP) time trials (2.5km, n=9, 3km, n=10, 5km, n=17, 10km, n=50) on a Velotron cycle ergometer. RPE was measured every 5% of the total distance, summated and normalized to the maximum value.

**RESULTS:** The  $\Sigma$ RPE increased in a regular, but non-linear, fashion during all races, and the pattern of increase amongst distances was overlapping. The relationship between % distance completed and  $\Sigma$ RPE was well explained with a 2<sup>nd</sup> order polynomial ( $R^2=0.9881$ ).

**CONCLUSIONS:** The  $\Sigma$ RPE may provide a tool for measuring the relative effort expended during competitive effort that is superior to the % distance completed, with 50% effort being completed at ~60% distance.

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### 1434 Board #215 MAY 30 11:00 AM - 12:30 PM

#### The Effect of Music on Cycle Time Trial Performance

Jana Hagen, Carl Foster, FACSM, Jos J. deKoning, FACSM, Charles R. Hendrix, Richard P. Mikat, FACSM, Jose Rodriguez-Marroyo, John P. Porcari, FACSM. *University of Wisconsin-La Crosse, La Crosse, WI.*

(No relationships reported)

High intensity competitive exercise depends on the interaction of a pre-exercise template with feedback from the body. In well-trained people the interaction between template and feedback is complex and can be understood in terms of comparisons between expected and experienced Rating of Perceived Exertion (RPE) at each point in the trial. Motivational music generally augments exercise performance, potentially by the arousal from music changing the template or by suppression of feedback from homeostatic disturbance.

**PURPOSE:** This study compared both the level of performance and the pattern of PO during a 10km cycle time trial in relation to the presence of motivational music.

**METHODS:** Well-trained, task habituated cyclists (n=18) performed two randomly ordered time trials, listening either to self-selected motivational music or no music (control). Performance markers including PO, HR, blood lactate [BL] & RPE were monitored.

**RESULTS:** Music had no effect on maximal HR  $174 \pm 11$  vs  $172 \pm 10$ , mean PO  $222 \pm 66$  vs  $220 \pm 65$  W, maximal RPE  $8.4 \pm 1.5$  vs  $8.5 \pm 1.6$ , maximal [BL]  $8.2 \pm 3.6$  vs  $8.2 \pm 3.5$  mmol $\cdot$ l $^{-1}$  or time  $17.7 \pm 2.1$  and  $17.8 \pm 2.1$  min ( $p > .05$ ). Further, the pattern of PO during the trial did not suggest a change in pacing pattern consistent with arousal related template modification (e.g. increased early PO) or suppression of feedback (e.g. higher mid-trial PO).

**CONCLUSIONS:** The results show that, despite the subjects preferring the time trial with music, there were no significant differences in time trial responses relative to the presence of music.

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### 1435 Board #216 MAY 30 11:00 AM - 12:30 PM

#### Effects of Warm-up Duration on Vo2 Kinematics and Lactate During a Cycling Time Trial

Jennifer Bunn. *Campbell University, Buies Creek, NC.*

(No relationships reported)

#### Effects of Warm-up Duration on VO<sub>2</sub> Kinematics and Lactate during a Cycling Time Trial

J. Bunn<sup>1</sup>, M. Magal (FACSM)<sup>2</sup>, L.C. Eschbach<sup>2</sup>, R. Vogel<sup>3</sup>, and R. Yow<sup>3</sup>

1) Campbell University, Buies Creek, NC; 2) NC Wesleyan

A warm-up prior to long-duration exercise has been shown to be effective during the initial phase of the activity, but may not have a significant impact on performance for the entire activity.

**PURPOSE:** The purpose of this study was to evaluate if the duration of a warm-up affects VO<sub>2</sub> kinematics and lactate during a 5K cycling time trial (TT).

**METHODS:** Sixteen trained cyclists ( $41.0 \pm 7.7$  years,  $76.5 \pm 13.5$  kg,  $1.75 \pm 0.11$  m,  $50.5 \pm 11.7$  ml/kg/min) completed a cycling graded exercise test to measured maximum oxygen consumption (VO<sub>2</sub>max) and lactate threshold, followed by an orientation session the TT. At subsequent visits, participants completed one of three warm-up protocols, in randomized order, and the TT. The warm-up protocols included: 1) a short duration three-minute warm-up at 60% max power (SW), 2) a long duration warm-up of 10 minutes at 60% max power (LW), and 3) no warm-up (NW). All cycle testing was completed using a stationary cycle simulator and the participant provided their own bicycle, and testing sessions were completed approximately one week apart. Data were analyzed to address differences amongst type of warm-up for VO<sub>2</sub>, TT time, and lactate at the 1K split and the entire 5K.

**RESULTS:** There was no difference between type of warm-up ( $p > 0.05$ ) for VO<sub>2</sub> (SW:  $50.1 \pm 9.0$ , LW:  $49.5 \pm 9.4$ , NW:  $50.6 \pm 9.0$  ml/kg/min), post-TT lactate levels (SW:  $9.0 \pm 2.9$ , LW:  $7.9 \pm 3.2$ , NW:  $8.0 \pm 3.2$  mmol/l), or TT completion time. There was also no difference between warm-ups ( $p > 0.05$ ) after completion of 1K for VO<sub>2</sub> (SW:  $41.5 \pm 7.6$ , LW:  $46.1 \pm 10.3$ , NW:  $37.4 \pm 5.2$  ml/kg/min) or 1K split time.

**CONCLUSION:** This data conflicts current evidence that a warm-up may be beneficial during the initial phase of an endurance activity, but agrees with research that indicates no difference amongst warm-up types for the entire performance. This study limited the warm-up sessions to steady state exercise, but future research should address variations in intensity during the warm-up in addition to the duration.

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**1436** Board #217 **MAY 30 11:00 AM - 12:30 PM**  
**Physiological And Performance Comparisons Between A Simulated Time Trial And The Respiratory Compensation Point In Well-Trained Cyclists**  
Rick T. Bradley, Jamie L. Donkin, Raymond Martinez, Jr., Roberto Quintana, Daryl L. Parker. *Irvin Faria Exercise Physiology Laboratory CSUS, Sacramento, CA.*  
(No relationships reported)

Graded exercise test (GXT) results are commonly used to prescribe exercise. However, investigators have found that GXT power overestimates submaximal steady-state (SS) power.

**PURPOSE:** This study evaluated the physiological and performance values from a simulated 576 kJ (~20 km) time trial (TT) in comparison to the values at the respiratory compensation point (RCP) from a GXT.

**METHODS:** Eight (female n=1) well-trained cyclists [ $VO_{2max}$ :  $62.3 \pm 7.16$  ml·kg<sup>-1</sup>·min<sup>-1</sup>, maximal power ( $W_{max}$ ):  $374 \pm 54.5$  W, BMI:  $23.5 \pm 4.5$  kg·(m<sup>2</sup>)<sup>-1</sup>, Age:  $32.8 \pm 7.5$  years] served as volunteer participants for this investigation. Each volunteer first underwent a GXT on a cycle ergometer to exhaustion beginning at 70 W (female=50 W) and increasing at a rate of 35 W·min<sup>-1</sup> (female=25 W·min<sup>-1</sup>) to determine RCP and  $VO_{2max}$ . On a separate day, a self-paced 576 kJ (~20 kilometer) TT was performed at an "all-out" effort, with only simulated distance revealed. A one-way ANOVA for RCP and TT variables; heart rate (HR), power, respiratory exchange ratio (RER), ventilation (Ve) and  $VO_2$  at 144 kJ (~5 K), 288 kJ (~10K), 432 kJ (~15K) and 576 kJ (~20K) was used to detect differences. Relationships between RCP and TT variables were assessed with Pearson's r.

**RESULTS:** RCP values were; HR ( $178 \pm 8.32$  bpm), power ( $317 \pm 47.2$  W, 85% of  $W_{max}$ ), RER ( $1.07 \pm 0.06$ ), Ve ( $100 \pm 19.2$  l·min<sup>-1</sup>) and  $VO_2$  ( $3.81 \pm 0.56$  l·min<sup>-1</sup>, 91% of  $VO_{2max}$ ). No significant difference was found over the course of the TT for any variable ( $p > 0.05$ ). HR, Ve and  $VO_2$  were not different between the TT and RCP ( $p > 0.05$ ), but power ( $249 \pm 55$  W) and RER ( $0.96 \pm 0.05$ ) from the TT were significantly less than RCP ( $p < 0.05$ ,  $p < 0.01$ ). RCP HR, power and  $VO_2$  were significantly correlated to TT HR ( $r = 0.92$ ,  $p < 0.05$ ), power ( $r = 0.90$ ,  $p < 0.05$ ) and  $VO_2$  ( $r = 0.93$ ,  $p < 0.05$ ).

**CONCLUSION:** The RCP HR, Ve and  $VO_2$  from a GXT are similar to TT responses in well-trained cyclists, but RCP power and RER are overestimated compared to the TT. As expected, strong correlations were found between RCP and TT HR, power and  $VO_2$ ; and RCP power and  $VO_2$  from this study are similar to others' findings as a percentage of maximum (~85-90%). Interestingly, we found the RCP power to be much greater than TT power ( $67.8 \pm 23.6$  W), with the difference being greater than that found between the ventilation threshold and equivalent sub-maximal SS exercise by previous investigators ( $45 \pm 12$  W).

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**1437** Board #218 **MAY 30 11:00 AM - 12:30 PM**  
**Decision Making Relative To Pacing Strategy: Test Of The Hazard Score Hypothesis**  
Katherine R. Malterer, Carl Foster, FACSM, Jos J. de Koning, FACSM, Samantha Bischel, Frieder Krause, Miranda Menke, Jose Rodriguez-Marroyo, Christian Thiel, John P. Porcari, FACSM. *University of Wisconsin-La Crosse, La Crosse, WI.*  
(No relationships reported)

Performance in any physically demanding task depends on a motor template and feedback regarding how the task is affecting the body. The 'language' of this feedback is the rating of perceived exertion (RPE). Previous evidence from our laboratory suggests that RPE x the % of distance remaining, the Hazard Score (HS), determines whether the athlete speeds up or slows down.

**PURPOSE:** This study tested if the HS will predict changes in running velocity during individual 3km time trials.

**METHODS:** Well-trained, task-habituated subjects (N=12), completed three 3km running time trials with individual starting times to discourage drafting/pacing off other runners. Changes in momentary running velocity vs. HS were computed every 200m by comparing the running velocity immediately (100m) before providing a RPE score vs the running velocity immediately (100m) after the RPE score, to test the hypothesis that HS > 3 yields deceleration & < 1.5 yields acceleration.

**RESULTS:** Regression analysis ( $R^2 = 0.16$ ) of a total of thirty-four 3km time trials, yielding 469 observations, revealed a regression curve predicting acceleration with HS < 1.5 and deceleration with HS > 3.5, which substantially supports the experimental hypothesis.

**CONCLUSION:** HS may be a tool for understanding how humans regulate energy expenditure during exercise.

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**1438** Board #219 **MAY 30 11:00 AM - 12:30 PM**  
**Long Range Correlations And Complex Regulatory Control Of Pacing In Half Marathon Racing**  
Olaf Hoos<sup>1</sup>, Tobias Boeselt<sup>1</sup>, Martin Steiner<sup>1</sup>, Kuno Hottenrott<sup>2</sup>, Ralph Beneke, FACSM<sup>1</sup>. <sup>1</sup>Philipps-University Marburg, Institute of Sports Science, Marburg, Germany. <sup>2</sup>Martin-Luther-University Halle-Wittenberg, Institute for Media, Communication and Sports, Halle, Germany.  
(No relationships reported)

Fractal scaling properties serve as evidence of complex regulatory controlling. Recent studies on prolonged, self-paced laboratory and field time trials have shown substantial variability and suggest fractal scaling in speed or power output. High resolution data on speed (S) reflecting stride frequency (SF) and stride length (SL) during real-world endurance competition are lacking.

**PURPOSE:** To determine and classify spectral and fractal properties of S, SF and SL fluctuations and interrelationships with half-marathon running performance.

**METHODS:** High-resolution (1 Hz) data on S (m/s), SF (Hz) and SL (m) were assessed during half-marathon (21,098 m) competition using a miniaturized accelerometric device in 21 male experienced runners ( $38 \pm 11$  yrs, BMI:  $23 \pm 2$  kg·m<sup>-2</sup>). Performance times, coefficient of variation (CV), spectral powers (TP) and peaks (PP), fractal scaling exponent (beta) and fractal dimension (FD) of S, SF and SL were computed.

**RESULTS:** S, SF, SL were  $3.65 \pm 0.41$  m/s,  $1.41 \pm 0.05$  Hz and  $2.58 \pm 0.25$  m, respectively. Variability of SF (CV:  $1.7 \pm 0.4$  %; TP:  $0.0004 \pm 0.0002$  n.u.) was lower ( $p < 0.05$ ) than that of S (CV:  $4.5 \pm 1.3$  %; TP:  $0.0260 \pm 0.0195$  n.u.) and SL (CV:  $4.4 \pm 1.4$  %; TP:  $0.0116 \pm 0.0081$ ). Non-stationary fractional Brownian motion (fBm) was found in SF (beta:  $1.35 \pm 0.16$ ; FD:  $1.82 \pm 0.08$ ), SL (beta:  $1.45 \pm 0.19$ ; FD:  $1.77 \pm 0.10$ ) and S (beta:  $1.57 \pm 0.20$ ; FD:  $1.71 \pm 0.10$ ) with similar PP-values (S:  $0.00156 \pm 0.00109$  Hz; SF:  $0.00170 \pm 0.00099$  Hz; SL:  $0.00150 \pm 0.00108$  Hz). Fractal and spectral variability measures were independent of performance. The semi-partial explanation of S variation was  $84 \pm 6$  % for SL and  $16 \pm 6$  % for SF. PP ( $r = 0.56$ ) and beta ( $r = 0.91$ ) were interrelated for S and SL.

**CONCLUSIONS:** fBm in SL, SF and S indicate long range correlations and complex regulatory control of pacing in real-world half marathon running. In experienced runners this control mechanism is independent of performance.

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**1439** Board #220 **MAY 30 11:00 AM - 12:30 PM**  
**Incidence Of Plateau At VO2max Is Influenced By Prior Knowledge Of Trial Number**  
Dan A. Gordon<sup>1</sup>, Oliver Caddy<sup>1</sup>, Rutendo Ganyani<sup>1</sup>, Marie Gemigon<sup>2</sup>, Nicolas Buttinger<sup>3</sup>, James Latchford<sup>3</sup>, Don Keiller<sup>1</sup>, Richard Barnes<sup>3</sup>. <sup>1</sup>Anglia Ruskin University, Cambridge, United Kingdom. <sup>2</sup>University of Angers, Angers, France. <sup>3</sup>University of Cambridge, Cambridge, United Kingdom.  
(No relationships reported)

**PURPOSE:** The purpose of this study was to examine the  $VO_2$  plateau response during a series of  $VO_{2max}$  trials in a group of well-trained an un-trained individuals who had no prior experience of completing incremental tests to exhaustion.

**METHOD:** Following University Institutional ethical approval, n=10 well-trained male athletes (WT) (age,  $23.0 \pm 3.16$  yrs; height,  $183.3 \pm 5.5$  cm; weight,  $77.5 \pm 11.1$  kg;  $VO_{2max}$ ,  $66.3 \pm 5.7$  ml·kg<sup>-1</sup>·min<sup>-1</sup>) and n=7 un-trained male subjects (UT) (age,  $20.1 \pm 0.9$  yrs; height,  $181.6 \pm 6.2$  cm; weight,  $72.9 \pm 10.0$  kg;  $VO_{2max}$ ,  $48.8 \pm 5.3$  ml·kg<sup>-1</sup>·min<sup>-1</sup>) volunteered and agreed to participate. The subjects completed four  $VO_{2max}$  trials (Tr 1-4) at the same time of day, each trial being separated by 72 h. For each trial the subject completed a cycle-based incremental ramp starting at 100 W. After 60 s of cycling the workrate increased by  $0.42$  W·s<sup>-1</sup> while maintaining a constant cadence of 60 rpm (UT) and 80-90 rpm (WT). The incremental ramp test was terminated either when the cadence decreased by <10 rpm or when the subject stopped due to volitional exhaustion. Verbal encouragement was initiated after 360 s of cycling and re-introduced continuously once VE displayed a significant break from linearity. Throughout all trials, the  $VO_2$  response to exercise was recorded on a breath-by-breath basis using a pre-calibrated metabolic cart. The first criterion for a plateau in  $VO_2$  was determined according to a  $\Delta VO_2 < 1.5$  ml kg<sup>-1</sup>·min<sup>-1</sup> over the final two consecutive 30 s sampling periods. Secondary criteria were RER  $\geq 1.15$ ,  $\Delta RER \geq 0.4$ , peak blood lactate  $\geq 8.0$  mM·l<sup>-1</sup>, HR $_{max} \geq 220$ -age  $\pm 10$  b·min<sup>-1</sup> and an RPE > 19.

**RESULTS:** In the WT group the  $\Delta\text{VO}_2$  ( $\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ ) during the final two consecutive 30 s sampling periods was  $2.52 \pm 1.63$  for Tr1,  $1.68 \pm 1.05$  for Tr2,  $1.68 \pm 1.19$  for Tr3 and  $1.28 \pm 0.87$  for Tr4 ( $P=0.083$ ), there was no-significant difference across trials for UT ( $P=0.699$ ). Plateau incidence for WT was 20% Tr1, 50% Tr 2-3 and 70% Tr4, while for UT incidence it was 7% across Tr 1-4. For both WT ( $P=0.295$ ) and UT ( $P=0.694$ ) there was no-significant difference in  $\text{VO}_{2\text{max}}$  across Tr 1-4.

**CONCLUSION:** The data suggests that the incidence of plateau at  $\text{VO}_{2\text{max}}$  is influenced by other factors aside from anaerobic substrate metabolism. The results suggest that a form of pacing occurs in WT based on the prior knowledge and anticipation of the number of trials.

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**1440** Board #221 **MAY 30** **11:00 AM - 12:30 PM**

**Racing the Favourite: Effects of Competition During Laboratory Based 4,000-m Cycling Time Trials**

Mark R. Stone<sup>1</sup>, Kevin Thomas<sup>2</sup>, Alan St Clair Gibson<sup>2</sup>, Michael Wilkinson<sup>2</sup>, Kevin G. Thompson<sup>2</sup>. <sup>1</sup>Buckinghamshire New University, High Wycombe, United Kingdom. <sup>2</sup>The University of Northumbria at Newcastle, Newcastle upon Tyne, United Kingdom.  
(No relationships reported)

Cyclists can achieve marginal reductions in the time taken to complete a time trial (TT) whilst racing against a simulated opponent compared with riding alone. However, in previous studies the opponent has typically mirrored the participants own previous performance. It is not known whether a simulated opponent whose exercise intensity is known to be greater than that previously achieved could 'push' participants to realise meaningful reductions in performance time.

**PURPOSE:** To assess whether trained cyclists could reduce the amount of time taken to complete a 4,000-m TT during head-to-head competition against a simulated opponent who they understood to be performing at a higher power output than their own previous performance.

**METHODS:** Ten trained male cyclists each performed four, 4,000-m TT with between three and seven days separating each trial. The first TT served to acclimatise participants and the second was used to form a baseline condition (BL). During TT three and four, two avatars were displayed on a video screen; one of these represented the progress of the participant and the other represented the progress of the simulated opponent. The power output of the simulated opponent was set at either 102% or 105% of the participants mean BL power output in a randomised and counter balanced order. Participants were briefed about the nature of the experiment and encouraged to try to beat their opponent. Heart rate was monitored continuously and session RPE was recorded on completion of each trial.

**RESULTS:** There were no significant differences between BL and either the 102% or 105% TT for time taken [( $F = 1.201_2$ ,  $p = 0.3$ ), ( $359.4 \pm 11.1$ ,  $360 \pm 11.7$  and  $361.2 \pm 12.8$  s, respectively)]; mean heart rate [( $F = 0.468_2$ ,  $p = 0.6$ ), ( $180 \pm 15$ ,  $180 \pm 13$  and  $179 \pm 12$  bpm, respectively)] or session RPE [( $F = 0.536_2$ ,  $p = 0.6$ ), ( $18 \pm 1$ ,  $18 \pm 1$  and  $19 \pm 1$ , respectively)].

**CONCLUSION:** The presence of a simulated opponent, known to be exercising at an intensity which was greater than participants achieved during BL, did not affect performance time or the physiological or perceptual responses during a 4,000-m TT. These findings indicate that the regulation of self paced exercise is a robust mechanism which is not readily influenced by the presence of a simulated opponent designed to 'push' the athlete to reduce the amount of time taken to perform a TT.

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**A-40** Free Communication/Poster - Posture/Balance

MAY 30, 2012 7:30 AM - 12:30 PM

ROOM: Exhibit Hall

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**1441** Board #222 **MAY 30** **11:00 AM - 12:30 PM**

**The Influence of Occupational Footwear on Balance**

John C. Garner, III<sup>1</sup>, Harish Chander<sup>1</sup>, Nicole C. Dabbs<sup>1</sup>, Jennica Roche<sup>2</sup>, Chip Wade<sup>3</sup>. <sup>1</sup>University of Mississippi, University, MS. <sup>2</sup>University of Pittsburgh, Pittsburgh, PA. <sup>3</sup>Auburn University, Auburn, AL. (Sponsor: Mark Lofitin, FACSM)  
(No relationships reported)

There is a wealth of research investigating human balance following exposure to smooth, level surfaces, with recent investigations examining posture following exposure to ramps, stairs, steps, and uneven terrain. Occupational footwear worn for a work setting are often designed for safety and stability, rather than comfort or aesthetics. As such the functionality of occupational footwear may impact balance characteristics over time.

**PURPOSE:** The purpose of the study was to examine balance while wearing different types of occupational footwear for extended durations.

**METHODS:** 14 adult males (age: 22-26yrs, ht:  $181 \pm 5.32\text{cm}$ , wt:  $197 \pm 32.14\text{lbs}$ ) with no vestibular, neurological, or gait related problems were selected for this study. The experimental session included an extended duration of walking (4hours) with balance testing done at 30min intervals (Pre, 30, 60, 90, 120, 150, 180, 210 & 240min). The standing balance protocol was assessed in the eyes open condition with sway velocities in the A/P and M/L directions (APVELO & MLVELO) and RMS Sway in the A/P and M/L directions (APRMS & MLRMS). Participants were randomly assigned 3 different types of occupational footwear: Work Boots (WB), Tactical Boots (TB) and Low Top Boots (LB) with a minimum of 72 hours of rest between conditions.

**RESULTS:** Balance related dependent variables were evaluated using a  $3 \times 9$  (Boot)  $\times$  (Extended duration of walking intervals) RMANOVA for each dependent variable,  $p = 0.1$ . Significant difference over time was seen only in MLRMS ( $p=0.063$ ), with a main effect for boot type seen in APRMS ( $p=0.025$ ).

**CONCLUSIONS:** These results indicate that balance; with reliable sensory inputs from each of the 3 systems (i.e. visual, somatosensory, vestibular) was not influenced over time during the extended duration of walking on a hard flat surface except for MLRMS. Further these results suggest that the fatigue level due to extended duration walking was not enough to alter sway parameters when tested with eyes open on a stable platform and visual environment. Significance found between LB and TB, where LB had a higher APRMS sway, despite having a greater mass, suggests the increased boot shaft height of TB may be the reason for greater stability. Results from this data suggest that the high boot shaft supports the ankle, resulting in decreased fatigue, thus better balance.

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**1442** Board #223 **MAY 30** **11:00 AM - 12:30 PM**

**Mediolateral Control Of The Center Of Pressure During Quiet Stance Is Altered In Parkinson's Disease**

Ryan T. Roemmich<sup>1</sup>, Joe R. Nocera<sup>2</sup>, Shinichi Amano<sup>1</sup>, Chris J. Hass, FACSM<sup>1</sup>. <sup>1</sup>University of Florida, Gainesville, FL. <sup>2</sup>Department of Veteran Affairs, Gainesville, FL. (Sponsor: Chris J. Hass, FACSM)  
(No relationships reported)

Presentation of unilateral motor symptoms is a hallmark of early Parkinson's disease (PD). While unilateral deficits in appendicular motor function have been studied in PD, influence of unilateral symptoms on postural control has remained relatively ignored.

**PURPOSE:** To examine whether unilateral symptoms affect postural control in persons with PD.

**METHODS:** Twenty persons with PD ( $64 \pm 11$  y) and six healthy older adults (HOA,  $72 \pm 10$  y) stood in a quiet stance on a single force plate with their eyes open for two two-minute trials. Kinematic and kinetic data were collected using a 12-camera Vicon Nexus motion capture system (120 Hz; Vicon Nexus, Oxford, UK) and a Bertec force plate (360 Hz; Bertec Corporation, Columbus, OH). The participants with PD completed the Unified Parkinson's Disease Rating Scale (UPDRS), which was subsequently scored by an independent rater. The participants' more-affected side (MAS) and less-affected side (LAS) were defined based on their subscores on UPDRS items 20-26. Of the 20 participants with PD, 13 performed the static balance trials with their center of pressure (COP) displaced toward their MAS relative to their center of mass (COM) for at least 50% of each trial (PD MAS). The remaining 7 PD participants displaced their COP toward their LAS relative to their COM (PD LAS). For each participant, we calculated the average anterior-posterior (AP) and medial-lateral (ML) velocities of the COP. We also calculated the average root mean square error (RMSE) of the COP position relative to COM position. A one-way ANOVA with Bonferroni post-hoc corrections for pairwise comparisons was performed to compare each variable across the three groups.

**RESULTS:** HOA demonstrated significantly lower ML COP velocity than the PD MAS and PD LAS groups (10.22 vs. 20.18 and 19.27 mm/sec, respectively;  $p = .011$ ,  $p = .014$ ). HOA also demonstrated higher RMSE values when compared to the PD LAS group but not the PD MAS group (33.49 vs. 14.62 and 22.00 mm, respectively;  $p = .016$ ,  $p = .138$ ). There were no significant differences between the PD MAS and PD LAS groups in any of the measures.

**CONCLUSIONS:** When compared to HOA, persons with PD exhibit higher ML COP velocity when the COP is displaced laterally from the COM during quiet stance. However, we did not observe an effect of leaning toward the MAS on postural control in persons with PD.

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**1443** Board #224 MAY 30 11:00 AM - 12:30 PM  
**Static And Dynamic Weight Shifting Ability In Children With Adolescence Idiopathic Scoliosis**

Gozde Gur, Songul Aksoy, Fatma Uygur, Yavuz Yakut. *Hacettepe University, Ankara, Turkey.*  
(No relationships reported)

It is well known that postural control and balance is adversely affected in children with idiopathic scoliosis. Adequate weight shifting is an important element of postural control. Most studies have focused on the evaluation of somatosensory organisation and these studies have shown that there is an increase in lateral and sagittal and postural sway during still standing activities. We have not come across a study measuring the ability to shift weight in these children.

**PURPOSE:** To investigate static and dynamic weight shifting abilities of children with adolescence idiopathic scoliosis.

**METHODS:** Twenty six patients (17 girls 9 boys) with adolescence idiopathic scoliosis with a mean age of  $14 \pm 3.4$  years were included in the study. The mean weight mass index of the subjects was  $18.59 \text{ kg/m}^2$ . The demographic characteristics of the subjects and characteristics of the scoliotic curve were recorded. The ability of the patients to bear weight in their right and left lower extremities during weight bearing squat was measured by means of "Neurocom Computerized Dynamic Posturography" at 0, 30, 60, 90 degrees of knee flexion. Also rhythmic weight shifting to the right and left, anterior and posterior directions was used to measure the centre of gravity by means of "Neurocom Computerized Dynamic Posturography". The results were evaluated according to on-axis velocity and directional control.

**RESULTS:** The Cobb angle was found to be a mean of 21 degrees for thoracic curves and 24 degrees for lumbar curves. The most common curves were right thoracic left lumbar. In weight bearing squat test, no difference was found between the right and left extremities in the positions of 0, 30, 60 and 90 degrees knee flexion. During rhythmic weight shifting test, there was 30% decrease in on-axis velocity and 27% decrease in directional control ability.

**CONCLUSION:** While adolescence idiopathic scoliosis did not affect static weight shifting ability, there was a decrease in dynamic weight bearing ability. This result can be interpreted as an adverse effect of scoliosis.

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**1444** Board #225 MAY 30 11:00 AM - 12:30 PM  
**Increases in Energy Expenditure and Muscle Activation While Performing Clerical Work in Three Body Postures**

Tibor Hortobagyi, FACSM<sup>1</sup>, Caitlin Pearl<sup>2</sup>, Olivia Ratcliff<sup>2</sup>, Jennifer Streeter<sup>2</sup>, Patrick Rider<sup>2</sup>, Paul DeVita, FACSM<sup>2</sup>. <sup>1</sup>University of Groningen, Groningen, Netherlands. <sup>2</sup>East Carolina University, Greenville, NC.  
(No relationships reported)

One cause for weight gain may be due to the increase in sedentary time leading to reduced energy expenditure, especially in the workplace. A preventative measure could be to perform clerical work in different postures that would increase the amount of active muscle such as sitting on a therapy ball or standing and accumulate excess energy expenditure throughout the day.

**PURPOSE:** We examined the hypotheses that the energy cost while performing clerical work standing or sitting on a therapy ball is higher than when sitting on a chair and this increase in energy cost is associated by an increase in muscle activation.

**METHODS:** Subjects ( $n = 10$ , mean age 21.2) copied printed text into a Word document under three randomized and standardized conditions: sitting on a chair, sitting on a therapy ball, and standing. EMG activation in two upper extremity muscles, four lower extremity muscles, and two trunk muscles, in addition to passive energy expenditure were recorded for 15 minutes during each condition. A basal measurement was taken while lying down for 15 minutes. Quality of typing was calculated by assessing correct word count.

**RESULTS:** Average  $\text{VO}_2$  was  $3.70 \text{ ml/kg/min}$  (SD  $\pm 0.23$ , lying) and lower ( $p < 0.05$ ) than  $4.40 (\pm 0.88, \text{ chair})$  and both lower ( $p < 0.05$ ) than  $4.57 (\pm 1.02, \text{ ball})$  and  $4.60 (\pm 0.58, \text{ standing})$ . Average EMG in 8 muscles was  $0.007 \text{ mV}$  ( $\pm 0.001$ , lying), lower ( $p < 0.05$ ) than  $0.022 \text{ mV}$  ( $\pm 0.006, \text{ chair}$ ), both lower ( $p < 0.05$ ) than  $0.034 \text{ mV}$  ( $\pm 0.009, \text{ ball}$ ) and  $0.030 \text{ mV}$  ( $\pm 0.001, \text{ standing}$ ). Increase in EMG activity explained 52% of variance in increase in oxygen uptake. Average word count per minute was  $48.5 (\pm 9.7, \text{ ball})$ ,  $46.5 (\pm 12.4, \text{ chair})$ , and  $49.6 (\pm 12.5, \text{ standing})$  ( $p > 0.05$ ).

**CONCLUSION:** These preliminary data suggest that there is a parallel and correlated increase in energy expenditure and muscle activation while performing clerical work in non-standard postures.

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**1445** Board #226 MAY 30 11:00 AM - 12:30 PM  
**Balance Control During Transition From Double To Single-leg Stance In Subjects With Chronic Ankle Instability**

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(No relationships reported)

Subjects with CAI (chronic ankle instability) are slower in activating their leg muscles when shifting weight from double to single leg stance (DLS and SLS, Van Deun et al., 2007).

**PURPOSE:** Based on these results, the hypotheses tested were: (1) that in CAI the shift of the COP takes longer, (2) that this delay is associated with longer stabilization times when standing on one leg is achieved, and (3) that the largest delays in EMG onset are correlated with the slowest transfer in weight and/or greater instability in the SLS.

**METHODS:** 20 subjects with CAI and 20 controls were tested. A single force platform was used to monitor the anteroposterior (AP), mediolateral (ML) and vertical components of the foot-ground reaction (FGR) forces before during and after transition (TR) from DLS to SLS, either with the eyes open (EO) or closed (EC). Trajectory of the center of pressure (COP) was calculated to determine TTR (time of TR) and TTS (time to stabilization). TTR is the time from the onset of TR until the second zero crossing of ML COP velocity time series. TTS was estimated with the method of sequential estimation by taking a cumulative average of the ML COP displacement time series (Colby et al, 1999). The quasi-stable (QS) phase started at the end of TR and finished at the point of TTS. Electromyography (EMG) signals were recorded from ankle, knee and hip muscles.

**RESULTS:** The TTS was longer for the CAI than for controls (3.25 vs. 2.28 s in EO and 3.41 vs. 2.51 s in EC;  $P < 0.01$ ). Similarly, the TTR was prolonged in CAI (1.48 vs. 1.14 s in EO and 1.53 vs. 1.20 s in EC;  $P < 0.05$ ). These prolonged periods came in parallel with an increase in the ML sway in the QS period (mean displacement 2.20 vs. 1.75 cm in EO; 3.37 vs. 2.62 cm in EC; significant for EC,  $P < 0.01$ ). The TTR in CAIs was positively correlated with time onset of the Adductor Longus during transitions with EC ( $R = 0.51$ ,  $P = 0.03$ ).

**CONCLUSIONS:** CAIs made slower transitions as indicated by longer TTR. These slower transitions in CAIs were associated with later onset time in the hip muscles and with larger instability in the ML direction in the period just after weight transfer (QS). The latter could indicate that for CAI the transfer was delayed because of anticipated instability. The present data support the use of a weight-shifting paradigm for the discrimination of stable and unstable ankles.

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**1446** Board #227 MAY 30 11:00 AM - 12:30 PM  
**Influence Of Visual Conditions And Leg Dominance On Balance Performance On Unstable Surfaces**

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(No relationships reported)

Maintaining stability on unstable surfaces in a quiet stance depends on the integration of afferent information (Peterka, 2002). It has been well documented how dynamic balance is affected by vision (Day et al., 1993), however the effect of vision impairment on dynamic balance is inconclusive (Houwen et al., 2009). Leg dominance has been reported to have no effect on full vision and no vision conditions (Hoffman et al., 1998). However, the research on impaired vision and balance performance is limited and inconclusive.

**PURPOSE:** To investigate the influence of vision and leg dominance for balance performance on an unstable surface.

**METHODS:** Twenty four females (Mean + SD; Age= 19.2 + 1.2; Wt= 72.1 + 13.45 kg; Ht = 166.0 + 6.3 cm) who were considered healthy with no previous injuries performed a dynamic balance task on a balance pad under three different vision conditions; full vision open, no vision, and impaired vision, on the dominant leg (dl) and non-dominant leg (ndl). Leg dominance was assessed using the recovery balance test. Sway velocity was the dependent variable. A 3x2 Repeated Measures ANOVA was used to compare differences between the vision conditions and dominant leg on dynamic balance.

**RESULTS:** Significance between full vision compared (dl: 9.7± 2.6m/s, ndl: 9.0± 1.6m/s) to no vision (dl: 12.8± 3.1m/s, ndl: 12.5± 2.5m/s) and impaired vision (dl: 10.8± 3.5m/s, ndl: 13.4± 4.5m/s), with  $p < 0.001$  were found. Significant differences between no vision and impaired vision ( $p = 0.925$ ) were not observed. The dominant leg showed significantly reduced sway velocities compared to the non-dominant leg ( $p = 0.012$ ) for impaired vision.

**CONCLUSION:** Leg dominance influenced balance performance for impaired vision. These findings imply that with impaired vision the non-dominant leg may cause instability, which can lead to fall related injuries.

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**1447** Board #228 MAY 30 11:00 AM - 12:30 PM

**Is the Activities-Specific Balance Confidence Scale Appropriate for Fall Screenings in Active Older Men?**

Gregory F. Martel<sup>1</sup>, John F. Yannessa<sup>1</sup>, Michael C. Rabel<sup>2</sup>, George W. Lyerly<sup>1</sup>, Dennis W. Klima<sup>2</sup>. <sup>1</sup>Coastal Carolina University, Conway, SC. <sup>2</sup>University of Maryland Eastern Shore, Princess Anne, MD.

(No relationships reported)

Although frequently used for fall risk screenings, the Activities-Specific Balance Confidence Scale (ABC) lacks data regarding the relationships between the ABC and factors affecting balance confidence in active older men. Previous work from our laboratory, which included a population of 59% women, indicated significant relationships between the ABC and fall history, physical activity status, 1-RM leg strength, and isokinetic peak torque (PT).

**PURPOSE:** 1) To compare differences in balance confidence among male fallers (F) and non-fallers (NF) and 2) examine relationships between the ABC and age, PT, body mass index (BMI), and medication use.

**METHODS:** Seventy-one physically active, community dwelling men were recruited (67±7 yr, 84±15 kg, 27.1±4.1 BMI) to complete the ABC, a health history, and testing for concentric PT for knee extensors and knee flexors. Data were then dichotomized based on fall history.

**RESULTS:** When comparing F (n=14, 69±6 yr, 27.8±3.3 BMI) to NF (n=57, 67±7 yr, 27.0±4.3 BMI), independent t-tests revealed significantly higher ABC scores for NF (94±7 vs. 87±12;  $p < 0.01$ ), but no group differences for age, BMI, or PT. A Spearman nonparametric test revealed that ABC significantly correlated with fall history ( $\rho = -0.264$ ;  $p < 0.05$ ) and left knee extension PT ( $\rho = -0.434$ ;  $p < 0.05$ ), but did not significantly correlate with age, BMI, or medication use.

**CONCLUSIONS:** ABC scores correlated with fall history and left knee extension PT, and were significantly lower among active older men who had recently fallen. However, typical balance confidence correlates (age, BMI, and polypharmacy) were not observed. Clinicians should be cautious when interpreting male balance confidence profiles in gender-mixed studies.

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**1448** Board #229 MAY 30 11:00 AM - 12:30 PM

**Changes in Plantar Loading During the Lower Quarter Y Balance Test**

Mary E. Russell<sup>1</sup>, Boyi Dai<sup>2</sup>, Robert J. Butler<sup>1</sup>, Robin M. Queen<sup>1</sup>. <sup>1</sup>Duke University, Durham, NC. <sup>2</sup>University of North Carolina, Chapel Hill, NC. (Sponsor: Donald T. Kirkendall, FACSM)

(No relationships reported)

Dynamic balance has previously been established as a risk factor for lower extremity injury during sport. One way to measure dynamic balance is by using the Lower Quarter Y-Balance Test (YBT-LQ), however, there is currently no research on how loading of the foot is altered for the three different reach directions that are part of this test.

**PURPOSE:** To determine if total foot, rear foot (RF), medial midfoot (MMF), lateral midfoot (LMF), medial forefoot (MFF), middle forefoot (MidFF), lateral forefoot (LFF), hallux, and the lesser toes (LT) loading (defined by maximum force (MF)) were significantly different when performing the different reach directions of the YBT-LQ. The effect of gender on this outcome was also examined.

**METHODS:** Plantar loading in 40 (20 men, 20 women) healthy, recreational athletes were evaluated using the Pedar-X in-shoe system collecting at 100Hz. Exclusion included any history of lower extremity injuries in the past 6 months. Subjects completed 3 trials bilaterally for each of the 3 reach directions of the YBT-LQ. Subjects were asked to reach as far as possible in the anterior (A), posteromedial (PM), and posteriolateral (PL) directions. 6 practice trials on each leg in each of the 3 reach directions were executed prior to formal testing. Repeated measures ANOVAs (gender by reach directions) examining the MF were used to determine statistical differences ( $\alpha = 0.05$ ). All MF measures were normalized to body weight.

**RESULTS:** The total foot MF in the A ( $1.16 \pm 0.10$ BW) direction was smaller than the PL ( $1.19 \pm 0.09$ BW) and PM ( $1.19 \pm 0.11$ BW) directions in males only ( $P < 0.001$ ). The LMF MF was highest in the PL direction, whereas MF in the MFF, MidFF, LFF, hallux and LT were all significantly higher in the A direction ( $P < 0.001$ ). MF in the RF, MidFF, and total foot were significantly higher in females than males overall ( $P < 0.001$ ).

**CONCLUSIONS:** Overall, the anterior direction had the highest load in the forefoot, hallux and LT while the PL direction was associated with higher loads beneath the lateral midfoot. During testing women exhibited increased loads in the RF and MMF, and LMF for all reach directions. These results may indicate that the three reach directions of the YBT-LQ load the foot differently and thus may have an application for various types of lower extremity injuries that have specific foot loading patterns.

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**1449** Board #230 MAY 30 11:00 AM - 12:30 PM

**Effects of Ankle Instability on Ground Reaction Forces during a Landing with Sidestep**

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(No relationships reported)

Ankle instability is associated with mechanical and functional deficits. Appropriate foot position during functional, stressful movement is important to avoid dangerous loads on the ankle. Whole-body center of mass motion, which is reflected by the ground reaction force, influences how loads are applied to the foot during movement.

**PURPOSE:** Compare certain ground reaction force characteristics between individuals who have functional ankle instability (ankle group) and those who do not (control group) during a functional, stressful movement.

**METHODS:** 20 functionally unstable subjects were matched with 20 control subjects (gender, height, and weight). Subjects jumped forward (1m) and upward ( $\pm 5\%$  of their averaged maximal height), landed on one leg on a force platform, and then quickly jumped laterally. Two-sample t-tests ( $\alpha = 0.05$ ) were used to evaluate the effect of ankle instability on peak vertical ground reaction force and loading rate, peak medial ground reaction force and loading rate, and average center of pressure distance from the midline of the foot while the subject contacted the plate.

**RESULTS:** No significant between-group differences were detected ( $p < 0.05$ ). Peak vertical ground reaction force and loading rates for the ankle and control group were  $2.86 \pm 0.44$  BW,  $6.83 \pm 1.53$  BW/s,  $2.91 \pm 0.45$  BW, and  $7.2 \pm 1.99$  BW/s, respectively. Peak medial ground reaction force and loading rates for the ankle and control group were  $0.44 \pm 0.29$  BW,  $1.06 \pm 0.75$  BW/s,  $0.31 \pm 0.32$  BW, and  $0.78 \pm 0.84$  BW/s, respectively. Center of pressure distances from the midline of the foot for the ankle and control groups were  $0.007 \pm 0.009$  m and  $0.007 \pm 0.004$  m, respectively.

**CONCLUSIONS:** No observed ground reaction force characteristic was different between groups, suggesting that certain characteristics of whole-body center of mass motion are not affected by ankle instability during this dynamic task. This lack of significance may be due to variability of the landing strategies used by the ankle group, or the nature of the jumping and landing task.

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1450 Board #231 MAY 30 11:00 AM - 12:30 PM

**Is Four Weeks Enough To Improve Balance And Mobility Function Of Older Adults Who Are Already Physically Active?**

Kali J. Tupper, Brandi S. Row. *Western Washington University, Bellingham, WA.*  
(No relationships reported)

**PURPOSE:** To determine the effectiveness of a brief balance-training (BT) program to improve the balance of physically active older adults.

**METHODS:** A 4-week BT program was conducted with physically active older men and women (Exercise [EX] group, n = 10, mean age [standard deviation, SD]: 77.2 [8.9] yr; waitlist control (EX2) group, n = 9, mean age [SD]: 75.8 [6.0] yr). The BT program focused on the multisensory, motor, and cognitive contributors to dynamic postural control & gait. During the EX2 group's waitlisted participation phase, fewer seated balance ball multisensory exercises were included, replaced instead by more weight-bearing balance, stepping, & gait exercises.

Outcome measures included a modified Fullerton Advanced Balance Scale (modFAB), including three items from the Community Balance & Mobility Scale. Additionally, gait speed & Gait Stability Ratio (GSR) of cadence to velocity, Trail Making Test, the Activities-Specific Balance Confidence Scale, & Stair Climb power. Acceleration measurements were made & are reported in a separate presentation.

For the initial 4-week intervention phase, repeated measures ANOVA (with factors Time [pre, post], Group [EX, EX2]) were conducted for measures that were suitable for parametric tests, otherwise, the Wilcoxon rank-sum (between groups) or Wilcoxon matched pairs (within group) tests were used. For the EX2 group's waitlisted intervention analysis, a one-way ANOVA (with factor Time [pre, post, EX2-post]) was used for variables suitable for parametric tests; otherwise, the Friedman's test was conducted.

**RESULTS:** Following BT, GSR decreased significantly during maximum gait speed trial for the EX group (EX: pre = 1.41 [SD 0.32], post = 1.32 [0.27]; EX2: pre = 1.18 [0.15], post = 1.21 [0.12]; p = 0.01). The EX2 group did not improve on GSR at EX2-post, but secondary analysis on each item of the modFAB revealed evidence of improvement in reactive postural control in this group at EX2-post. No differences on the other measures resulted.

**CONCLUSIONS:** Overall scores on the modFAB did not improve, but even in this small sample & brief intervention, there were some indications of a benefit of four weeks of BT regarding dynamic walking pattern (GSR) & reactive postural control. Evidence of improved frontal plane control is presented in an accompanying abstract from our lab.

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1451 Board #232 MAY 30 11:00 AM - 12:30 PM

**Effects Of Hyperthermia, Hypohydration And Fatigue On Balance**

Lindsay J. DiStefano, Megan VanSumeren, Rachel Karslo, Julie K. DeMartini, Rebecca L. Stearns, Robert Huggins, Lawrence Armstrong, FACSM, Carl Maresh, FACSM, Douglas J. Casa, FACSM. *University of Connecticut, Storrs, CT.*  
(No relationships reported)

Poor balance increases lower extremity injury risk. Fatigue, dehydration, and hyperthermia may impair balance, which could increase an individual's injury risk.

**PURPOSE:** To evaluate the effects of hyperthermia, dehydration, and fatigue on balance ability.

**METHODS:** Twelve trained healthy male subjects (age=20±2 yrs, height=182±8 cm, body mass=74.0±8.2 kg, body fat=9±3%, VO<sub>2</sub>max = 57.0 ± 6.0 mL·kg<sup>-1</sup>·min<sup>-1</sup>) completed four randomized test sessions in a climate controlled chamber. Sessions varied based on environmental conditions and hydration status (Euhydrated Temperate (EUT), Euhydrated Hot (EUH), Hypohydrated Temperate (HYT), Hypohydrated Hot (HYH). Temperate and hot conditions were performed in 18±0.2°C, 50±3.5% relative humidity (RH), and 34 ±0.3°C, 45±4.5% RH, respectively. Dynamic balance during a 10-second unilateral landing task was assessed three times per session: before exercise (PRE), after exercise (POST), and after recovery (REC). The 90-minute treadmill exercise protocol required subjects to walk carrying a 20.5 kg backpack (1.34-1.78 m-s<sup>-1</sup>; 5% grade). Subjects sat quietly in the test environment during a 60-minute recovery period. Mean sway velocity and elliptical sway area were calculated from force plate data (4060-NC Bertec Corporation). A repeated measures analysis of variance with a Tukey HSD post hoc test evaluated differences between time and condition for all dependent variables.

**RESULTS:** Body mass loss differed across sessions (HYT:-3.80 ± 1.22%, HYH:-5.66 ± 1.57%, EUT:0.10 ± 0.90%, EUH:-1.30 ± 0.85%). Regardless of time, HYH resulted in the highest values for sway velocity (p=.024, 6.62±0.28 vs. 6.06±0.16 (HYT), 6.16±0.25 (EUH), 6.19±0.26 (EUT) m/s) and sway area (p=.048, 3.40±0.35 vs. 2.71±0.19 (HYT), 2.65±0.21 (EUH), 2.72±0.24 (EUT) cm<sup>2</sup>). POST sway velocity (PRE: 5.89±0.21, POST: 6.53±0.27, REC: 6.35±0.21) was higher than PRE and REC, regardless of condition (p=.003).

**CONCLUSION:** Regardless of hydration status and environmental conditions, fatigue appears to decrease balance ability. Dehydration in a hot environment also impairs balance ability. These findings suggest that hydration during physical activity in the heat may be critical to alleviate an increased risk of injury.

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1452 Board #233 MAY 30 11:00 AM - 12:30 PM

**The Relationship Between Dynamic Balance and Isokinetic Ankle Strength in College Female Athletes**

Danika Evans, Barbara Warren, FACSM. *University of Puget Sound, Tacoma, WA.*  
(No relationships reported)

Conflicting results have been found between dynamic balance and isokinetic ankle strength as measured by peak torque.

**PURPOSE:** To investigate the relationship between ankle joint peak torque and dynamic balance. **METHOD:** Fifteen healthy female Division III varsity athletes (mean (SD) age = 20.53 yrs (.743), height = 170.02 cm (4.962), weight = 67.27 kg (9.183)) were tested on a Cybex NORM isokinetic dynamometer performing maximal ankle plantar and dorsiflexion for both right and left ankles. Dynamic balance was assessed using the Star Excursion Balance Test (SEBT). Isokinetic strength was assessed through 8 reciprocal maximal contractions of plantar and dorsiflexion at 60, 120, and 180°/s with a 60 second rest between each velocity set. Pearson's correlations were used to assess the relationship between the dynamic balance score and peak torque at each velocity for each muscle group (alpha < 0.05).

**RESULTS:** Moderate correlations were found between right ankle dorsiflexor peak torque and dynamic balance (60°/s: r = .476, 120°/s: r = .608, and 180°/s: r = .667), left dorsiflexor peak torque and dynamic balance at all velocities (60°/s: r = .499, 120°/s: r = .488, 180°/s: r = .445), and between right and left ankle plantarflexor peak torque and dynamic balance (60°/s: r = .520, 60°/s: r = .454). Weak correlations were found between right ankle plantarflexor peak torque and dynamic balance at 120°/s and 180°/s (120°/s: r = .362, 180°/s: r = .274) and left plantarflexor peak torque and dynamic balance at 120°/s and 180°/s (120°/s: r = .237, 180°/s: r = -.037).

**CONCLUSION:** In this population of female athletes, these results suggest that dynamic balance may be related more to dorsiflexion strength than plantarflexion strength.

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1453 Board #234 MAY 30 11:00 AM - 12:30 PM

**Heart Rate and Postural Stability Recovery are Similar after Aerobic and Anaerobic Exercise**

Katelyn Fleishman Allison, Jonathan S. Akins, Timothy C. Sell, John P. Abt, Mita T. Lovalekar, Kim Crawford, Scott M. Lephart. *University of Pittsburgh, Pittsburgh, PA.*  
(No relationships reported)

Postural stability (PS) assessment is an important component of sideline concussion testing and fatigue may influence PS independent of neurological insult. While studies found that PS is disrupted after both anaerobic (ANA) and aerobic (AER) exercise, the relationship between heart rate (HR) and PS recovery following exercise has not been determined.

**PURPOSE:** To compare PS and HR following maximal ANA and AER exercise using a cross-over study design.

**METHODS:** Physically active subjects (M=8, F=5, 23.5±3.5 yrs, 173.7±9.5 cm, 72.7±15.0 kg) participated in two test sessions, where PS and HR were assessed utilizing a single-leg balance task prior to and following ANA or AER exercise every 2-min for 20 min. Dominant-leg balance was measured with eyes open while standing on a foam pad on top of a force plate. A Wingate cycle power test induced ANA fatigue and a graded treadmill exercise test induced AER fatigue. Separate one-way repeated measures ANOVA with simple contrast compared standard deviations of ground reaction forces in the anterior-posterior (AP), medial-lateral (ML) and vertical (V) directions during post-fatigue time intervals to baseline in order to determine PS recovery for each condition (α=0.05). Paired t-tests compared % of max HR achieved during ANA and AER (%HRmax) between conditions at each post-fatigue time interval; adjustment for multiple comparisons set α=0.0045.

**RESULTS:** AP was greater than baseline up to 8-min post-fatigue for ANA (7.2±2.9 vs 5.5±2.0 N) and AER (6.8±2.3 vs 5.5±2.1 N); ML and V were greater than baseline at 0-min post-fatigue for ANA (ML: 6.1±2.9 vs 4.0±1.4 N, V: 23.3±22.2 vs 11.0±5.2 N) and AER (ML: 6.8±3.1 vs 3.7±1.2 N, V: 24.3±17.5 vs 12.1±3.4 N) ( $p<0.05$ ). While max HR achieved during AER was significantly greater than ANA (193.4±10.6 vs 174.8±17.6 bpm,  $p<0.001$ ), no significant differences in %HRmax were found between ANA and AER at any post-fatigue time interval ( $p>0.0045$ ).

**CONCLUSION:** PS and HR recovered similarly following ANA and AER fatigue. Since PS recovered by 10-min post-fatigue with %HRmax at ~52.7%, future research should investigate the potential of using %HRmax to determine when fatigue may be ruled out as a confounding factor during sideline concussion PS assessment following intense sporting activities.

Supported by the Freddie H. Fu, MD Doctoral Research Award

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**1454** Board #235 MAY 30 11:00 AM - 12:30 PM  
**The Effects of Core Strength Training on Static and Dynamic Balance in Female Collegiate Athletes**

Kathryn E. Kramer, Sheila K. Kelly, Tina M. Manos, Justus D. Ortega. *Humboldt State University, Arcata, CA.*

(No relationships reported)

The core muscles of the body are essential components to most kinetic chains in sport activities; therefore, control of core strength should improve controlled motion during dynamic and static balance tasks. Although it is well established that core strength training (CST) improves balance in untrained adults, it is unknown whether CST improves balance in trained athletes.

**PURPOSE:** To determine if a 6-week core strength-training program improves dynamic and static balance in Division II female athletes with prior core strength training experience.

**METHODS:** The Experimental (EXP) and Control (CON) groups were comprised of 33 Division II female athletes (19 softball, 2 basketball, 7 crew, and 5 cross-country); age 19±3.5 yrs, mass 72.3±12.3 kg, height 167.6±7.0 cm. Both EXP and CON groups performed baseline core strength tests [60-second max sit up, max time held in side plank (sec), and max number of medicine-ball twists] and balance tests [Functional Reach (FR), Single-Limb Dynamic Balance (SLDB), Single-Limb Eyes Closed (SLEC), and Single-Limb Eyes Open (SLEO) performed on a force platform and Star Excursion Balance Test (SEBT)]. For the core strength tests, T-scores were calculated for each test and then summed, resulting in a composite core strength score for each athlete (CS-T). For the four tests on the force platform, average CoP velocity (AveVel in cm/s) and 95% of the total area ellipse (95%TAE in cm<sup>2</sup>) were calculated in addition to the maximum reach (cm) of the FR test and the combined maximum reach (sum of three directions) for the SEBT (cm). The EXP group completed a training program consisting of ten core strength exercises performed three times per week for 6 weeks. After the training, the EXP and CON groups performed the core strength and balance testing.

**RESULTS:** Prior to the core strength training there was no difference in strength or balance between the EXP and CON groups. After 6 weeks of core strength training, the EXP group improved in core strength (CS-T: 594.60% increase,  $p=0.0001$ ) and dynamic balance (SLDB: 95%TAE decreased 30.82%,  $p=0.049$  and AveVel decreased 9.76%,  $p=0.005$ ; SEBT: combined maximum reach increased 6.94%,  $p=0.0001$ ). Maximum functional reach (sum of three directions) for the SEBT did not change. Although the CON showed a modest improvement in core strength measures (10.76%,  $p=0.001$ ), there was no improvement in balance except for a 10% decrease in the average CoP velocity during the SLDB test ( $p=0.027$ ).

**CONCLUSION:** Six weeks of supplemental core strength training improves core strength and dynamic balance but does not significantly affect static balance or functional reach in Division II, collegiate female athletes.

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**1455** Board #236 MAY 30 11:00 AM - 12:30 PM  
**Effect of a Lower Extremity Fatigue Protocol on the Balance Error Scoring System**

Rose L. Smith, Jessica Murphy, Kirk Rhein, Melissa Smith, Emanuel Werner, Daniel L. Carl. *University of Cincinnati, Cincinnati, OH.*

(No relationships reported)

Concussion is one of the most common sports-related head injuries accounting for approximately 300,000 diagnosed cases yearly and with as many as 15% of those resulting in persistent long term symptoms. Current concussion assessment and return-to-play decisions rely on the athlete's willingness to share self-reported symptoms. Missed diagnosis due to relying on subjective symptoms from athletes could lead to future complications, such as second impact syndrome. The Balance Error Scoring System (BESS) was developed in order to provide a cost-effective sideline assessment tool for evaluating deficits in postural stability following a concussion. To date the role of the athlete's level of fatigue and how it may interact with BESS scoring is unclear.

**PURPOSE:** To determine if lower extremity (LE) exercise induced fatigue will result in elevated BESS scores.

**METHODS:** 28 subjects (20M, 8F; 18-25 yo) participated in the study. Each subject completed an informed consent and was familiarized with the error measurements of the BESS protocol. Subjects were tested (Pre), LE fatigued, tested immediate post (Post I) and tested 20min post exercise (Post II). The LE fatigue protocol consisted of in order a 1.5 mile run/walk, a Queen's College step test, and 4 sets of squats based on the DAPRE technique. The BESS protocol consisted of a 20s trial for single leg stance, double leg stance and tandem leg stance. In addition each stance was conducted on a firm surface and a medium density (60 kg.m<sup>3</sup>) foam block. The BESS performance score was a compilation of the total errors committed. A paired t-test was conducted to determine differences in Pre, Post I and Post II BESS scores.

**RESULTS:** BESS scores were significantly elevated immediate post fatiguing exercise (Pre 38.4 + 10.2 vs. Post I 54.3 + 12;  $p<0.01$ ) and returned to statistical baseline by 20 min. post exercise (Pre 38.4 + 10.2 vs. Post II 38.1 + 7.0). No statistical differences were identified between M & F or with regard to subject's level of conditioning.

**CONCLUSIONS:** Fatigue adversely affected BESS scoring immediately post exercise. Although a return to statistical baseline was observed at 20 min post exercise, as many as 21% of the participants had not fully recovered. Additional studies are warranted to further elucidate the role of BESS in return-to-play decision making.

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**1456** Board #237 MAY 30 11:00 AM - 12:30 PM  
**Integrative Training Of Strength And Sensorimotor Control Enhances Vestibular And Proprioceptive Activation During Postural Challenges**

Henrike Fischer, Hans Martin Sommer, Olaf Hoos, Ralph Beneke, FACSM. *Philipps University of Marburg, Marburg, Germany.*

(No relationships reported)

Postural control depends on visual (VI), vestibular (VE) and proprioceptive (PR) feedback. Corresponding treatment effects usually do not discriminate between underlying sensory mechanisms.

**PURPOSE:** To discriminate between different adaptations of somatosensory control of a combined strength and sensorimotor intervention (EG) and a classical back school training (CG) in physically active subjects.

**METHODS:** EG (n=17, 25.9 yrs, 61.8kg, 1.70m) joined a specifically designed integrative strength and coordination program to promote joint extensions in supine and upright position (1h weekly for three months). CG (n=13, 26.5 yrs, 63.9kg, 1.75m) performed an identical volume of trunk muscle strength training and balance exercises on stable and unstable surfaces. Postural sway was assessed in barefooted single-leg stance with eyes open on a force platform (1 kHz). Center of pressure sway area (COPA) and spectral powers of Fast Fourier transformation distinguishing between VI (0.1-0.3 Hz), VE (0.3-1 Hz) and PR (1-3Hz) frequency bands were computed for anterior-posterior (AP) and medio-lateral (ML) directions.

**RESULTS:** COPA were unchanged in EG (pre: 1.02±0.37cm<sup>2</sup>, post 0.89±0.24cm<sup>2</sup>; ns) and in CG (pre 1.17±0.48cm<sup>2</sup>, post 1.32±0.86cm<sup>2</sup>; ns). In CG the distribution of spectral powers remained constant in ML (VI: pre 86.4±12.4%, post 88.9±15.6%; ns; VE: pre 10.0±8.8%, post 8.5±11.7%; ns; PR: pre 3.6±3.7%, post 2.6±3.9%; ns) and AP (VI: pre 95.4±1.2%, post 95.3±0.9%; ns; VE: pre 3.5±0.9%, post 3.6±0.7%; ns; PR: pre 1.1±0.3%, post 1.1±0.3%; ns). In EG the COP-powers shifted in terms of a reduction in VI (ML: pre 86.6±8.9%, post 77.8±13.7%;  $p<0.05$ ; AP: pre 96.0±0.6%, post 93.8±1.8%;  $p<0.001$ ) and an increase in VE (ML: pre 10.4±7.4%, post 16.6±10.6%,  $p<0.01$ ; AP: pre 3.1±0.5%, post 4.8±1.4%;  $p<0.001$ ) and AP component of PR (ML: pre 3.0±2.0%, post 5.6±4.5%; ns; AP: pre 0.9±0.2%, post 1.4±0.4%,  $p<0.001$ ).

**CONCLUSIONS:** Both interventions had no effect on COPA. However, the integrative strength and coordination program to promote joint extensions in supine and upright position reduced dependency of the VI system in favour of increased VE and PR control during postural challenges.



**1457 Board #238 MAY 30 11:00 AM - 12:30 PM**  
**Association of Dynamic Postural Stability Index Scores and Clinical Impairments: A Preliminary Analysis**

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*(No relationships reported)*

Recurrent lateral ankle sprains (RLAS) are common injuries which may lead to impairments in postural control. A measure of *dynamic* postural stability was recently developed by Wikstrom. The relationships between the Dynamic Postural Stability Index (DPSI) and physical/functional impairments are currently unknown.

**PURPOSE:** To examine the relationships between the DPSI and selected clinical measurements.

**METHODS:** DPSI and clinical tests (questionnaires, ankle ROM and joint stability/mobility, hip and ankle strength, Y Balance and Lateral Hop tests) were performed on 15 subjects (3 male, 14 female, age: 28 ± 4.5) with RLAS. Forward, diagonal and lateral jumps were examined using GRF data acquired by a force platform (1000 Hz). Three successful trials averaged for DPSI calculations (described by Wikstrom) and clinical measures were entered into a correlation matrix (p<0.05).

**RESULTS:** Moderate correlations were observed between all DPSI scores and the FADI Sports questionnaire and ankle dorsiflexion ROM scores (Table 1); whereas, ankle mobility/stability and inversion ROM, ankle and hip strength, Lateral Hop tests and DPSI scores were non-significant and weakly correlated.

**CONCLUSION:** These data suggest DPSI scores are related to self-reported activity limitations and physical/functional impairments. The moderate association between FDPSI and Y Balance scores may provide insight into dynamic postural stability in clinical situations where force plate data is not available. Supported by **NIH/NCRR/OD UCSF-CTSI Grant Number TL1 RR024129.**

|                 |                                    | Forward:<br>FDPSI | Diagonal:<br>DDPSI | Lateral:<br>LDPSI |
|-----------------|------------------------------------|-------------------|--------------------|-------------------|
| FADI:           | Activity Limitation                | -0.705            | -0.633             | -0.783            |
| Sports          | Pain Limitation                    | -0.423            | -0.398             | -0.540            |
| Clinical        | Ankle DF_ AROM_KE *                | 0.692             | 0.759              | 0.708             |
| Tests           | Ankle DF_ AROM_ KF *               | 0.643             | 0.762              | 0.671             |
| Functional Test | "Y" Balance-Posterior Medial Reach | -0.433            | -0.408             | -0.263            |

Table 1: FADI - Foot and Ankle Disability Index; \* Ankle DF AROM in weight bearing with knee extended (KE) and knee flexed (KF). Italicized values are significant (p<0.05).

**1458 Board #239 MAY 30 11:00 AM - 12:30 PM**  
**Impaired Standing Balance Performance After Maximal And Submaximal Endurance Exercise In Healthy Seniors**

Oliver Faude, Lars Donath, Mareike Cordes, Livia Fricker, Ralf Roth, Henner Hanssen, Arno Schmidt-Trucksäss, Lukas Zahner. *University of Basel, Institute of Exercise and Health Sciences, Basel, Switzerland.*  
*(No relationships reported)*

Impaired standing balance performance (SBP) is a relevant intrinsic fall risk factor in seniors. Acute effects of endurance exercise (maximal and submaximal) on SBP have not yet been studied in elderly.

**PURPOSE:** To evaluate the acute effects of an exhaustive maximal exercise test and 2 km walking at moderate intensity on single and double limb SBP.

**METHODS:** 19 healthy seniors (10 women, 9 men, age = 64.6 (SD 3.2) yrs, height = 1.70 (0.10) m, weight = 69.6 (11.2) kg) completed 3 experimental conditions on separate days one week apart. After a maximal ramp-like treadmill test (duration = 23.1 (3.1) min, maximal oxygen uptake (VO2max) = 32.3 (4.8) mL/min/kg, maximal heart rate = 165 (9) /min) participants randomly completed a 2 km walking test on a treadmill at moderate intensity (27.5 (3.6) min at CR-10 Borg level 4 corresponding to 76 (8)% VO2max) and a resting control condition. During exercise tests heart rate and gas exchange data were continuously recorded. Ratings of perceived exertion (CR-10 scale) were assessed every minute (ramp test) as well as every 5 minutes (2 km walking test). Directly before and after maximal and submaximal exercise and the control condition, SBP was assessed by double leg stance with closed eyes (DLEC) and single leg stance with open eyes (SLEO) on a force platform. Total path length of center of pressure (COP) displacement was determined over 30 s (DLEC) and 10 s (SLEO).

**RESULTS:** A significant condition x time interaction in COP path length data for both standing balance tests was observed (p < 0.001). Whereas COP path length during DLEC slightly decreased from pre to post test on the control day (-8%, effect size (d) = 0.21, p = 0.60), a small (+18%, d = 0.42, p = 0.05) and large (+52%, d = 1.04, p < 0.001) increase was observed after the 2 km and the ramp test, respectively. Similarly, COP path length during SLEO was reduced on the control day (-22%, d = 0.47, p = 0.04), whereas it was slightly increased (+15%, d = 0.29, p = 0.65) after the 2 km test. A large significant increase was observed after the maximal exercise test (+88%, d = 1.24, p < 0.001).

**CONCLUSIONS:** SBP was considerably deteriorated after maximal exhaustive treadmill exercise in healthy seniors. The small changes after walking 2 km at moderate intensity (typical endurance tasks of everyday life or health-oriented cardiovascular training) were of minor relevance.

**1459 Board #240 MAY 30 11:00 AM - 12:30 PM**  
**Progression Of Ankle Muscle Activation Performing Exercises With Different Types Of Body Stability**

Victor Tella, Julio Martin, Sebastian Borreani, Juan Carlos Colado, Fernando Martin, Joao Alves. *University of Valencia, Valencia, Spain.*  
*(No relationships reported)*

Ankle injury is one of the most prevalent in athletics. Rehabilitation protocol must include proprioception to improve the ankle stability and thus to the return to the functional status. Proprioception and balance training equipments are used despite the insufficient knowledge about a proper progression with these devices.

**PURPOSE:** To compare ankle muscular activity performing 4 exercises performed in stable and unstable conditions using Thera-Band® devices.

**METHODS:** 18 physically fit and healthy male subjects took part in a randomized, within-subject design assessment. The maximum isometric voluntary contraction (MIVC) was evaluated for the normalization. Peroneus longus (PL), tibialis anterior (TA) and soleus (S) muscular activities were recorded, and then the average root mean square values of all of them were calculated. Surface electromyography activity was analyzed during the central 16 seconds of 20 of 4 isometric unipodal postures: Sitting on swissball and foot over the floor (SF), standing up on the floor (UF), standing up on a Rocker Board (UR) and standing up on a Stability Soft (US). All values, expressed as the mean of the 5 muscles %MIVC, were compared using a mixed-model MANOVA with a post-hoc analysis of Bonferroni. Significance level was set at p≤0.05.

**RESULTS:**

|    | Peroneus Longus | Tibialis Anterior | Soleus        | Total Mean    |
|----|-----------------|-------------------|---------------|---------------|
| SF | 36.22 (5.04)    | 4.30 (0.54)       | 15.71 (1.91)  | 18.74 (2.24)  |
| UF | 45.05 (6.56)*   | 11.79 (2.10)*     | 27.83 (3.04)* | 28.22 (2.97)* |
| UR | 46.39 (6.80)*   | 18.49 (3.38)†     | 28.62 (3.26)* | 31.16 (3.24)† |
| US | 49.12 (6.11)*   | 19.38 (3.12)†     | 30.35 (2.75)† | 32.95 (2.68)† |

Data is expressed as a mean (SEM) in percentage of the MIVC.  
\* indicates significant differences ( $p \leq 0.05$ ) related to SF  
† indicates significant differences ( $p \leq 0.05$ ) related to SF and UF  
SF= sitting on swissball and foot on the floor, UF= standing up on the floor, UR= standing up on a Rocker Board, US= standing up on a Stability Soft.

**CONCLUSION:** Unipodal exercise performed sitting on the swissball generates the lower ankle muscles activation. Rocker Board and Soft Stability are unstable surfaces which increase significantly ankle muscle activity in comparison with stable surface. US provokes greater but not significant activation of all ankle muscles in comparison with the UR probably due to the direction of the unbalance which is multidirectional and unidirectional respectively.

**1460 Board #241 MAY 30 11:00 AM - 12:30 PM**  
**Changes In Functional Balance Among Firefighters Following Live Fire Training**

Deanna Colburn, Serina J. McEntire, Joe Suyama, Steven E. Reis, Riana R. Pryor, Priya Khorana, Jennifer Erin, Francis X. Guyette, David Hostler. *University of Pittsburgh, Pittsburgh, PA.* (Sponsor: Fredric Goss, FACSM)  
(No relationships reported)

Slips, trips, and falls are a common cause of injury and disability among firefighters. Little is known about the relative contribution of protective clothing, physical fitness, and body composition on functional balance following fire suppression.

**PURPOSE:** Determine if the time to complete a test of functional balance or the number of errors committed during the test changes after fire suppression and if these variables are related to maximal oxygen consumption or body composition.

**METHODS:** 31 firefighters (90% male) had maximal oxygen consumption and body fat ( $18.4 \pm 5.3\%$  male,  $17.5 \pm 4.4\%$  female) measured prior to participating in a 20-minute live fire exercise at a county fire academy. Subjects completed a test of functional balance at a baseline assessment in shorts and athletic shoes and immediately before and after fire suppression while wearing thermal protective clothing and breathing apparatus. Subjects completed three trials of the task at each assessment. Time to complete the task and the number of errors committed were recorded. Repeated measures ANOVA was performed to identify changes in time and errors. Correlations were calculated between VO<sub>2</sub>max and body fat against the change in time to complete the task and change in errors committed.

**RESULTS:** Body core temperature following fire suppression was  $38.5 \pm 0.5^\circ\text{C}$  and heart rate after exiting the fire was  $152 \pm 28$  bpm. Time to complete the task did not differ between baseline in normal clothing ( $12.3 \pm 4.4$  sec), compared to pre- ( $12.1 \pm 4.0$ ), and post- ( $12.2 \pm 3.9$ ) fire in protective clothing ( $p = 0.84$ ). There was a trend ( $p = 0.056$ ) towards more errors committed after fire suppression (1.4) when compared to baseline (0.9). A correlation was identified ( $r = -0.41$ ,  $p = 0.04$ ) between VO<sub>2</sub>max and time to complete the task with high VO<sub>2</sub>max associated with faster completion times. No significant correlations were identified between VO<sub>2</sub>max and errors or between body fat (%) and either time to complete or errors committed.

**CONCLUSIONS:** Time to complete a test of functional balance and the number of errors committed during the task did not differ either between normal clothing and protective clothing conditions or after a single 20-minute bout of fire suppression. Maximal oxygen consumption, but not percent body fat, was correlated with time to complete the task.

**1461 Board #242 MAY 30 11:00 AM - 12:30 PM**  
**The Role of Foot Type in Dynamic Balance Performance**

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(No relationships reported)

The Star Excursion Balance Test (SEBT) is a simple clinical test designed to measure dynamic balance. Determining which parameters are associated with SEBT performance can help therapists understand potential underlying impairments that lead to decreased or enhanced dynamic balance performance. Specifically, the association between SEBT performance and foot type is yet to be determined. The Arch Index (defined as the ratio between midfoot and total foot area) is a simple and reliable measure used to quantify foot type.

**PURPOSE:** Our primary purpose was to investigate the association between foot morphology and Star Excursion Balance Test (SEBT) performance in recreational runners. The secondary purposes were to explore the association between the severity of past injuries and SEBT performance and to test the hypothesis that increased severity of past injuries will be correlated with flatter feet among recreational runners.

**METHODS:** 20 healthy recreational runners (15 women, 5 men, aged 23 -58 years) participated in this cross-sectional study. We interviewed the participants about their running habits and history of injuries. A pressure sensitive mat and associated software (Footscan USB plate, RSScan International, Olen, Belgium) was used to obtain the static footprints of all participants. Arch indexes were calculated from the footprints. Participants performed the SEBT.

**RESULTS:** Participants with lower medial longitudinal foot arch reached significantly farther on all SEBT directions except for anterolateral. The Spearman correlation coefficient between arch index and the SEBT composite score was 0.55 and the  $R^2$  was 0.31 ( $p = 0.02$ ) indicating that arch index explained 31% of the variance in SEBT performance. Severity of injuries in the past was not associated with SEBT performance ( $p > 0.1$ ) and was significantly associated with arch index ( $R_s = 0.54$ ,  $p = 0.02$ ).

**CONCLUSION:** When using the SEBT to measure dynamic balance, researchers and clinicians need to be aware of potential differences in performance with different foot types. In the clinic, asymmetry in arch index may affect symmetry in SEBT performance. In the research setting, arch index may need to be adjusted for when comparing SEBT performance between groups.

**1462 Board #243 MAY 30 11:00 AM - 12:30 PM**  
**Reliability Investigation of A Novel Custom-made Body Posture and Spinal Curve Measurement System**

Shih-Ting Wang<sup>1</sup>, Yu-Chi Hsu<sup>1</sup>, Yi-Hsuan Yeh<sup>1</sup>, Yu-Lin Yu<sup>1</sup>, Chich-Haung Yang<sup>2</sup>, Lan-Yuen Guo<sup>1</sup>. <sup>1</sup>*Kaohsiung Medical University, Kaohsiung, Taiwan.* <sup>2</sup>*TzuChi University, Hualien, Taiwan.*  
(No relationships reported)

Poor posture may not only induce musculoskeletal pain, but also related to dysfunction in cardiopulmonary system. Measuring posture and spinal curve can be as a reference for clinical decision. Few instruments can assess both posture and spinal curve simultaneously.

**PURPOSE:** This study was to develop a custom-made body posture and spinal curve measurement system and to examine its with-day and between-days reliability while measuring both in sagittal and frontal planes.

**METHODS:** Five healthy subjects (two male and three female, mean age 20.2 years old) were recruited. The measurement system included three encoders for measuring the distance of moved and representing the relative positions of the subjects' anatomic makers in the three dimensional space. For measuring the spinal curve, those makers included the spinal process of the 1<sup>st</sup> and 12<sup>th</sup> thoracic (T1, T12) and of the 1<sup>st</sup> and 5<sup>th</sup> lumbar (L1, L5). Thoracic kyphosis was defined as the angle projected in sagittal plane between the intersections of the tangents at the T1 and the T12, meanwhile the lumbar lordosis was defined by using the tangents at the L1 and the L5. For measuring the body posture in sagittal plane, the craniocervical (CVA) angle was determined by the measured positions of the ear canal and the spinal process of the 7<sup>th</sup> cervical and trunk forward lean (TFL) angle was determined by the measured positions of acromioclavicular joint and greater trochanter of femur. For measuring the body posture in coronal plane, back symmetry variables was calculated through measuring the positions of the following markers (shoulder, axilla and trunk) bilaterally. With-day and between-days reliability were determined using statistical analysis by intraclass correlation coefficient (ICC).

**RESULTS:** For both with-day and between-days measurements, the ICC values of the thoracic kyphosis and lumbar lordosis were between 0.77-0.98. For measuring the body posture in sagittal plane, ICC values of the CVA and TFL were between 0.90-0.95. For measuring the body posture in coronal plane, ICC values of the back symmetry variables were between 0.78-0.93.

**CONCLUSION:** Body posture and spinal curves measurement using this custom-made system demonstrated a good reliability.

**ACKNOWLEDGEMENTS:** This study was supported by NSC 99-2410-H-037-009-MY2

1463 Board #244 MAY 30 11:00 AM - 12:30 PM

**A History of Multiple Concussions Does Not Alter Dual Task Gait Stepping Characteristics**

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(Sponsor: Chris Hass, FACSM)  
(No relationships reported)

Recent investigations have suggested that multiple concussions, typically identified as three or more, may have serious long term consequences including multiple cognitive and neurological pathologies resulting in impaired quality of life. A recent investigation identified alterations in gait performance in individuals with a concussion history; however, the specific threshold of three or more concussions has not been assessed.

**PURPOSE:** The purpose of this study was to identify changes in gait spatial and temporal characteristics in individuals with a history of at least 3 concussions.

**METHODS:** Ten individuals (age: 20.6 ± 1.2 years, ht: 1.76 ± 0.12m, wt: 83.8 ± 24.8kg) with a history of at least three concussions (3.5 ± 0.9), CONC group, were matched to ten individuals with no history of concussions (age: 20.5 ± 1.6 years, ht: 1.75 ± 0.11m, wt: 83.6 ± 22.9kg), No CONC group. All participants performed 5 trials of self-selected single task gait (ST) and dual task gait (DT) on a 4.9m instrumented walkway, previously identified as valid and reliable. The dual task group answered working memory challenges while walking. Stepping characteristics were compared using a 2 (group) x 2 (task) repeated measures ANOVA.

**RESULTS:** There were no interaction (p=0.243) or group effect (p=0.495) for gait velocity (CONC: ST: 1.30 ± 0.12m/s, DT: 1.18 ± 0.11m/s and No CONC: ST: 1.31 ± 0.08, DT: 1.27 ± 0.26m/s). Similarly, there was no interaction (p=0.230) or group effect (p=0.967) for stride length (CONC: ST: 1.36 ± 0.07m, DT: 1.31 ± 0.09m and No CONC: ST: 1.34 ± 0.7m, DT: 1.34 ± 0.15m). Further, there was no interaction (p=0.838) or group effect (p=0.986) in double support phase (CONC: ST: 23.8 ± 1.9%, DT: 24.7 ± 1.9% and No CONC: ST: 23.8 ± 2.0%, DT: 24.6 ± 2.6%). Finally, there was no difference between groups for the number of dual task challenges successfully completed.

**CONCLUSION:** The results of this study suggest there are no differences in gait spatial and temporal characteristics between individuals with a history of multiple concussions and those with no history of concussion when performing working memory dual task challenges during normal overground walking. This population of otherwise young healthy adults appeared to possess sufficient supraspinal compensatory resources to accomplish both a cognitive and postural task simultaneously.

1464 Board #245 MAY 30 11:00 AM - 12:30 PM

**Accelerometry Reveals Improvements In Frontal Plane Control After Only Four-weeks Of Balance And Mobility Training**

Brandi S. Row, Kali J. Tupper. Western Washington University, Bellingham, WA.  
(No relationships reported)

**PURPOSE:** To study the effects of balance-training (BT) on frontal plane control during gait.

**METHODS:** A 4-week BT program was conducted with physically active older men & women (Exercise group [EX], n = 10, mean age [standard deviation, SD]: 77.2 [8.9] yr; waitlist control group [EX2], n = 9, 75.8 [6.0] yr). The BT program focused on multisensory, motor, & cognitive contributors to postural control & gait. EX2's training had less seated training & more weight-bearing exercise.

Four gait trials included: Normal (NORM) & Maximal (MAX) speed, and NORM & MAX speed with a cognitive distraction (COG). Average per-step peak medial-lateral (M-L) trunk acceleration (ACC) magnitude & variability (SD) were calculated.

For the initial 4-week intervention phase, repeated measures ANOVA (with factors Time [pre, post], Group [EX, EX2]) were conducted for measures appropriate for parametric tests, otherwise, the Wilcoxon rank-sum (between groups) or Wilcoxon matched pairs (within group) tests were used. For EX2's waitlisted intervention analysis, a one-way ANOVA (with factor Time [pre, post, EX2-post]) was used for variables suitable for parametric tests; otherwise, the Friedman's test was used.

**RESULTS:** No M-L trunk ACC changes occurred for EX or EX2 from pre to post. Though no changes occurred in gait speed, the waitlisted EX2 group had significant reductions in M-L ACC variables following their BT phase between post- & EX2-post (Table 1).

**Table 1:** Mean [SD] of acceleration results.

| ACC VARIABLE (m/s <sup>2</sup> )                | PRE                                 | POST                                | EX2-POST                    |
|---|-------------------------------------|-------------------------------------|-----------------------------|
| NORM, mean per-step peak M-L ACC                | EX: 3.23 [0.87]<br>EX2: 2.87 [0.66] | EX: 3.00 [0.74]<br>EX2: 2.77 [0.57] | EX: N/A<br>EX2: 2.41 [0.37] |
| MAX, mean per-step peak M-L ACC                 | EX: 6.13 [2.19]<br>EX2: 5.31 [1.13] | EX: 6.87 [3.05]<br>EX2: 5.62 [1.74] | EX: N/A<br>EX2: 4.37 [1.44] |
| MAX, mean per-step M-L ACC variability (SD)     | EX: 1.96 [0.64]<br>EX2: 1.66 [0.36] | EX: 2.16 [0.99]<br>EX2: 1.81 [0.61] | EX: N/A<br>EX2: 1.43 [0.46] |
| MAX COG, mean per-step M-L ACC variability (SD) | EX: 1.34 [0.45]<br>EX2: 1.24 [0.27] | EX: 1.22 [0.48]<br>EX2: 1.17 [0.24] | EX: N/A<br>EX2: 1.02 [0.33] |

**CONCLUSIONS:** Reduced magnitude & variability of per-step M-L ACC following BT indicate improved frontal plane control during NORM & MAX walking & MAX COG gait. The latter result may also represent an improved ability to switch attention between walking & the cognitive task.

1465 Board #246 MAY 30 11:00 AM - 12:30 PM

**Differential Effects Of Foot Sole Sensory Impairment On Balance And Gait**

Shuqi Zhang, Li Li, FACSM. Louisiana State University, Baton Rouge, LA.  
(No relationships reported)

Foot somatosensation provides valuable feedback information to central nervous system to maintain balance. Acute reduced foot sensation would change the plantar pressure distribution during standing and gaits. However, the effect of long-term foot sole sensory impairment on plantar pressure distribution is unclear.

**PURPOSE:** this study was to examine the effects of chronic sensory loss due to peripheral neuropathy (PN) on plantar pressure distribution during walking and standing.

**METHODS:** Twenty-four elderly PN suffers (7 male, 17 female) participated the study (average age/standard deviation = 73.0/6.9). The foot sole sensitivity was tested at big toe (BT), 1<sup>st</sup> and 5<sup>th</sup> metatarsal (M1 and M5), mid-foot (MF) and med-heel (MH) with a 5.07 monofilament and sties was divided into sensitive and insensitive groups based on test score. Relative peak pressure (RPP) of the five tested sites collected according to sensitivity of each of the five sites via an in-shoe pressure system during walking and standing. Walking was conducted on a treadmill at 0.45 m/s (1 mile / hour) for 20 seconds, while standing data was collected during a 30 seconds quiet standing with eyes open. Five-way MANOVA examined the association between dependent variables as a group, RPP of BT, M1, M5, MF and HL, and the sensitivity (sensitive versus insensitive groups) of BT, M1, M5, MF and HL as independent variables during standing and walking separately. Significant associations were examined further using Tukey's test.

**RESULTS:** during standing, the sensitivity of BT affected average RPP at BT significantly (P < .05), where RPP associated with insensitive BT (8.1% ± 5.7%) was greater than with sensitive BT (4.5% ± 4.9%). Furthermore, the RPP at HL was greater for insensitive MF (36.1% ± 17.9%) than sensitive MF (23.6% ± 7.4%) (P < .05). No pressure distribution change observed due to insensitivity of other sites during standing. No pressure distribution changes observed during walking.

**CONCLUSION:** These results indicate feedback from foot sole sensation in gait is not as important as in standing. It suggests maintaining standing balance is more reliance on the feedback control mechanism, while gait control is more reliance on the feedforward control mechanism.

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**1466** Board #247 **MAY 30 11:00 AM - 12:30 PM**  
**Relationships Between Presynaptic Inhibition and Static Postural Sway in Subjects With and Without Diabetic Neuropathy**

Kevin G. Burfeind, Junggi Hong. *Willamette University, Salem, OR.*  
(No relationships reported)

Nearly 50% of diabetic patients also suffer from neuropathy, the most common form being diabetic peripheral neuropathy (DPN). DPN affects men and women with equal frequency, and symmetrically damages nerves of the limbs, especially the foot, leading to balance impairment. One mechanism that has been reported to be important for balance, yet has not been investigated in DPN patients, is the spinal reflex. The inhibitory or facilitatory behavior of the spinal reflex plays an important role in controlling static postural sway by filtering afferent nerve signals.

**PURPOSE:** To compare the differences in spinal reflex and balance in subjects with and without DPN to determine the influence of the spinal reflex on balance in DPN patients.

**METHODS:** Eight DPN patients (58+6 yrs) and eight normal subjects (59+7 yrs) participated in this study. Presynaptic inhibition (PI) and static postural sway were tested for each subject. The mean percent difference of the conditioned relative to the unconditioned spinal reflex amplitude was assessed to calculate PI. To quantify static postural sway, a balance index was determined for each subject from a single-leg balance assessment on a computerized balance-measuring device.

**RESULTS:** DPN patients showed less PI than the normal group (47+30% vs. 87+17%,  $p < 0.05$ ), as well as increased balance index (0.65+0.24 vs. 0.38+0.06,  $p < 0.05$ ) indicating increased postural sway. No significant correlation was found between PI and balance index ( $R = 0.37$ ,  $p = 0.15$ ).

**CONCLUSION:** DPN patients demonstrated decreased spinal reflex inhibition accompanied by a decrease in static balance compared to normal age-matched controls. Further research is necessary to explore the role of PI in the decreased balance seen in DPN patients.

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**1467** Board #248 **MAY 30 11:00 AM - 12:30 PM**  
**Human Motion Differentiation Based on Inertial Parameters**

Chao-Ping Chi<sup>1</sup>, Kuo-Wei Tseng<sup>1</sup>, Wen-Ting Tei<sup>2</sup>, Yi-Pin Wang<sup>3</sup>. <sup>1</sup>Taipei Physical Education College, Taipei City, Taiwan. <sup>2</sup>Cheng Hsin General Hospital, Taipei City, Taiwan. <sup>3</sup>Power & Health Rehabilitation Clinic, Taipei City, Taiwan.  
(No relationships reported)

**PURPOSE:** This project plans to develop an alert system based on inertial parameters with human motion differentiation, high-risk movement detection, and fall detection.

**METHODS:** 90 subjects volunteered to participate in this study. The Xbus Master (Xsens Technologies B.V., The Netherlands) inertial parameter detector were carried by the subjects during various movements, including standing, sitting, supine, prone, lying, up/down stairs, sit-to-stand, stand-to-sit, running, jumping and walking.

**RESULTS:** An algorithm was developed for each decision node with hierarchy structure as binary tree method. A human motion classifier was constructed with best basis feature extraction, maximal likelihood classifier and the accuracy tested. Half of the sample data were used as the released-set and applied in constructing individual classifiers. The other half will be used as the withhold-set and employed in testing reliability of the individual classifiers. The results have shown that the level 3 static and transfer action have high sensitivity (95.6%-100%) and level 4 static and transfer action have well sensitivity (84.4%-93.3%). (Tab. 1)

**CONCLUSION:** The method has potential applications to apply in telemedicine and fall-risk analysis for the elderly, and long-distance monitoring and behavioral pattern analysis for daily activities modern of elderly people. There are clear limits in the calculation time on what can be achieved in a free-living monitoring environment.

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**1468** Board #249 **MAY 30 11:00 AM - 12:30 PM**  
**Postural Control, Knee Alignment, And Self-reported Function In Patients With Symptomatic Knee Osteoarthritis And Normal Control Subjects**

Carrie L. Silkman, Jennifer M. Medina McKeon. *University of Kentucky, Lexington, KY.*  
(No relationships reported)

**PURPOSE:** Declining levels of function are associated with osteoarthritis (OA); however it is unknown to what degree balance deficits occur. The purpose was to evaluate differences between healthy individuals and those with OA on subjective measures of pain and disability, and objective measures of structure, balance, and clinical measures of function.

**METHODS:** Ten subjects (1 male, 9 females, age = 40.4 ± 11.7 yrs, ht = 166 ± 9 cm, mass = 82.6 ± 14 kg) with OA were matched by sex, height and mass with 10 healthy subjects (1 male, 9 female, age = 41.6 ± 11.9 yrs, ht = 166 ± 9 cm, mass = 81.9 ± 15 kg). The subjects completed the Knee injury Osteoarthritis Outcome Survey (KOOS), which consists of 5 subscales (Pain, Symptom, Activities of Daily Living (ADL), Sports and Recreation (Sport/Rec), and Quality of Life (QOL). Subjects underwent functional testing including the 15m Timed Up and Go (TUG), 15.24m walk test, timed stair ascent, and stair descent. Balance was measured using the step test as a dynamic balance task, and force plate static balance as measured by time to boundary (TTB). Additionally, knee varus alignment was measured bilaterally. Hedge's g effect sizes [95% confidence intervals] were calculated to assess the difference between the affected limb of the OA group compared to the matched limb of the control group for each outcome.

**RESULTS:** The OA group demonstrated worse scores for all subscales of the KOOS (pain 5.2 [1.8]; KOOS symptom 5.7 [2.0]; KOOS ADL 2.1 [1.1]; KOOS sport/rec 3.8 [1.5]; KOOS QOL 3.9 [1.5]), increased knee varus (1.0 [0.9]), and slower stair ascent (1.0 [0.9]) than the healthy group. For other functional tests (TUG 0.5 [0.9]; Walk test 0.5 [0.9]; Stair descent 0.8 [0.9]), confidence intervals encompassed zero, indicating a need for caution when interpreting results. Lastly, there was no difference in balance between groups for either measure (Step Test 0.2 [0.9]; TTB mean of minima in the medial-lateral direction 0.6 [0.9]; TTB mean of minima in the anterior-posterior direction 0.1 [0.9])

**CONCLUSION:** Patient reports of functional deficits as a result of OA were not substantiated by laboratory testing of balance, and not well-associated with functional, clinical tests. Other objective methods for determining the extent in OA, which are also highly correlated with patient reports, are needed.

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**1469** Board #250 **MAY 30 11:00 AM - 12:30 PM**  
**Post Nuchal Icing Effect On Neck Fitness And Balance Performance Between Boxers And Non-boxers**

Shih-Wei Chou<sup>1</sup>, Cheng-Hsiu Lai<sup>2</sup>, Yu-Tsai Tu<sup>1</sup>, Yin-Chou Lin<sup>1</sup>, Yi-Liang Cheng<sup>2</sup>, Ching-Ya Huang<sup>2</sup>. <sup>1</sup>Chang Gung Memorial Hospital, Taoyuan, Taiwan. <sup>2</sup>Taipei Physical Education College, Taipei City, Taiwan. (Sponsor: Chia-Hua Kuo, FACSM)  
(No relationships reported)

Boxing involves impacts to the head, potentially resulting in acute or chronic head and neck injuries. Objective: To evaluate post nuchal icing effect on the neck fitness and balance performance between the boxer and the age-matched non-boxers who had not been specialized in any specific sport.

**METHODS:** A 2 x 2 factorial design between the boxing and the icing pre-post factors was conducted. Twenty five boxers from the Taipei Physical Education College (20.92 ± 1.35 years of age; 169.32 ± 9.86 cm; 64.84 ± 13.24 kg) and 11 students of non-sport majors (21.55 ± 1.51 years of age; 169.55 ± 6.15 cm; 65.10 ± 8.41 kg) were enrolled as the boxer group and the non-boxer group, respectively. Their balance performance were assessed by the sensory organization test (SOT) with the Smart Balance Master (Neurocom International Inc., USA) and then the microFET3 (Hoggan Health Industries, USA) was used to measure neck maximal isometric strength and active range of motion (ROM) in six directions. After icing intervention, the boxers and the control group were measured again for their balance performance and neck fitness.

**RESULTS:** Statistic significance was shown in the more challenging conditions, i.e., conditions 5 and 6 of the SOT for the main icing pre-post effect, and condition 5 for the interaction effect. In sensory analysis, statistic significance was shown in the visual and vestibular ratios only for the main icing pre-post effect. In neck fitness with respect to maximal isometric strength and active ROM, the main effects of boxing and icing pre-post factors and their interaction effect were almost all statistically significant.

**CONCLUSION:** In balance, icing may be effective of both the boxer and non-boxer groups, but more in the boxers. In general, maximal isometric strength scored higher but active ROM scored lower in the boxers than in the non-boxers. Icing may be also effective in both strength and flexibility of both groups, but more in the boxers. As a result, the detrimental effect in boxing and the beneficial effect of icing were demonstrated in terms of neck fitness and balance performance.

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1470 Board #251 MAY 30 11:00 AM - 12:30 PM

**Relationship Between Anthropometric And Postural Balance In Semi-static Upright Posture**

Angelica Castilho Alonso, Luciana Baltazar Dias, Emmanuel Gomes Ciolac, Fábio Brabieri, Júlia MD<sup>1</sup> Andréa Greve. *faculdade de medicina da universidade de são paulo, São Paulo, Brazil.*  
(No relationships reported)

**INTRODUCTION:** The maintenance of posture is a constant contest for the human body, because it demands a system capable of responding quickly and efficiently, even in unstable situations, avoiding falls and maintaining balance. Objectives: to assess the influence of anthropometric characteristics and gender on postural balance of irregularly active adults in the upright, bipedal and semi-static posture, with eyes open and closed.

**METHODS:** 100 individuals of both genders were assessed, with age between 20 and 40 years, through an anthropometric measurements, bone densitometry (lean and fat mass, composition and bone mineral density), BMI, height, body mass, lower and head length limb and upper torso length, waist and hip, support base and postural balance test performed on a force platform.

**RESULTS:** The correlation analysis showed weak correlations between the postural balance and anthropometric measure. The multiple linear regression analysis demonstrated that in the whole group (female and male) height explained 12% of the medial-lateral displacement, 10% of the speed of oscillation and 11% of the scroll area. The torso circumference length explained 6% of the shift from anterior to posterior. In the eyes closed condition, height and base of support explained 18% of the medial lateral displacement, height explained 10% of the speed displacement and 5% of the scroll area.

**CONCLUSION:** Postural balance measured by posturography is little influenced by anthropometric variables with eyes open and closed. Postural balance is more influenced by anthropometric factors in the men than those of women. Height is the anthropometric variable that most influenced the postural balance among the three groups, with eyes open and closed. The balance between men and women measured by posturography is equal, except for the lateral displacement and average speed of oscillation, which are larger in women.

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**A-41 Free Communication/Poster - Pregnancy Postpartum**

MAY 30, 2012 7:30 AM - 12:30 PM

ROOM: Exhibit Hall

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1471 Board #252 MAY 30 9:30 AM - 11:00 AM

**The Effect Of Exercise During Early Lactation On Bone Mineral Density At 1 Year Postpartum**

Andrea Sorvillo, Heather Colleran, Laurie Wideman, Cheryl Lovelady. *The University of NC at Greensboro, Greensboro, NC.* (Sponsor: Allan Goldfarb, FACSM)  
(No relationships reported)

**PURPOSE:** Hyperprolactemia, which results in increased bone turnover, causes breastfeeding women to lose 1 to 10% of bone mineral density (BMD) by 6 mo postpartum (PP). BMD usually returns to prepregnancy levels with weaning; however, not in all women. Exercise, particularly resistance training, prevents the loss of BMD. We hypothesized that exercise may slow bone loss during early lactation, resulting in higher BMD at 1 yr PP. Therefore, the purpose of this study was to determine the effects of a 16 wk exercise program, beginning 4 wks PP, on BMD at 20 wks and 1 yr PP.

**METHODS:** At 4 wks PP, fully breastfeeding women were randomized to either exercise group [EG, n=18, aerobic and resistance exercise (3d/wk)] or control group [CG, n=18] for 16 wks. Exercises included bench press, bent over row, deadlift, military press, pushups, squats and walking 30-40 min/d, 4d/wk or 10,000 steps/d. Measurements were made at baseline (4 wks PP), end of intervention (20 wks PP), and 1 yr PP. Maximal strength and predicted maximal oxygen consumption (VO<sub>2</sub> max) were determined by 1-rep max and submax treadmill test. BMD was measured by DXA at lumbar spine (LS), hip and total body. Prolactin levels (analyzed by ELISA) and calcium intake (24-hr diet recalls) were measured in a subsample of 20 women. Repeated measures ANOVA was used to test for time and group differences.

**RESULTS:** At 20 wks PP, strength increased significantly more in EG compared to CG; with no differences in VO<sub>2</sub> max. LS BMD decreased in both groups; however, EG decreased less (EG = 3.59 ± 2.12% vs. CG = 5.17 ± 3.28%, p = 0.10). Results were similar for hip and total body. At 1 yr PP, LS, hip, and total body BMD changed significantly over time (p < 0.001) but not by group. When controlling for calcium intake and prolactin levels, EG lost less LS BMD from 4 to 20 wks PP and gained slightly more from 20 wks to 1 yr PP (EG 1.114 ± 0.128 to 1.070 ± 0.130 to 1.107 ± 0.127 vs. CG 1.105 ± 0.139 to 1.031 ± 0.135 to 1.065 ± 0.137, p = .02). The overall change in the EG group was -0.67 ± 2.23%, while the change in the CG was -3.65 ± 2.41%; a 5.4 fold difference in LS BMD change. Hip and total body BMD did not change significantly over time or by group.

**CONCLUSIONS:** These results suggest that resistance exercise slows LS BMD losses during early lactation, resulting in higher BMD levels at 1 yr PP. This may result in a decreased risk for fracture as women age.

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1472 Board #253 MAY 30 9:30 AM - 11:00 AM

**Fat Tissue Inflammation, Sedentary Time, and Light Daily Activity among Postpartum Latinas**

Paska Permana<sup>1</sup>, Barbara Ainsworth, FACSM<sup>2</sup>, Michael Belyea<sup>2</sup>, Kathie Records<sup>2</sup>, Sonia Vega-López<sup>2</sup>, Allison Nagle-Williams<sup>2</sup>, Dean V. Coonrod<sup>3</sup>, Colleen Keller<sup>2</sup>.  
<sup>1</sup>Phoenix Veterans Affairs Health Care System, Phoenix, AZ <sup>2</sup>Arizona State University, Phoenix, AZ <sup>3</sup>Maricopa Integrated Health System, Phoenix, AZ  
(No relationships reported)

Postpartum Latinas have high rates of obesity and are at risk for obesity-related metabolic disorders, yet their physical activity (PA) rates are often quite low. Chronic sub-clinical inflammation associated with obesity may exacerbate risk for metabolic disorders and pro-inflammatory cytokines released by fat tissue contribute to systemic inflammation.

**PURPOSE:** To determine if fat tissue inflammation correlates with daily PA in postpartum Latinas.

**METHODS:** *Madres para la Salud* is a prospective, randomized trial exploring the effectiveness of a culturally specific social support intervention using moderate-intensity PA to reduce body fat, systemic and fat tissue inflammation, and depression symptoms in postpartum Latinas. PA was assessed at baseline with the ActiGraph GT3X accelerometer, worn for 7 days. PA intensities were determined from sedentary to vigorous using Freedson's and Matthews' cut-points. A subcutaneous abdominal fat biopsy and a blood draw were performed on a subset (n=15) of participants. We determined mRNA expression levels of inflammatory markers Interleukin-6 (IL-6), Interleukin-8 (IL-8), and Tumor Necrosis Factor  $\alpha$  (TNF- $\alpha$ ) in fat tissue using Real Time PCR. Plasma concentrations of IL-6 and IL-8 were measured using Enzyme Linked Immunosorbent Assay. Data are presented as Mean $\pm$ SD.

**RESULTS:** Daily proportion of light PA (39 $\pm$ 9%) correlated negatively (r=-0.98, p<0.001) with sedentary time (58 $\pm$ 10%). Fat tissue mRNA expression levels, but not plasma concentrations, of IL-6 (3.8 $\pm$ 6.8 Relative Units), IL-8 (1.7 $\pm$ 1.6), and TNF- $\alpha$  (0.9 $\pm$ 0.2) correlated with sedentary time (r=0.47, p=0.08; r=0.7, p=0.004; r=0.55, p=0.04, respectively) and inversely with light PA (r=-0.51, p=0.05; r=-0.75, p<0.001; r=-0.59, p=0.02, respectively).

**CONCLUSION:** The correlation between the mRNA expression levels of inflammatory markers in fat tissue with sedentary time and, inversely, with light PA is strengthened by the inverse correlation between the two types of activity. These results indicate that even light PA incorporated in daily routine, independent of more intense PA, may already reduce inflammation in fat tissue in postpartum Latinas. Moderate-intensity intervention will likely further reduce fat tissue and systemic inflammation, thus minimize risk for obesity-related diseases.

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1473 Board #254 MAY 30 9:30 AM - 11:00 AM

**Healthcare Providers' Beliefs And Practices Related To Antenatal Physical Activity For Sedentary And Overweight Women**

Margaret J. Gutilla, Jenn A. Leiferman. *University of Colorado, Aurora, CO.* (Sponsor: John B. Bartholomew, FACSM)  
(No relationships reported)

Despite the fact that the American Congress of Obstetricians and Gynecologists recommends pregnant women who are free of obstetrical complications engage in regular leisure physical

activity, women who are pregnant engage in less physical activity than their nonpregnant counterparts. Pregnant women often report a lack of knowledge concerning the safety of exercising during pregnancy and believe that if they received information related to how to safely and effectively exercise during pregnancy it would facilitate their engagement in physical activity.

**PURPOSE:** To explore the relationship between healthcare providers' beliefs that sedentary and/or overweight pregnant women should begin exercise and their current practices regarding exercise counseling.

**METHODS:** Obstetricians and certified nurse midwives who provide obstetric care for women residing in Denver-Aurora completed a cross-sectional survey, containing a total of 48 items, assessing their current beliefs and practices pertaining to antenatal physical activity.

**RESULTS:** The sample included 102 healthcare providers (HCPs) with the majority of respondents being obstetricians (70.6%), female (79.4%), non-Hispanic white (87%) and reporting an average of 18.7 years of healthcare experience (SD=10.2 years, range=3-41 years). Overall, HCPs reported that they discuss exercise with approximately 73% (SD=26.8%) of their patients. The majority of HCPs (92%) also believe that sedentary patients should begin an exercise program during pregnancy; however only 47% reported that they always or often discuss physical activity with their sedentary patients. Further, HCPs more strongly believed that overweight and sedentary patients should begin an exercise program, compared to only sedentary patients ( $p=0.0042$ ).

**CONCLUSIONS:** These data suggest that, in general, HCPs believe that women who are free of obstetric complications should engage in regular physical activity during pregnancy. However, many HCPs are not currently providing antenatal physical activity anticipatory guidance. Further analysis is warranted to determine other factors (e.g. perceived provider, practice, and patient level barriers) that may be influencing providers' ability or decision to deliver physical activity counseling. Supported by AHRQ #1R03HS018595-01A1.

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1474 Board #255 MAY 30 9:30 AM - 11:00 AM

**The Effects of Supervised Exercise and Telehealth Support on Postpartum Health-Related Physical Fitness**

Katie L. Chapman, Darren ER Warburton, Shannon SD Bredin. *University of British Columbia, Vancouver, BC, Canada.*

(No relationships reported)

Excessive gestational weight gain and failure to return to a healthy body weight within one year postpartum heightens a woman's risk for obesity and related co-morbidities. Moreover, the transition to motherhood (including various barriers to physical activity participation) often leads to a decline in health-related physical fitness. Therefore, physical activity interventions tailored to the unique needs of postpartum women are needed.

**PURPOSE:** This prospective randomized intervention study examined changes in health-related physical fitness after participation in either supervised mom-and-baby fitness classes (Fit 4 Two) or telehealth physical activity support (the Physical Activity Line) versus control.

**METHODS:** Thirty-three women (6 wks to 11 mo postpartum) were assigned randomly to one of three conditions for 10 wks: 1) the Fit 4 Two group (twice/wk,  $n = 11$ ), 2) the Physical Activity Line group (twice/wk,  $n = 11$ ), or 3) a usual activity control group ( $n = 11$ ). Health-related physical fitness (BMI, grip strength, push-ups, flexibility, and aerobic fitness) was measured pre- and post-intervention.

**RESULTS:** In both the Fit 4 Two and the Physical Activity Line group, key changes included a similar reduction in BMI ( $-2.1 \pm 2.4\%$  and  $1.6 \pm 2.2\%$ , respectively), greater change in flexibility ( $8 \pm 9\%$  and  $9 \pm 9\%$ , respectively), significant increases in aerobic capacity ( $4 \pm 5\%$  and  $3 \pm 5\%$ , respectively), and an increase in number of push-ups completed in comparison to the control group. There was no significant change in grip strength in the three conditions.

**CONCLUSION:** Fit 4 Two and telehealth physical activity support are effective at improving health-related physical fitness in postpartum women. A novel telehealth program can lead to similar changes in various indicators of health-related physical fitness versus supervised exercise.

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1475 Board #256 MAY 30 9:30 AM - 11:00 AM

**Exercise During Pregnancy Decreases Cesarean Rate In Nulliparous Women**

Katrine M. Owe<sup>1</sup>, Wenche Nystad<sup>2</sup>, Hein Stigum<sup>2</sup>, Siri Vangen<sup>3</sup>, Kari Bø<sup>1</sup>. <sup>1</sup>Norwegian School of Sport Sciences, Oslo, Norway. <sup>2</sup>Norwegian Institute of Public Health, Oslo, Norway. <sup>3</sup>Norwegian Resource Center for Women's Health, Oslo University Hospital, Oslo, Norway.

(No relationships reported)

Exercise during pregnancy may influence the course of labor and mode of delivery by affecting metabolic and hormonal changes, uterine contractility, endurance, and muscle strength. Given the worldwide rising cesarean delivery (CD) rates over the past decades, the search for modifiable factors associated with CD is needed.

**PURPOSE:** To investigate the association between exercise during pregnancy and CD, both acute and elective, in nulliparous women.

**METHODS:** We used data from a population based pregnancy cohort study, involving 25,160 nulliparous women with a singleton pregnancy who were enrolled in the Norwegian Mother and Child Cohort Study (MoBa) between 2000 and 2006. Acute and elective Cesarean deliveries obtained from the Medical Birth Registry of Norway were the main outcome variables. Information on exercise frequency and type was assessed by two questionnaires in pregnancy weeks 17 and 30. From the generalized linear model, adjusted risk differences (RD) with 95% CI for different frequencies and types of exercise during pregnancy were reported.

**RESULTS:** The total CD rate was 15.6% ( $n=3928$ ), in which 67.8% ( $n=2663$ ) was acute CD. CD rates, both acute and elective type, were reduced in women exercising during pregnancy compared to non-exercisers. The greatest risk reduction was observed for acute CD among women reporting a high weekly frequency of exercise ( $\geq 6$  times per week) during pregnancy weeks 17 and 30 ( $-3.8\%$ , 95% CI  $-5.7$ ;  $-2$ , and  $-4.5\%$ , 95% CI  $-6.5$ ;  $-2.4$ , respectively). Participation in high impact exercises such as jogging, running, ballgames orienteering or high-impact aerobics in weeks 17 and 30, was associated with the largest reductions in risk ( $-5.1\%$ , 95% CI  $-6.9$ ;  $-3.3$ , and  $-6.2\%$ ,  $-9.4$ ;  $-3.0$ , respectively) compared to non-exercisers. For elective CD, exercising 1-2 per week in week 17 showed the greatest RD ( $-2.2\%$ ,  $-3.0$ ;  $-1.4$ ), whereas women had to exercise at least 6 times a week in week 30 to reach comparable risk reductions ( $-2.1\%$ ,  $-3.3$ ;  $-0.9$ ).

**CONCLUSIONS:** Nulliparous women exercising during pregnancy had a substantially reduced risk of having a CD, in particular acute CD. A "can do" attitude towards labor and self-efficacy may also play a role here.

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1476 Board #257 MAY 30 9:30 AM - 11:00 AM

**Comparison of Two BodyMedia Algorithms for Estimating Energy Expenditure During Mid-Pregnancy.**

Katie M. Smith, Lorraine M. Lanningham-Foster, Gregory J. Welk, FACSM, Christina G. Campbell. *Iowa State University, Ames, IA.*

(No relationships reported)

Excessive gestational weight gain (GWW) is an independent risk factor for future maternal chronic disease. Accurate assessment of physical activity (PA) is required to appropriately control for energy expenditure (EE) when evaluating GWW. Metabolic alterations during pregnancy complicate the assessment of PA and EE in pregnant women. The BodyMedia SenseWear® Mini armband monitor has been shown to provide accurate estimates of EE in adults but has not been tested in pregnancy.

**PURPOSE:** The purpose of the study was to evaluate the accuracy of the SenseWear® Mini physical activity armband (SWA) in predicting EE in pregnant women performing activities of daily living (ADLs). A secondary aim was to assess how a new proprietary algorithm (v5.2) performed relative to an older algorithm (v2.2).

**METHODS:** Twenty-three women completed a series of ADLs between 22-24 weeks of pregnancy. Activities included typing, folding laundry while standing, sweeping, and treadmill walking at speeds of 2.0, 2.5, 3.0 mph, 0% incline and 3.0 mph, 3% incline. Participants wore the SWA on their left arm and had oxygen consumption measured by indirect calorimetry (IC). Data from both IC and SWA were processed on a minute-by-minute basis. Correlation analyses and a mixed model analysis of variance were used to examine agreement between the measures.

**RESULTS:** Average individual correlations between IC and SWA were 0.857 and 0.865 for the old and new algorithm respectively. The model analysis showed significant main effects for the algorithm (F-Value 6.98,  $P < 0.01$ ) and activity (F-Value 21.5,  $P < 0.0001$ ). Both algorithms significantly overestimated EE for all activities except walking at 3.0 mph, 3% incline; however, follow-up tests showed that the new algorithm had significantly less error than the old algorithm (0.594 kcal/min vs 0.804 kcal/min, respectively). Post-hoc analysis for the activities showed non-significant differences between algorithms for all activities except sweeping ( $P = 0.0304$ ).

**CONCLUSION:** Both algorithms significantly overestimated EE compared to IC but the newer algorithm had less error. Additional training of the algorithms with pregnancy-specific data could minimize the overestimation of EE for this population.

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1477 Board #258 MAY 30 9:30 AM - 11:00 AM

**Measurement of Energy Expenditure During Pregnancy and Postpartum**

Rebecca A. Schlaff, Alaina K. Vince, Karin A. Pfeiffer, FACSM, Kimberly Maier, James M. Pivarnik, FACSM. *Michigan State University, East Lansing, MI.*  
(No relationships reported)

Recall questionnaires use MET values from the Compendium of Physical Activities (Compendium: Ainsworth, et al. 2011) to assess energy expenditure (EE) for pregnant women, but the validity of this practice has not been well-established.

**PURPOSE:** The purposes of this study were 1) to compare actual EE in pregnant women to MET values listed in the Compendium, and 2) to evaluate EE longitudinally across pregnancy and postpartum periods.

**METHODS:** Fifteen pregnant women were tested at 20 and 32 weeks gestation, seven of whom were also evaluated at 12 weeks postpartum. Participants were 18-35 years old, nonsmokers, and considered low-risk by their health care providers. Each participant was tested in our laboratory, and equipped with a portable gas analyzer to measure EE via indirect calorimetry. Resting EE was determined during ten minutes of left lateral/supine rest. Women performed a series of five-minute activities ranging from light to vigorous. MET values were calculated for each activity by dividing steady state relative  $\dot{V}O_2$  by actual resting EE measured at each time point. MET values for each activity at 20 and 32 weeks gestation were compared to MET values listed in the Compendium using a one sample t-test. For the seven women with postpartum data, EE across the three time points were evaluated using repeated measures ANOVA.

**RESULTS:** Compared to the Compendium, observed MET values for laundry, dusting, sweeping, and aerobics were lower (range= -0.2 to -2.8 METS, effect sizes (ES)= 0.6 to 4.1;  $p<0.05$ ) at both pregnancy time points, while child care and walking were higher (range=0.4 to 1.1 METS; ES=0.6 to 1.9;  $p<0.05$ ). Longitudinal analysis revealed that resting EE was significantly higher (0.2 METS; ES=0.55) and dusting was significantly lower (-0.5 METS; ES=0.75) at 32 weeks gestation compared to 12 weeks postpartum ( $p<0.05$ ). Average MET values for all other activities were lower at 32 weeks gestation than at 12 weeks postpartum, however these differences were not statistically significant.

**CONCLUSION:** Compendium MET values may not be accurate during pregnancy, and the direction of measurement errors do not appear consistent. Future research with larger samples is needed to corroborate these results.

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1478 Board #259 MAY 30 9:30 AM - 11:00 AM

**Physical Activity And Lipid Levels During Pregnancy: Results For 1999-2006 NHANES Data**

Lanay M. Mudd<sup>1</sup>, Rebecca A. Battista<sup>1</sup>, Jean Kerver<sup>2</sup>. <sup>1</sup>*Appalachian State University, Boone, NC.* <sup>2</sup>*Michigan State University, East Lansing, MI.* (Sponsor: Alan Utter, FACSM)

(No relationships reported)

Physical activity (PA) is related to higher high-density-lipoprotein cholesterol (HDLc) and modestly lower total cholesterol (TC) among non-pregnant adults. One study found similar relations among pregnant women in the 1st trimester; however, PA and lipid relations later in pregnancy, when lipids rise dramatically, have not been studied.

**PURPOSE:** To determine trimester-specific relations between PA and lipids among pregnant women in the National Health and Nutrition Examination Survey (NHANES).

**METHODS:** In this cross-sectional study design, we analyzed self-reported demographics, PA, trimester of gestation, diet, and measured serum TC and HDLc, for pregnant women in NHANES 1999-2006 (n=995 with complete PA and lipid values: 193 in 1st, 418 in 2nd, and 384 in 3rd trimester). PA was categorized as none (referent), less than recommended (LT Recs: 1- <150 min/wk), meets U.S. recommendations (Meets Recs: 150-300 min/wk), and far exceeds recommended (FE Recs: 300+ min/wk). SAS v9.2 used weighted analyses to account for the complex sampling frame of NHANES. Linear regression analyses assessed relations among mean lipids and PA within trimesters.

**RESULTS:** Mean  $\pm$  standard error for 1st, 2nd, and 3rd trimester, TC (171.5 $\pm$ 2.9, 218.7 $\pm$ 3.8, and 247.6 $\pm$ 4.6 mg/dl) and HDLc (59.3 $\pm$  1.7, 68.5 $\pm$  1.6, and 67.6 $\pm$  1.9 mg/dl) differed ( $p<0.05$ ). PA participation was higher in the 1st (36.1% Meets/FE Recs) vs. the 3rd trimester (24.3%,  $p>0.05$ ). All regression models adjusted for body mass index, total caloric intake, race, and marital status. In the 1st trimester, compared to no PA, LT Recs was significantly related (adjusted beta, 95% confidence interval: -15.0, -28.5 to -1.4 mg/dl) and Meets Recs was borderline ( $p=0.06$ ) related (-15.4, -32.7 to 2.0 mg/dl) to reduced mean TC, but FE Recs was not (6.3, -17.3 to 29.9). FE Recs was related to significantly higher HDLc in the 1st trimester (10.9, 1.8 to 20.0 mg/dl) compared to no PA, but lower amounts of PA were not significant. PA was not related to lipids in either the 2nd or 3rd trimesters.

**CONCLUSIONS:** Relations among PA and lipids within the 1st trimester are similar to, if not stronger than, those seen in non-pregnant adults. Physiological changes to lipids in later gestation may overpower effects of PA. More work is needed to examine these relations prospectively throughout pregnancy.

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**A-42 Free Communication/Poster - Renal**

MAY 30, 2012 7:30 AM - 12:30 PM

ROOM: Exhibit Hall

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1479 Board #260 MAY 30 11:00 AM - 12:30 PM

**Arterial Stiffness in Patients with Chronic Kidney Disease: Correlations at Different Level of Physical Function**

Pei-Tzu Wu<sup>1</sup>, Emily J. Tomayko<sup>1</sup>, Hae Ryong Chung<sup>1</sup>, Brandon M. Kistler<sup>1</sup>, Jin Hee Jeong<sup>1</sup>, Peter J. Fitchen<sup>1</sup>, Bo Femhall, FACSM<sup>2</sup>, Kenneth R. Wilund<sup>1</sup>. <sup>1</sup>*University of Illinois at Urbana Champaign, Urbana, IL.* <sup>2</sup>*University of Illinois at Chicago, Chicago, IL.*

(No relationships reported)

Studies have shown that exercise training improves arterial stiffness in healthy populations, but there is little research investigating the relationship between physical function and arterial health in hemodialysis patients. The few studies that have assessed this relationship have used indirect measures of arterial stiffness, such as central pulse wave velocity and augmentation index, and the results from these studies have been equivocal.

**PURPOSE:** The purpose of this study was to evaluate the relationship between physical function and arterial stiffness in hemodialysis patients using  $\beta$ -stiffness via ultrasound, which is a direct measure of arterial stiffness.

**METHODS:** Forty-nine hemodialysis patients were recruited (29 men, 20 women; 54.7 $\pm$ 1.9 years). Arterial stiffness index ( $\beta$ ) was measured by applanation tonometry and ultrasound. Physical function was measured by a validated shuttle walk test and a battery of objective physical performance tests. Patients were divided into high function (HF; n=26) and low function (LF; n=23) groups according to the scores of the physical function tests. One-way analysis of variance (ANOVA) was used to evaluate the difference between groups. Bivariate analyses were performed to assess the associations between  $\beta$ -stiffness and physical function tests.

**RESULTS:** Among 49 subjects,  $\beta$ -stiffness was significantly correlated with physical function tests, including gait speed, shuttle walk distance, and time on 8-foot up-and-go test ( $r=0.33$ , -0.30, and 0.34, respectively;  $p<0.05$ ), but not with repetitions of arm-curl and chair-stand.  $\beta$ -stiffness was greater in the LF group (13.9 $\pm$ 1.2) compared to the HF group (10.1 $\pm$ 0.9;  $p<0.05$ ).

**CONCLUSION:** In contrast to previous studies showing equivocal evidence that exercise training improves arterial stiffness, we found a close relationship between reduced physical function and increased arterial stiffness in hemodialysis patients. The increased arterial stiffness observed in the LF group suggests that the patients with lower fitness level may have increased cardiovascular disease risk. We have an ongoing longitudinal clinical trial to confirm these findings, and assess if exercise training improves  $\beta$ -stiffness in hemodialysis patients.

1480 Board #261 MAY 30 11:00 AM - 12:30 PM

**Body Composition is Associated with Arterial Stiffness and Physical Function in Chronic Kidney Disease Patients**

Jin H. Jeong<sup>1</sup>, Pei-Tzu Wu<sup>1</sup>, Emily J. Tomayko<sup>1</sup>, Hae R. Chung<sup>1</sup>, Brandon M. Kistler<sup>1</sup>, Peter M. Fitchen<sup>1</sup>, Bo Fernhall, FACSM<sup>2</sup>, Kenneth R. Wilund<sup>1</sup>. <sup>1</sup>University of Illinois at Urbana-Champaign, Urbana, IL. <sup>2</sup>University of Illinois at Chicago, Chicago, IL.  
(No relationships reported)

Patients with renal failure requiring hemodialysis experience a reversal in the relative risk of death from many traditional risk factors including the Body Mass Index (BMI). This phenomenon is often referred to as a reverse epidemiology. While many studies have demonstrated survival benefits with increasing BMI, few studies have differentiated between the components of BMI, fat mass and lean mass.

**PURPOSE:** To determine the association of fat mass and lean mass with cardiovascular disease (CVD) risk factors and physical function in a cross-sectional analysis of patients undergoing maintenance hemodialysis.

**METHODS:** Sixty-five hemodialysis patients were recruited (men=41, women=24; 54.2±11.8). Whole body lean mass (LM) and fat mass (FM) were measured using dual-energy X-ray absorptiometry (DXA). Augmentation index (AIx), a measure of arterial stiffness, was assessed by applanation tonometry. Physical function was measured by a validated shuttle walk test and a battery of objective physical performance tests. Linear regression was used to determine predictors of arterial stiffness.

**RESULTS:** Among 65 subjects, AIx was significantly correlated with BMI ( $r=-.25$ ,  $p<.05$ ); however, this was primarily due to a correlation between AIx and LM ( $r=-.34$ ,  $p<.01$ ), while there was no correlation between AIx and FM. AIx decreased 3% for each 10g increase of LM ( $F(2, 62)=5.1$ ;  $p<.01$ ). Percent body fat was associated with worse performance on several metrics of physical function, including gait speed, shuttle walk distance, time on 8-foot up-and-go, and repetitions of chair-stand ( $r=.32$ ,  $-.45$ ,  $.34$ , and  $-.36$  respectively;  $p<.05$ ). By contrast, percent lean mass was associated with better performance in gait speed, shuttle walk distance, time on 8-foot up-and-go, and repetitions of chair-stand ( $r=-.32$ ,  $.46$ ,  $-.32$ , and  $.32$ , respectively,  $p<.05$ ).

**CONCLUSION:** Although higher BMI is associated with lower mortality in patients undergoing hemodialysis, this study differentiated the contributions of BMI, LM and FM to CVD risk in this population. We found that increased LM is a predictor of reduced arterial stiffness, and higher percent body fat is associated with declined physical function in hemodialysis patients. However, longitudinal studies are needed to confirm these findings.

1481 Board #262 MAY 30 11:00 AM - 12:30 PM

**Exercise Capacity Is Associated With Myocardial And Vascular Function In Patients With Chronic Kidney Disease**

Erin J. Howden<sup>1</sup>, Nicole M. Isbel<sup>2</sup>, Thomas H. Marwick<sup>3</sup>, Jeff S. Coombes, FACSM<sup>1</sup>. <sup>1</sup>University of Queensland, St Lucia, Australia. <sup>2</sup>Princess Alexandra Hospital, Woollongabba, Australia. <sup>3</sup>Cleveland Clinic, Cleveland, OH.  
(No relationships reported)

**BACKGROUND:** Understanding the correlates of exercise capacity may help to explain the poor prognosis observed in patients with chronic kidney disease (CKD).

**PURPOSE:** To determine the relationship between exercise capacity (VO<sub>2</sub> peak), clinical factors and myocardial and vascular parameters in patients with CKD.

**METHODS:** 115 patients with stage 3 and 4 CKD performed a graded exercise test to exhaustion for determination of VO<sub>2</sub> peak. Myocardial function was assessed using two dimensional echocardiography and tissue Doppler imaging. Vascular function and structure were assessed using ultrasound to measure brachial artery reactivity and carotid intima-media thickness (cIMT). Central arterial stiffness was assessed by aortic pulse wave velocity (aPWV) and systemic arterial stiffness by augmentation index (AIx). Demographics were recorded and standard biochemistry performed. Patients were categorized by tertiles of fitness.

**RESULTS:** The lowest fitness group (VO<sub>2</sub> peak 19.4±4.6) had worse diastolic function (E/e' 16.0±10.0 vs. 11.5±5.2), central (aPWV 11.1±3.5 vs. 8.5±1.8) and systemic arterial stiffness (AIx 22.2±7.8 vs. 17.2±8.2) than the highest fitness group (VO<sub>2</sub> peak 28.2±7.7) ( $p<.05$ ). Whilst the middle fitness group (VO<sub>2</sub> 21.7±4.2) had significantly worse central (aPWV 10.2±2.5) and systemic arterial stiffness (AIx 23.6±7.8) compared to the highest fitness group ( $p<.05$ ). Patients who achieved age predicted VO<sub>2</sub> peak had significantly lower cIMT, reduced aPWV and were less likely to have myocardial ischaemia ( $p<.05$ ). Clinical associates of VO<sub>2</sub> peak were BMI ( $r=-.343$ ,  $p<.001$ ), diabetes ( $r=-.380$ ,  $p<.001$ ), phosphate ( $r=-.343$ ,  $p<.001$ ), HbA1c ( $r=-.306$ ,  $p<.001$ ), physical activity ( $r=.219$ ,  $p=.026$ ) and LDL cholesterol ( $r=.239$ ,  $p=.016$ ). VO<sub>2</sub> peak was negatively associated with outcome; atheroma (cIMT,  $r=-.219$ ,  $p=.028$ ), diastolic function (E/e',  $r=-.283$ ,  $p=.004$ ), arterial stiffness (aPWV,  $r=-.373$ ,  $p<.001$ ) and (AIx,  $r=-.373$ ,  $p<.001$ ).

**CONCLUSION:** Low exercise capacity is associated with poor myocardial and vascular function in patients with CKD.

1482 Board #263 MAY 30 11:00 AM - 12:30 PM

**Effects of Intradialyze Resistance Exercise in Chronic Kidney Disease Patients**

Bruna S. Lourenço, Marcos A. Nascimento, Thiago S. Rosa, Anderson S. Haro, Vicente N. Siqueira, Sergio Tufik, Marco T. Mello, Maria E. Canziani, Elisa S. Higa. Universidade Federal de São Paulo, São Paulo, Brazil.  
(No relationships reported)

The loss of body mass is common in chronic kidney disease (CKD) patients, and it is a great predictor of mortality in this population. Around 91% of the patients with CKD need hemodialysis as substitutive renal therapy (SRT). In Brazil the number of patients utilizing this treatment in 2009 was 77,589. The decrease of life quality in this population can also be attribute to other factors as psychological alterations, comorbidities, biological aging, malnutrition, oxidative stress, use of corticosteroids and the hemodialysis process itself. Studies show that resistance training (RT) can be efficient on power gain and improve to life quality in CKD patients, analyzed by questionnaires and functional capacity tests.

**PURPOSE:** Evaluate the strength values before and after RT, made intradialysis in CKD patients.

**METHODS:** There were recruited 11 patients in hemodialysis clinic Oswaldo Ramos (UNIFESP), we included both male and female patients with age between 20 and 76 yrs and dialysis treatment > 3 months. The body mass index (BMI) was 25.2± 5.2 characterizing overweight. Previous RT, the patients were submitted to exercise test, echocardiography and physical evaluation. Then, it was realized the 1 maximum repetition test (1MR), during the hemodialysis, before and after the training, in order to obtain strength values and exercise load estimative for each exercise. The RT was constituted of seven exercises, being: 3 to upper limb and 4 to lower limb realized on 6 weeks period, with exercise intensity of 40% of 1MR on the first 3 weeks and 60% of 1MR in the other weeks. Each session was composed of 3 series of 12 repetitions with two minutes resting intervals between the exercises. For data analysis (mean± standard error) it was utilized the t student test with value of  $P<.05$ .

**RESULTS:** On the 1MR tests we found strength increase (kg) after training, on the following exercises: shoulder press 8± 0.55 vs 7± 0.51; biceps 8±0.47 vs 7±0.61, triceps 5±0.56 vs 4±0.82 and leg extension 10± 1.32 vs 7± 0.70.

**CONCLUSIONS:** Intradialysis resistance exercise promotes power increase in CKD patients which may improve their life quality.

1483 Board #264 MAY 30 11:00 AM - 12:30 PM

**Intradialytic Protein Supplementation Reduces Inflammation and Improves Physical Function**

Brandon M. Kistler<sup>1</sup>, Emily J. Tomayko<sup>1</sup>, Pei-Tzu Wu<sup>1</sup>, Peter J. Fitchen<sup>1</sup>, Hae Ryoung Chung<sup>1</sup>, Jin Hee Jeong<sup>1</sup>, Barbara Yudell<sup>1</sup>, Elizabeth Jeanes<sup>2</sup>, Shane A. Phillips<sup>2</sup>, Bo Fernhall, FACSM<sup>2</sup>, Kenneth R. Wilund<sup>1</sup>. <sup>1</sup>University of Illinois, Urbana, IL. <sup>2</sup>University of Illinois at Chicago, Chicago, IL.  
(No relationships reported)

In maintenance hemodialysis patients (MHD), high inflammation contributes to muscle wasting, cardiovascular disease, and bone-mineral disorders. Inflammation and poor nutrition status often occur in unison and therefore improving nutrition status may reduce inflammation and improve dialysis comorbidities.

**PURPOSE:** To determine the effects of intradialytic protein supplementation on markers of inflammation and physical function in MHD patients.

**METHODS:** Sixty MHD patients were randomly assigned to receive whey protein, soy protein, or placebo. On days separated by one week, blood was drawn both immediately after initiation of dialysis and again three hours later and analyzed for serum Interleukin-6 (IL-6). For the first day, subjects received no study beverage to measure baseline response to a single dialysis session. One week later, the subject consumed their study beverage immediately prior to the start of dialysis and blood was again collected as described. A subset of subjects (n=29) continued



to receive their respective study beverage during dialysis sessions for six months. Standard clinical laboratories were drawn monthly and High Sensitivity C - reactive protein (CRP), IL-6, and measures of physical function were measured at baseline and six months.

**RESULTS:** When no study beverage was provided, IL-6 increased during a single dialysis session in all groups. The rise in IL-6 was attenuated by intradialytic protein supplementation ( $p < 0.05$ ). At six months, repeated measures ANOVA revealed a time by treatment effect for reduced IL-6 with protein supplementation in relation to the control group ( $p < 0.05$ ). A similar but non-significant trend was observed for CRP ( $p > 0.089$ ). For functional measures, there was an interaction effect for shuttle walk with the whey group improving over six months ( $p < 0.05$ ).

**CONCLUSION:** Intradialytic protein supplementation attenuates the rise in inflammation during an individual dialysis session. Chronic supplementation reduces inflammation and improves physical function, suggesting intradialytic protein supplementation may represent a low-cost intervention to reduce inflammation and improve function in MHD patients.

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**1484** Board #265 MAY 30 11:00 AM - 12:30 PM

**Physical Inactivity Causes Differential Changes in Vascular Gene Expression in Rat Iliac and Renal Arteries**

Jaume Padilla, Nathan T. Jenkins, Michael D. Roberts, M Harold Laughlin, FACSM, Frank W. Booth, FACSM. *University of Missouri, Columbia, MO.*

(No relationships reported)

It is now well established that local factors such as hemodynamic forces (e.g. shear stress) can modulate the susceptibility of the vasculature to dysfunction. In vivo, conduit arteries are constantly exposed to alterations in wall shear stress as a result of changes in blood flow demands in downstream tissues and/or changes in vasoconstriction tone. During running, blood flow is prominently increased in skeletal muscles of the rat hindlimb, but decreased in organs that are metabolically less active (e.g. kidney).

**PURPOSE:** Using our "rodent wheel lock (WL) model", we tested the hypothesis that the influence of short-term physical inactivity on vascular gene expression in the iliac and renal arteries would be divergent as a result of removal of episodic bouts of increased iliac artery blood flow and decreased renal artery blood flow associated with exercise.

**METHODS:** We used generation 4-5 female Wistar rats selectively bred to voluntarily run long distances. Following 23 days of access to voluntary running wheels (average distance of ~16 km/night), rats were rapidly transitioned to a sedentary state by locking the wheels for 7 days (WL 7 days;  $n=9$ ) or remained active (WL 0 days;  $n=9$ ) for 7 days. Real-time PCR was conducted on total RNA isolated from iliac and renal arteries to evaluate expression of 22 genes selected for their involvement in preservation of vascular health.

**RESULTS:** Compared to iliac arteries of WL 0-day rats, iliac arteries of WL 7-day rats exhibited increased expression of TNFR1 (1.2-fold), ET1 (1.6-fold), and LOX-1 (1.3-fold) (all  $p < 0.05$ ). Moreover, compared to renal arteries of WL 0-day rats, renal arteries of WL 7-day rats exhibited decreased expression of ETb (0.77-fold), p47phox (0.68-fold), and p67phox (0.81-fold) (all  $p < 0.05$ ).

**CONCLUSIONS:** These data provide evidence that changes in the expression of vascular cell genes with cessation of physical activity are artery-specific, and suggest that differential alterations in exercise-induced blood flow signals between the iliac and renal arteries may contribute to the heterogeneous influence of short-term physical inactivity on vascular gene expression. Support: NIH RO1HL036088, AHA 11POST5080002

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**A-43 Free Communication/Poster - Skeletal Muscle Cellular and Molecular Physiology**

MAY 30, 2012 7:30 AM - 12:30 PM

ROOM: Exhibit Hall

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**1485** Board #266 MAY 30 11:00 AM - 12:30 PM

**Focal Adhesion Kinase Expression in Heat-shocked Rat Soleus Muscle Following Eccentric Exercise**

Zachary A. Graham<sup>1</sup>, Chad Touchberry<sup>2</sup>, Paige Geiger<sup>3</sup>, Anishe Gupta<sup>3</sup>, Gregory Bumhoff<sup>3</sup>, Phil Gallagher<sup>1</sup>. <sup>1</sup>University of Kansas, Lawrence, KS. <sup>2</sup>University of Missouri, Kansas City, Kansas City, MO. <sup>3</sup>University of Kansas Medical Center, Kansas City, MO.

(No relationships reported)

Integrins are heterodimeric proteins that span the cell surface. They also detect stretch and coordinate intracellular protein signaling. One of these principal proteins, focal adhesion kinase (FAK), has been shown to coordinate hypertrophic and protective signaling in skeletal muscle. It has also been demonstrated that inducing heat shock protein 70 (Hsp70) prevents caspase-mediated degradation of FAK, possibly allowing it to maintain pro-survival signaling and providing an overall protective mechanism for the cell.

**PURPOSE:** The purpose of this study was to compare total and phosphorylated FAK in the soleus (SOL) muscle of rats following exercise-induced muscle damage.

**METHODS:** Male Wistar rats were randomly assigned to either a control group (CON), an eccentric exercise group (EE) (downhill running), or a heat shock (core temp 41°C for 20 min) + EE group (HS). SOL muscles were removed at 2h and 48h following exercise. Protein expression of FAK was determined using western immunoblotting and spot densitometry. A multivariate analysis of variance (MANOVA) was used to determine significance. Follow-up tests were conducted using one way ANOVAs and a Bonferroni test was used to adjust the level of significance.

**RESULTS:** Total FAK was significantly lower in the EE and HS groups when compared to CON 2h post-exercise. There were no significant differences in total FAK in the 48hr group. There were also no differences in phosphorylated FAK at either 2hr or 48hr post-exercise.

**CONCLUSION:** Eccentric exercise, regardless of heat treatment, causes a decrease in total FAK expression in rat soleus muscle two hours post-exercise.

Research supported, in part, by a University of Kansas General Research Fund grant (P. Gallagher).

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**1486** Board #267 MAY 30 11:00 AM - 12:30 PM

**Strain-Dependent Protein Metabolism and Muscle Hypertrophy under Chronic Isometric Training of Rat Gastrocnemius Muscle**

Koji Kobayashi<sup>1</sup>, Riki Ogasawara<sup>2</sup>, Arata Tsutaki<sup>1</sup>, Kihyuk Lee<sup>1</sup>, Eisuke Ochi<sup>3</sup>, Koichi Nakazato<sup>1</sup>. <sup>1</sup>Nippon Sport Science University, Tokyo, Japan. <sup>2</sup>The University of Tokyo, Tokyo, Japan. <sup>3</sup>Meiji Gakuin University, Kanagawa, Japan.

(No relationships reported)

Skeletal muscle size is regulated by both protein synthesis and degradation. Appropriate mechanical stimulation of skeletal muscles induces muscle hypertrophy characterized by enhanced protein synthesis. Conversely, muscle unloading induces atrophy characterized by increased protein degradation. Because several studies have shown the presence of strain-dependent differences in rat skeletal muscles (i.e., myosin heavy chain [MHC] composition), we hypothesized that muscle responses to resistance training (RT) might be strain dependent.

**PURPOSE:** We examined the levels of molecules related to protein synthesis/degradation to elucidate strain-dependent responses to isometric RT in 2 rat strains.

**METHODS:** Isometric resistance exercise involving only the right legs of male Sprague-Dawley (SD) ( $n = 5$ ) and Wistar rats ( $n = 6$ ) was performed for 2 days (2 sessions) followed by rest for 1 day (Total 12 sessions). Twenty-four hours after the last session, the gastrocnemius (GST) muscles were harvested. The levels of target proteins were analyzed by western blotting. Paired t-test was used to evaluate differences between the trained leg (TRN) and control leg (CON). GST mass, GST mass relative to body mass, MHC isoform, and the levels of proteins involved in protein synthesis/degradation (Akt, mTOR, p70<sup>S6k</sup>, FOXO1, FOXO3a, MuRF1, and MAFbx/atrogen-1) were measured.

**RESULTS:** After RT, fast (IIB) to slow (IIX) MHC isoform transition was observed in the 2 strains. In the case of the SD rats, muscle mass and muscle mass relative to body mass in the TRN group were significantly higher than those in the CON group (8.5% and 8.6%, respectively,  $p < 0.05$ ). In the case of the Wistar rats, the 2 groups did not differ significantly. In the case of the SD rats, the level of p70<sup>S6k</sup> (2.9-fold,  $p < 0.05$ ) and FOXO3a (2.2-fold,  $p < 0.05$ ) phosphorylation increased in the TRN group, compared to the CON group. Further, decreased expressions of MuRF-1 (0.6-fold,  $p < 0.05$ ) and MAFbx/atrogen-1 (0.7-fold,  $p < 0.05$ ) were observed in the TRN group of SD rats. In the case of the Wistar rats, the 2 groups did not differ significantly with regard to protein levels.

**CONCLUSIONS:** Strain-dependent protein metabolism and hypertrophy exists in rat skeletal muscles. This phenomenon may be useful for studying individual differences in response to RT.

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1487 Board #268 MAY 30 11:00 AM - 12:30 PM

**The Effect Of High Intensive Physical Exercise In Expression Of Myostatin And Smad7 In Skeletal Muscle**

Hakan C. Rundqvist, Mona Esbjörnsson, Ted Österlund, Eva Jansson. *Clinical Physiology, Laboratory Medicin, Karolinska Institutet, Stockholm, Sweden.*  
(No relationships reported)

Myostatin is a negative regulator of muscle growth and a member of the transforming growth factor- $\beta$  family partly by being a negative regulator of satellite cells proliferation and differentiation and plays thereby a critical role in development, repair and regeneration of 'adult' muscle. It is produced within the muscle cell thereafter transported out of the cell and binds to the activin receptor 2b, which is located in the cell membrane. The binding to act2b receptor activates the type 1 receptor enhancing SMAD-signaling. Myostatin gene expression has been shown, by others, to increase following periods of muscle inactivity and decrease following acute resistance training. We have found that myostatin also decreases after sprint exercise (unpublished observation). How the myostatin gene expression is regulated in these situations is not known. From cell studies, it has been shown that myostatin auto-regulates its own expression through a SMAD7-dependent negative feedback loop.

**PURPOSE:** To test the hypothesis that SMAD7 is involved in the regulation of the gene expression of myostatin in human skeletal muscle after sprint exercise.

**METHODS:** Healthy, physically active and young men and women (n=17) performed three bouts of sprint exercise with 20 minutes rest in between. Muscle biopsies were obtained from quadriceps femoris vastus lateralis at rest and 140 minutes after third bout of exercise. The gene expression of myostatin and SMAD7 was related to rps18 (housekeeping gene) and analyzed by real time-PCR technique. The myostatin at the protein level was analyzed by Western blot technique.

**RESULTS:** Gene expression of SMAD7 increased by 53 % (p<0.0006) and gene expression of myostatin decreased by 52 % (p<0.013). Myostatin at the protein level, did not change by sprint exercise.

**CONCLUSION:** This is, to our knowledge, the first study analyzing SMAD7 in human skeletal muscle after exercise. The increased SMAD7 together with the decreased myostatin gene expression in skeletal muscle after sprint exercise support earlier cell studies showing that SMAD7 is involved in the auto regulation (feed-back regulation) of myostatin gene expression.

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1488 Board #269 MAY 30 11:00 AM - 12:30 PM

**Temporal Resolution of PGC-1 $\alpha$  Splice Variants in Human Skeletal Muscle After One Bout of Exercise**

Eva-karin Sällstedt, Mia Ydfors, Jessica Norrbom. *Karolinska Institutet, Department of Physiology & Pharmacology, Stockholm, Sweden.*  
(No relationships reported)

Increased mitochondrial and capillary densities are central components of skeletal muscle remodeling in response to exercise. The transcription co-activator peroxisome proliferator-activated receptor  $\gamma$  coactivator-1 $\alpha$  (PGC-1 $\alpha$ ) has been shown to be important for this coordination of multiple processes in training-induced skeletal muscle remodeling. Recently, our lab showed for the first time that at least two splice variants of PGC-1 $\alpha$  (PGC-1 $\alpha$ -a and PGC-1 $\alpha$ -b) exist in human skeletal muscle and that they are highly regulated with exercise.

**PURPOSE:** To investigate the temporal resolution of PGC-1 $\alpha$  and its splice variants after one acute bout of cycle exercise. Also, to study transcription factors important for mitochondrial biogenesis regulated by PGC-1 $\alpha$ , namely NRF-1, Tfam and TFB1M.

**METHODS:** Healthy men (n=4) and women (n=3) performed one hour of cycling exercise at 70 % of their VO<sub>2</sub>max. Skeletal muscle biopsies were obtained before and after exercise (pre, 30', 2h, 6h and 24h).

**RESULTS:** PGC-1 $\alpha$ -b mRNA increased significantly at 2h and 6 h after exercise compared to pre-values (p<0.01), and had returned to baseline levels at 24 h after the exercise bout. Neither PGC-1 $\alpha$ -a nor total PGC-1 $\alpha$  showed a significant change in mRNA levels in response to exercise. There was no significant change in NRF-1, Tfam or TFB1M mRNA levels after one bout of cycle exercise.

**CONCLUSIONS:** This study shows that an upstream promoter of PGC-1 $\alpha$  (PGC-1 $\alpha$ -b) is massively induced up to 6 h after exercise by a single exercise bout, and that the levels were back to baseline at 24 h after exercise. This implies that the exercise-induced PGC-1 $\alpha$  response is more complex than previously suggested. The lack of significant change in PGC-1 $\alpha$ -a and total PGC-1 $\alpha$  levels is likely due to the low number of subjects.

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1489 Board #270 MAY 30 11:00 AM - 12:30 PM

**mTORC2 Is Activated In Muscle During Exercise And Regulates Contraction Induced Glucose Uptake**

Maximilian Kleinert, Lykke Sylow, Erik A. Richter. *University of Copenhagen, Copenhagen, Denmark.*  
(No relationships reported)

**PURPOSE:** Two distinct mTOR complexes (mTORCs) have been defined. While mTORC1 serves as a regulator of protein synthesis, mTORC2 has been found to be downstream of PI3K and to phosphorylate Akt on Ser 473. However, little is known about the physiological importance of mTORC2 in skeletal muscle during muscle contractions. Here we test the hypothesis that mTORC2 is activated during exercise and might be involved in contraction-induced glucose uptake in skeletal muscle.

**METHODS:** mTORC2 activity was judged by phosphorylation of its downstream target N-myc downregulated gene 1 (NDRG1) on the Thr346 residue. Mice ran for 30 min on a treadmill at 70% of their individual maximal running capacity, or EDL and soleus muscles were incubated in vitro and stimulated with insulin or contracted in the presence or absence of pharmaceutical inhibitors. Radioactive tracers were used to estimate glucose uptake.

**RESULTS:** In vivo running increased NDRG1 Thr346 phosphorylation by 60% (p < 0.05) compared to resting controls in gastrocnemius muscle. To test whether the running induced increase in mTORC2 activity was dependent upon AMPK activity, NDRG1 Thr346 phosphorylation was measured in mice that overexpress a kinase-dead alpha 2 subunit of the AMPK protein in skeletal muscle (AMPK-KD). In these mice NDRG1 Thr346 phosphorylation increased significantly to the same extent as in WT mice. Treatment of mouse soleus muscles with the total mTOR inhibitor, AZD8055, blocked basal and insulin stimulated NDRG1 Thr346 phosphorylation (p < 0.001) and inhibited Akt phosphorylation and glucose uptake, while rapamycin (a mTORC1 specific blocker) treatment had no effect. In EDL muscle AZD8055 had no effect on insulin stimulated glucose uptake despite ablation of Akt and NDRG1 phosphorylation. During in vitro contractions AZD8055 reduced contraction induced glucose uptake by 23% (p < 0.05) in EDL. In soleus the inhibitor had no effect on contraction induced glucose uptake. While AZD8055 reduced NDRG1 Thr346 phosphorylation to almost undetectable levels, AMPK Thr172 phosphorylation was unaffected by the blocker and increased about 2-fold with contractions in both EDL and soleus (p < 0.05).

**CONCLUSIONS:** It is concluded that mTORC2 is activated in muscle during exercise and has muscle specific effects on insulin and contraction induced glucose uptake.

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1490 Board #271 MAY 30 11:00 AM - 12:30 PM

**Enhanced As160 Phosphorylation In Response To Sprint Exercise In Severe Acute Hypoxia**

David Morales-Alamo, Amelia Guadalupe-Grau, Jesús Gustavo Ponce-González, Ismael Pérez-Suárez, David Feijoo-Díez, Jaime Calle-Herrero, Alfredo Santana, Cecilia Dorado, Jose A L Calbet, Borja Guerra. *Universidad De Las Palmas De Gran Canaria, Las Palmas, Spain.*  
(No relationships reported)

Muscle glucose uptake is increased during exercise in hypoxia. Akt is activated through phosphorylation on Ser<sup>473</sup> and Thr<sup>308</sup>. Although Akt phosphorylation in these residues could be regulated independently, a higher Akt activity has been reported when both sites are phosphorylated. Acute sprint exercise elicits Ser<sup>473</sup> Akt phosphorylation that subsequently induces AS160 phosphorylation, which may facilitate muscle glucose uptake.

**PURPOSE:** To determine if severe acute hypoxia enhances the skeletal muscle Akt/AS160 phosphorylation response to sprint exercise.

**METHODS:** Ten healthy physical males (age: 25±5 yrs; VO<sub>2</sub>max: 51±6 ml.kg<sup>-1</sup>.min<sup>-1</sup>; means ± SD) performed on separate days and random order two 30s-isokinetic Wingate test at 100 rpm in normoxia and hypoxia (F<sub>I</sub>O<sub>2</sub>=0.10). Blood samples and muscle biopsies were obtained before, at the end of the test, and at 30 and 120 min into the recovery period. Akt, p38-MAPK, ERK1/2, and AS160 phosphorylation levels and the protein expression of the total form of these kinases was determined by western blot.

**RESULTS:** Peak power output and peak blood lactate were similar, but mean power output was 6% and VO<sub>2</sub> 37% lower in hypoxia than in normoxia (P<0.05). At the end, and thirty minutes after the Wingate test, insulin and glucose serum concentrations were increased by a 10-24% (P<0.05). Compared to rest, thirty and 120 minutes after the Wingate tests, Ser<sup>473</sup>-Akt

phosphorylation was increased by 117% and a 14%, respectively, ( $P < 0.05$ ). Thr<sup>308</sup>-Akt phosphorylation was elevated 1.4-fold just after the Wingate test and remained elevated during the first 2 hours after the test ( $P < 0.05$ ). p38-MAPK and ERK1/2 phosphorylations did not change significantly after the sprints. Compared to rest, AS160 phosphorylation was 50% greater 30 minutes after Wingate performed in hypoxia ( $P < 0.05$ ).

**CONCLUSIONS:** Isokinetic sprint exercise in severe acute hypoxia elicits an essentially similar signaling response to that observed in normoxia, with the exception of a slightly higher AS160 phosphorylation.

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1491 Board #272 MAY 30 11:00 AM - 12:30 PM

### Molecular Responses in Skeletal Muscle to Resistance Training in Older Men

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(No relationships reported)

IGF-I and its splice variant mechano growth factor (MGF) has been suggested to be involved in skeletal muscle regeneration via Erk and/or Akt pathways. Both of these pathways can control protein translation by p70S6K1. Effects of heavy resistance training (RT) on these regulating proteins are still, however, mostly unknown.

**PURPOSE:** To determine changes in skeletal muscle MGF, Erk, Akt and p70S6K1 protein concentrations and IGF-IEa and MGF mRNA expression following RT, and their associations with RT-induced changes in muscle strength and mass.

**METHODS:** Healthy untrained older men ( $61 \pm 5$  yrs,  $177 \pm 3$  cm,  $80 \pm 5$  kg,  $24 \pm 3$  fat%) were recruited for the study. RT comprised whole body resistance exercises twice a week with a progressively increased training load for 21 weeks. Maximal concentric strength of leg extensors (1RM), fat free mass (FFM; by bioimpedance) and m.vastus lateralis (VL) thickness (by ultrasound) were measured pre- and post-RT. Experimental heavy resistance exercises (RE; 5 x 10RM leg presses with 2-minute recovery periods) were performed pre- and post-RT. Muscle biopsies were obtained before and 48h after the REs from VL to determine molecular responses during the regeneration phase after RE.

**RESULTS:** RT led to increases in 1RM ( $20.8 \pm 8.7$  %,  $p < 0.001$ ), FFM ( $1.6 \pm 2.0$  %,  $p < 0.05$ ) and VL thickness ( $13.6 \pm 5.0$  %,  $p < 0.001$ ). Present muscle proteins or mRNAs were not systematically influenced by the REs or RT, except MGF mRNA expression was increased ( $p < 0.01$ ) after RE before the RT. Changes in 1RM correlated with changes in VL thickness ( $r = 0.74$ ,  $p < 0.05$ ). When RE-induced changes at pre- and post-RT were averaged, MGF protein ( $r = 0.70$ ,  $p < 0.05$ ) and Erk ( $r = 0.67$ ,  $p < 0.05$ ) were related to changes in 1RM. Changes in pre- to post-RE responses in p70S6K1 were related to changes in FFM ( $r = 0.71$ ,  $p < 0.05$ ). Changes in Akt from pre- to post-RT were related to changes in FFM ( $r = 0.72$ ,  $p < 0.05$ ).

**CONCLUSIONS:** Present study demonstrated that the basal levels or RE-induced responses in skeletal muscle MGF, Erk, Akt and p70S6K1 protein concentrations or IGF-IEa and MGF mRNA expression did not change systematically due to RT in older men. However, individual changes in MGF and Erk protein concentrations may be related to RT-induced changes in muscle strength, and changes in Akt and p70S6K1 may be associated with RT-induced changes in lean body mass.

1492 Board #273 MAY 30 11:00 AM - 12:30 PM

### Contraction-Induced rpS6 Phosphorylation Is Attenuated After Chronic Resistance Training But Recovered After Short-Term Detraining

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(No relationships reported)

Resistance training-induced muscle anabolism and subsequent hypertrophy is most rapid during early phase of training, and it becomes progressively slower with time. However, little is known about the intracellular signaling mechanisms underlying such changes in sensitivity of muscle to training stimulus.

**PURPOSE:** To investigate the changes in exercise-induced activation (phosphorylation) of signaling proteins associated with muscle protein anabolism during chronic resistance training and subsequent detraining.

**METHODS:** Twenty male SD rats were divided into 4 groups: one bout group (1B), 12 bouts group (12B), 18 bouts group (18B), and detraining group (DT). In the DT group, rats were detrained for 12 days after completion of 12 exercise sessions and then completed one exercise session before sacrificed. The right gastrocnemius muscle was isometrically trained (maximum isometric contraction was produced via percutaneous electrical stimulation) every other day, whereas the left gastrocnemius muscle served as an internal control (CON). Muscles were removed 24 h after the last exercise session. Phosphorylation and total protein levels of p70S6K, 4E-BP1, rpS6, and p90RSK were determined by Western blotting.

**RESULTS:** The wet weight of exercised muscle increased by 8.6% in 12B and 10.7% in 18B group ( $P < 0.05$  vs CON). Twelve days of detraining did not decrease muscle wet weight (8.8% above the weight of CON;  $P < 0.05$  vs CON,  $P > 0.1$  vs 12B) in DT group. Acute exercise increased p70S6K (1.3-fold), 4E-BP1 (1.8-fold), rpS6 (3.1-fold), and p90RSK (1.8-fold) phosphorylation 24 h after exercise in 1B group (all  $P < 0.05$  vs CON). However, repeated bouts of exercise blunted the phosphorylation of rpS6 and p90RSK in 12B or 18B groups (rpS6: 0.9- and 1.8-fold, p90RSK: 1.0- and 1.0-fold, all  $P > 0.1$  vs CON). Interestingly, the phosphorylation of rpS6 and p90RSK were restored following 12 days of detraining in DT group (rpS6: 2.6-fold, p90RSK: 2.0-fold, both  $P < 0.05$  vs CON). Phosphorylation of p70S6K and 4E-BP1 were not altered with chronic training and detraining.

**CONCLUSION:** These results suggest that with chronic resistance training, specific signaling become less sensitive to resistance exercise stimulus even muscle is contracted maximally but those are restored after a short detraining period without attenuation of muscle mass.

1493 Board #274 MAY 30 11:00 AM - 12:30 PM

### Botanical Supplement Effects On Nuclear Factor Kappa B (NF-κB) DNA-binding Activity Following Eccentric Exercise

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(No relationships reported)

Inflammation and oxidative stress contribute to exercise-induced muscle damage (EIMD). NF-κB is an important redox-sensitive molecule that increases gene expression of many pro-inflammatory mediators. Because evidence has shown that NF-κB signaling pathway is activated after exercise, antioxidant supplements may exert beneficial effects against EIMD via inhibiting NF-κB activation.

**PURPOSE:** To examine the effects of two novel botanical supplements containing mixtures of plant extracts with anti-inflammatory and antioxidant properties on NF-κB DNA-binding activity following eccentric exercise.

**METHODS:** 26 healthy men (18-30yrs) were randomly assigned to receive the placebo (N=8), Supplement 1 (N=10), or Supplement 2 (N=8) for 35d. Stage 1 - subjects exercised one leg (knee extensors) and a muscle biopsy of both legs (vastus lateralis) was taken at ~3.5h post-exercise; Stage 2 - subjects took supplements or placebo for 28d; Stage 3 - subjects repeated the exercise and tests with the contralateral leg. NF-κB DNA-binding activity of biopsy samples was measured using ELISA-based TransAM NF-κB p65 assay kit (Active Motif, Carlsbad, CA). Data were expressed as either absorbance at 450 nm or the percentage of p65 DNA-binding activity of eccentric exercised (ECC) leg relative to control (CON) leg. Paired t-test and repeated measures ANOVA were performed to analyze the data.

**RESULTS:** p65 DNA-binding activity was increased following eccentric exercise in both Stage 1 (ECC  $0.24 \pm 0.01$  vs. CON  $0.20 \pm 0.01$  (Mean  $\pm$  SE);  $p < 0.001$ ) and Stage 3 (EC  $0.22 \pm 0.01$  vs. CON  $0.21 \pm 0.01$ ;  $p < 0.05$ ). Compared with Stage 1 (122.9%  $\pm$  2.6%), NF-κB DNA-binding activity was significantly decreased in Stage 3 (109.1%  $\pm$  3.0%;  $p = 0.002$ ). There was no significant Treatment effect or Treatment X Stage interaction.

**CONCLUSION:** The botanical supplements had no effect on changes in NF-κB DNA-binding activity following eccentric exercise. However, the increased response of NF-κB DNA-binding activity post-exercise was attenuated in Stage 3. This attenuation effect may be due to a blunted systemic inflammatory response following a repeated bout of eccentric exercise with the contralateral leg.

Supported by Interleukin Genetics, Inc, Waltham, MA and Nutrilite Health Institute, Buena Park, CA.

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1494 Board #275 MAY 30 11:00 AM - 12:30 PM

**Rapid Ryanodine Receptor-1 Phosphorylation In Response To High Intense Resistance Exercise In Human Skeletal Muscle**

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(No relationships reported)

**BACKGROUND:** Resistance exercise is a common mode to increase muscle strength. However, severe resistance exercise leads to rapid and enduring muscle fatiguing which functional mechanisms have not been fully resolved, yet. One candidate involved in the regulation of myocellular fatigue is calcium (Ca<sup>2+</sup>) which is vital for electromechanical coupling of myofilaments. Rapid Ca<sup>2+</sup> modulation is mediated by ryanodine receptor-1 (RyR1), which, when phosphorylated at serine<sup>2844</sup> (pRyR1Ser<sup>2844</sup>) results in leaky ryanodine calcium channels, impaired calcium homeostasis and thus decreased abilities to sustain the molecular basis of electromechanical coupling. However, little is known about the time course and magnitude of acute exercise on pRyR1Ser<sup>2844</sup> phosphorylation in human skeletal muscle.

**PURPOSE:** It was aimed to investigate the effect of acute resistance exercise (EX) on pRyR1Ser<sup>2844</sup> phosphorylation (phosph.) in human type I and II myofibers.

**METHODS:** Six healthy male subjects (age: 23 ± 2 years, height: 185 ± 7 cm, and weight: 82 ± 5 kg) performed 3 sets with 8 repetitions of maximum eccentric knee extensions. Muscle biopsies were taken PRE exercise, 15 min, 30 min, and 60 min post EX. Immunohistochemistry, western blots and confocal microscopy were used to determine pRyR1Ser<sup>2844</sup> and pAMPK<sup>Thr172</sup> phosph. levels at the respective time points.

**RESULTS:** pRyR1Ser<sup>2844</sup> phosph. increased rapidly at 15 min in both type I and II myofibers (p<0.01) and further showing a sustained phosph. pattern up to 30 min (p<0.01) post EX. Compared to baseline levels, type I fibers showed higher increases in phosph. levels of RyR1 up to 60 min post EX (p<0.05) than type II myofibers. pAMPK<sup>Thr172</sup> phosph. showed significant increases 15 to 30 min post EX (p<0.01) in type I and II myofibers with a higher increase in phosph. levels in Type I myofibers.

**CONCLUSION:** Severe resistance exercise contributes to temporarily increased phosph. of RyR1 and AMPK due to active recruitment of myofibers. This result supports the hypothesis that RyR1 can be rapidly phosphorylated by resistance exercise and very likely contributes to muscle fatiguing by a decline in calcium handling properties. Enhanced phosph. of RYR1 is sustained up to 60 min post EX in both myofibers what may contribute up to this time point to impaired skeletal muscle contraction abilities.

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1495 Board #276 MAY 30 11:00 AM - 12:30 PM

**Ryr-1 Phosphorylation Responds Differently Between Concentric And Eccentric Workload In Rat Skeletal Muscle**

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(No relationships reported)

**BACKGROUND:** Calcium (Ca<sup>2+</sup>) handling in skeletal muscle regulates to diverse pathologies and performance capacities as Ca<sup>2+</sup> is involved in muscle contraction machinery. Ca<sup>2+</sup> homeostasis is mainly regulated by transmembrane channel complexes of sarcoplasmic reticule, called ryanodine receptor-1 (RyR1). RyR1 associates to many regulatory proteins, of which calstabin-1 plays a key role. It was described that long-lasting exercise models hyperphosphorylate RyR1 at Ser2843 and thus induce a leaky channel leading to impaired muscle function by dissociating calstabin-1 from RyR1. However, time patterns of RyR1 hyperphosphorylation (pRyR1) is unknown wherefore short-term exercise stimuli and their effects on pRyR1 were investigated.

**PURPOSE:** It was aimed to investigate whether concentric and eccentric exercise offers a different impact on ryanodine receptor phosphorylation in loaded rat skeletal muscle.

**METHODS:** 32 Sprague-Dawley rats were assigned to one of following groups: age-matched control (AC, sedentary), concentric (Conc, 0° decline) or eccentric (Ecc, -20° decline) exercise (each exercise lasted 15 min). pRyR1 was investigated by immunohistochemistry in both medial gastrocnemius and vastus lateralis.

**RESULTS:** In lateralis muscle 15 min of either concentric or eccentric led to markedly increased levels of pRyR1 compared to AC. Furthermore, concentric led to significantly higher amounts of pRyR1 compared to eccentric exercise. In gastrocnemius muscle a similar pattern was observed. However, there was no difference between concentric and eccentric stimuli. Discussion: The present results demonstrate that RyR1 is hyperphosphorylated very fast, which is an additional finding compared to data from the literature. Importantly, different muscle types react in a comparable manner. Interestingly, concentric exercise seems to exert a more severe effect on RyR1 hyperphosphorylation, at least in lateralis. These findings give new insights into RyR1 regulation by exercise.

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1496 Board #277 MAY 30 11:00 AM - 12:30 PM

**Igf-1 Downstream Signaling Response To Protein Rich Supplementation During Hindlimb Suspension**

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(No relationships reported)

It was known that anabolic signals were suppressed and catabolic signals were activated during prolonged muscle disuse, but the exact underlying molecular mechanisms are unclear. High protein supplementation has been recognized to increase the rate of muscle protein synthesis and activate anabolic signaling pathways (ex. IGF-1) and was employed in this study.

**PURPOSE:** To examine whether high protein supplementation would elevate phosphorylation of Akt and downstream pathways and maintain muscle function during hindlimb suspension (HS).

**METHODS:** Lower limbs of female rats were subjected to be unloaded by tail suspension for 28 days. During this period, one group (HS-PRO) was provided high protein supplementation (5ml/kg body weight), but others (HS) was received water via gavage twice per day, and ambulatory rats were served as control group (CON). After 28 days, contractile function of lateral gastrocnemius (LGAS) was evaluated, and both LGAS were excised and stored at -80°C. Total and phosphorylated levels of Akt, mTOR, p70S6K, and FOXO3a were measured from the sampled muscle by Western blot analysis.

**RESULTS:** LGAS weight was significantly decreased in HS and HS-PRO compared to that of CON at 28 days after HS, -19 and -22.5% respectively (P <0.01). However, in-situ peak tetanic force (Po) of HS-PRO was significantly higher than HS by 12% (P<0.05) but lower than CON by 25% (P<0.01). Phosphorylation of Akt in HS-PRO was significantly increased to CON, and pFOXO3a was also elevated in HS-PRO compared to CON and HS (P<0.05 and P<0.01 respectively). In addition, the supplementation prevented the reduction of mTOR phosphorylation during HS, -31 and -34% compared to CON and HS-PRO respectively (P <0.05), but there was no difference in p70S6K phosphorylation between groups. Total protein contents of all detected signals were not changed.

**CONCLUSION:** Although protein rich supplementation was not able to prevent the loss of muscle mass during prolonged HS, it reduced the decrease of contractile function, and elevated pAkt and pFOXO3a while maintained pmTOR .

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1497 Board #278 MAY 30 11:00 AM - 12:30 PM

**Influence Of Age On Leptin Induced Skeletal Muscle Signalling**

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(No relationships reported)

Aging is a multifactorial process that is characterized by decreased physical activity, low fat-free mass and reduced ability to mobilize fat. Leptin is an adipocyte-derived hormone where systemic levels increases in proportion with adiposity. Chronic hyperleptinemia leads to leptin resistance, as indicated by a lower abundance of leptin receptors (OBRb), and reduced phosphorylation of STAT3 and AMPK in human skeletal muscle. The potential contribution of leptin resistance to the increase of fat mass with aging has not yet been elucidated.

**PURPOSE:** To determine if there is indication of increased skeletal muscle leptin resistance with aging, the basal amount of leptin receptors and the phosphorylation levels of STAT3 and AMPK, as well as the protein amount of SOCS3 and PTP1B (the last two leptin signalling inhibitors) was assessed in healthy young and aged non-obese adults.

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**METHODS.** Muscle biopsies were obtained in fourteen young (YG), seventeen middle-aged (MG), and eight aged (AG) healthy lean men (age:  $25 \pm 2$ ,  $46 \pm 1$ ,  $62 \pm 2$  yrs, and BMI:  $24.3 \pm 0.5$ ,  $25.5 \pm 0.3$ ,  $25.0 \pm 0.7$  kg/m<sup>2</sup>, respectively). Protein expression of OBRb, STAT3, AMPK, PTP1B and SOCS3 was measured by Western Blot. Plasma leptin, glucose, insulin and FFA were measured by conventional assays. Insulin sensitivity was estimated by HOMA. Body composition was measured by DXA.

**RESULTS.** Fat mass, FFA and leptin plasma concentrations were higher in MG and AG group than YG ( $P < 0.05$ ), whereas HOMA values did not differ between the groups. OBRb protein abundance was similar among groups; however, Thy705STAT3 phosphorylation was lower in AG and MG compared to YG ( $0.29 \pm 0.05$ ;  $0.32 \pm 0.11$  and  $0.63 \pm 0.20$  a.u., respectively,  $P < 0.05$ ). Surprisingly, Thr172AMPK $\alpha$  phosphorylation was 2-fold higher in AG than in MA and YG groups ( $2.94 \pm 0.05$ ;  $1.32 \pm 0.29$  and  $1.74 \pm 0.17$  a.u., respectively,  $P < 0.05$ ). SOCS3 expression remained unchanged, whereas PTP1B expression was higher in the AG compared with MG and YG ( $P < 0.05$ ).

**CONCLUSION.** Skeletal muscle 170 KDa OBRb protein amount is not affected by aging. However, a lower basal phosphorylation of Thy705STAT3 and a higher abundance of PTP1B suggest that leptin resistance is increased with aging in healthy lean males. It is possible that increased phosphorylation of Thr172AMPK $\alpha$  is a compensatory mechanism to attenuate this.

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**1498** Board #279 **MAY 30** **11:00 AM - 12:30 PM**

**Short-Term Unloading and Exercise Effects on Mechanical Stress-Sensitive Structural and Sensor Proteins in Human Soleus**

Clay E. Pandorf, Fadia Haddad, Joshua A. Cotter, Kenneth M. Baldwin, FACSM, Vincent J. Caiozzo, FACSM, Gegory R. Adams. *University of California, Irvine, Irvine, CA.*

(No relationships reported)

Loading forces are critical to maintaining homeostasis in the muscle cell. Perturbations, such as unloading/disuse, upset the normal gene expression of structural and signaling proteins. Exercise countermeasures can offset these alterations.

**PURPOSE:** To examine gene expression of several large sarcomeric proteins that provide structural support to the myofilament (titin, nebulin and  $\alpha$ -actin) and converge at the Z-disc. Since evidence suggests that loading forces in the muscle may be transmitted by structural support proteins that integrate mechanical stress at the Z-disc, we also examined several signaling proteins that reside in this region (STARS, atrogin-1, and calcineurin via its modulator MCIP1) and can in-turn regulate the expression of sarcomeric genes.

**METHODS:** Two groups of healthy inactive human subjects participated in unilateral lower limb suspension (ULLS; male N=5; female N=4) for 10 days alone or with a combination of aerobic and resistance exercise training (ULLS+T; male N=5; female N=5). Soleus biopsies were obtained before and after ULLS; ULLS+T biopsies were obtained ~24 hrs after the last training session. RT-PCR was used to quantify pre-mRNA and mRNA levels of select genes (arbitrary units/mg).

**RESULTS:** Nebulin, titin and  $\alpha$ -actin RNA levels changed pre to post by -11%, +26% and +7% with ULLS, and by +25%\*, +56%\* and +16% with ULLS+T, respectively (\* $p < 0.05$  pre to post). STARS, atrogin1 and MCIP1 mRNA levels changed pre to post by -75%\*, +77%\* and -40%\* with ULLS, and by -63%\*, +30%\* and -26%\* with ULLS+T, respectively (\* $p < 0.05$  pre to post).

**CONCLUSIONS:** While changes in transcription of the Z-disc associated structural proteins nebulin and titin following 10d unloading was not statistically significant, there was significant upregulation with unloading + training stimuli. The unfavorable unloading-induced signaling response was ameliorated when combined with training as suggested by differential mRNA levels of mechano-sensitive Z-disc factors that can promote atrophy (atrogin) and fiber-type shifts (calcineurin/MCIP1). These data suggest that exercise countermeasures to short-term unloading of the loading-sensitive slow soleus muscle can promote favorable transcriptional responses of proteins associated with the stress-sensitive Z-disc. (Supported by NSBRI-NASA NCC 9-58)

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**1499** Board #280 **MAY 30** **11:00 AM - 12:30 PM**

**Sumo-1 Rapidly Translocates In Human Skeletal Muscle Myonuclei In Response To High Intense Resistance Exercise**

Sebastian Gehlert<sup>1</sup>, Suhr Frank<sup>1</sup>, Lena Willkomm<sup>1</sup>, Franz-Josef Klimz<sup>2</sup>, Wilhelm Bloch<sup>1</sup>. <sup>1</sup>German Sport University Cologne, Cologne, Germany. <sup>2</sup>University of Cologne, Cologne, Germany.

(No relationships reported)

**INTRODUCTION:** The small ubiquitin-like modifier "SUMO" regulates target protein functions via post-translational modification and regulates cellular integrity. Sumoylation is triggered in vivo by stressors like oxidative stress but also acute hypoxia. Exercise induced myocellular adaptation requires a complex network of nuclear protein shuttling as well as post-translational modification of proteins and thus may include also the SUMO system as acute modulator of loaded skeletal muscle.

**PURPOSE:** It was aimed to investigate whether SUMO-1 is involved in the early response towards exercise in sarcoplasmatic and myonuclear compartments of loaded skeletal muscle myofibers.

**METHODS:** 6 healthy male subjects (age:  $23 \pm 4$  years; height:  $180 \pm 8$  cm; weight:  $79 \pm 10$  kg) performed 1 single set of 20 maximum eccentric and concentric isokinetic knee extensions. PRE, 15, 30, 60, 240 min and 24h after exercise (EX) muscle biopsies were taken from vastus lateralis muscle. DAB and Fluorescence staining was performed on  $7 \mu\text{m}$  cross-sections of skeletal muscle. The density and sub-cellular localization of SUMO-1 in sarcoplasmatic and nuclear compartments of type I and II myofibers were determined via optical densitometry and confocal laser microscopy as well as in whole skeletal muscle lysates by western blotting.

**RESULTS:** Sarcoplasmatic SUMO-1 density was higher in type I than in type II myofibers ( $p < 0.05$ ) PRE exercise, increased 15 to 30 min POST EX significantly ( $p < 0.01$ ) in both fiber types but returning to PRE levels within 60 min. SUMO-1 positive nuclear areas increased significant ( $p < 0.01$ ) from PRE values within 15 min up to 60 min post EX but returning below PRE levels within 24 hours. Confocal microscopy offered a predominant sub cellular localization of SUMO-1 towards the nuclear envelope at baseline and 24h post EX. Western blotting offered substantial changes in the pattern of SUMO-1 positive bands within the first hour POST EX.

**CONCLUSION:** The present investigation reveals time dependent changes in SUMO-1 density in nuclear and sarcoplasmatic compartments of human skeletal muscle fibers as early response towards high intense resistance exercise. This modulation offers a potential role of the SUMO system in myocellular adaptation towards acute exercise induced stress but also in recurring homeostasis.

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**1500** Board #281 **MAY 30** **11:00 AM - 12:30 PM**

**Novel Transcriptional Changes Associated with Age-related Muscle Insulin Resistance**

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(No relationships reported)

Skeletal muscle insulin resistance is a characteristic feature of the normal aging process and plays a key role in the pathogenesis of age-related type II diabetes mellitus and Alzheimer's disease. However the mechanisms associated with age-related muscle insulin resistance are not completely understood.

**PURPOSE:** Through a global view of transcriptional changes in young and older skeletal muscle, we sought to identify the molecular mechanisms underlying age-associated insulin resistance.

**METHODS:** Muscle biopsies were obtained basally from young (19-28yrs) and older (65-76 yrs) men (7 young, 4 older) and women (8 young, 4 older). Gene expression profiling was performed using the Affymetrix Human Genome U133 Plus 2 chip. Differential gene expression between older and young muscle was analyzed, separately for men and women, using an intensity-based Bayesian moderated t-test (IBMT). A logistic regression-based method (LRpath) was used to test for significant (FDR $< 0.01$ ) enrichment of biological functions based on Gene Ontology (GO) terms and KEGG pathways.

**RESULTS:** LRpath analysis in combination with IBMT revealed different patterns of transcriptional changes with aging in men and women. A much greater number of GO and KEGG were found to be significantly enriched with differentially expressed genes in older women than in older men (259 vs. 57). Transcriptional changes in older women presented a coordinated up-regulation of immune activation (e.g., *FABP4*, *LOX*, *C1R*), extracellular matrix (ECM) remodeling (e.g., *COL6A2*, *COL8A2*), lipids storage (e.g., *CD36*, *SCD*); and down-regulation of mitochondrial biogenesis and function (e.g., *PPARGC1*, *CS*), muscle regeneration (e.g., *MYF6*, *AKT2*). In contrast, no consistent biological themes can be inferred based on the limited number of significant GO/KEGG in older men.

**CONCLUSION:** Sex-based differences exist in skeletal muscle transcriptional regulation that may play a major role in the muscle's aging process in women but not in men. Moreover, given that immune activation, ECM remodeling, lipids storage, mitochondrial dysfunction, and muscle atrophy have all been implicated in muscle insulin resistance, altered transcriptional regulation in these biological pathways may represent novel mechanisms for age-associated insulin resistance, especially in women.

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**1501** Board #282 MAY 30 11:00 AM - 12:30 PM

**Erk and p38 Phosphorylation Following Three Different Maximal Velocity Squat Protocols**

Rebecca Kudrna<sup>1</sup>, Nicole Moodie<sup>2</sup>, Michael Prewitt<sup>3</sup>, Andrew Fry<sup>3</sup>, Phillip Gallagher<sup>2</sup>. <sup>1</sup>DeSales University, Center Valley, PA. <sup>2</sup>Rockhurst University, Kansas City, MO. <sup>3</sup>University of Kansas, Lawrence, KS.

(No relationships reported)

Changes in the cellular signaling molecules within skeletal muscle are believed to account for the specific adaptations that occur following various types of exercise. Mitogen activated protein kinases (MAPKs) including extracellular regulated kinase 1/2 (ERK1/2) and stress-activated kinase (p38) that likely play a role in muscle adaptation. While it has been shown that these kinases are affected by aerobic and anaerobic exercise, less is known about how these molecules are affected by different resistance training protocols.

**PURPOSE:** The purpose of this study was to determine the effect of low, moderate, and high intensity exercise protocols as are commonly used by athletes on the phosphorylation of ERK1/2 and p38 MAPKs.

**METHODS:** Nine recreationally trained males ( $21.4 \pm 1.67$  yrs,  $92.23 \pm 9.72$  kg), completed each of three speed squat (emphasizing speed of the concentric phase) protocols in randomized order and on non-consecutive days. The three testing protocols consisted of a low relative intensity (LI; 5 sets of 10 repetitions at 30% 1RM); moderate intensity (MI; 5 sets of 5 repetitions at 70% 1RM); and high intensity (HI; 5 sets of 3 repetitions at 90% 1RM). Muscle biopsies were taken before and after each exercise bout and examined by western blot analysis. Separate 3x2 repeated measures ANOVAs compared differences between the ratio of phosphorylation among the three protocols and at the pre- and post- exercise time points for ERK1/2 and p38 respectively.

**RESULTS:** For ERK1/2, there was a significant main effect for time ( $F_{(1,8)} = 6.86, p = 0.031$ ). Ratio of phosphorylated to total ERK1/2 increased by 33%, 56%, and 43% for the HI, MI, and LI respectively but was not significantly different between protocols ( $F_{(2,16)} = 0.186, p > 0.05$ ). There was no interaction between protocol and timepoint for ERK1/2. There were no significant main effects or interactions for p38 phosphorylation ( $p > 0.05$ ).

**CONCLUSIONS:** ERK1/2 phosphorylation was equally elevated following each of the three lower body resistance training protocols examined. Though not measured in this study, force production under these three different circumstances may have been more similar than the external exercise load indicates due to the maximal velocity contraction. p38 phosphorylation did not change following the short bouts of exercise in this study.

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**1502** Board #283 MAY 30 11:00 AM - 12:30 PM

**A Polymorphism Of Angiotensin-converting Enzyme Gene Does Not Affect Exercise-induced Muscle Damage Following Eccentric Muscle Contractions**

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(No relationships reported)

It is well demonstrated that angiotensin-converting enzyme (ACE) is one of the critical factors for renin-angiotensin system leading to vasoconstriction. It is also known to be related to exercise metabolism and performance including muscle strength and endurance. A recent study showed that ACE genotype may be related to creatine kinase activity following eccentric exercise but other muscle damage markers were not compared.

**PURPOSE:** To investigate whether ACE genotype can affect exercise-induced muscle damage to explain a large inter-subject variability shown after eccentric muscle contractions.

**METHODS:** Total 80 male subjects who had not participated in any exercise program in the past six months were recruited. A polymorphism of ACE gene was determined using real-time polymerase chain reaction. Each subject performed 2 sets of 25 eccentric contractions of the elbow flexors in the non-dominant arm. Maximal isometric force (MVC), muscle soreness (SOR), and blood markers including creatine kinase (CK) activity and myoglobin (Mb) were measured at pre, immediately after, 24, 48, 72 and 96 hours after exercise.

**RESULTS:** The frequency distribution of I allele and D allele was 62(78%) and 18(23%) respectively corresponding to Hardy Weinberg's equilibrium ( $p = 0.887$ ). There were no significant group by time effects in MVC ( $p = 0.399$ ), SOR ( $p = 0.644$ ), CK activity ( $p = 0.199$ ) and Mb levels ( $p = 0.399$ ) following eccentric muscle contractions.

**CONCLUSIONS:** Our data showed that there is no effect of ACE gene polymorphism on exercise-induced muscle damage suggesting that ACE may not be the factor to explain inter-subject variability of muscle damage markers.

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**1503** Board #284 MAY 30 11:00 AM - 12:30 PM

**Small Differences in Exercise Intensity May Impact Muscle Glycogen Without Concurrent Changes in Metabolic Gene Expression.**

Matt Heesch<sup>1</sup>, Dustin Slivka<sup>1</sup>, Charles Dumke, FACSM<sup>2</sup>, John Cuddy<sup>2</sup>, Walter Hailes<sup>2</sup>, Brent Ruby, FACSM<sup>2</sup>. <sup>1</sup>University of Nebraska at Omaha, Omaha, NE. <sup>2</sup>University of Montana, Missoula, MT.

(No relationships reported)

Intensity in exercise studies is often established relative to VO<sub>2</sub> peak. However, when there is an experimental manipulation of altitude, the intensity may be different depending on the altitude at which VO<sub>2</sub> peak is measured.

**PURPOSE:** To determine the impact of different absolute intensities associated with 60% VO<sub>2</sub> peak, when VO<sub>2</sub> peak is measured at 975 m or at a simulated altitude of 3000 m on metabolic gene expression.

**METHODS:** Twelve recreationally trained males (age  $23.8 \pm 3.8$  y, mass  $81.6 \pm 11.6$  kg, body fat  $14.6 \pm 7\%$ ) had their VO<sub>2</sub> peak measured on a cycle ergometer at 975 m and 3000 m. Participants then completed two trials consisting of cycling at 965 m elevation for 60 min at 60% VO<sub>2</sub> peak as measured at (A) 975 m and (B) 3000 m. Skeletal muscle biopsies were obtained from the vastus lateralis before exercise (PRE) and after 4 hours of recovery (POST4). Gene expression was measured using real-time RT PCR and expressed using the  $\Delta\Delta$  CT method.

**RESULTS:** VO<sub>2</sub> peak was statistically similar when measured at 975 m and 3000 m ( $p = 0.139$ ;  $4.24 \pm 0.89$  L·min<sup>-1</sup> and  $4.03 \pm 0.60$  L·min<sup>-1</sup>). The absolute intensities were  $174 \pm 33$  watts for trial A and  $158 \pm 23$  watts for trial B ( $p > 0.05$ ). The VO<sub>2</sub> during trial A ( $2.48 \pm 0.40$  L·min<sup>-1</sup>) was not significantly different than during trial B ( $2.43 \pm 0.56$  L·min<sup>-1</sup>). Skeletal muscle glycogen was similar between trials at PRE but at was 37.6% higher in trial B at POST4 ( $p < 0.05$ ). There were no differences between trials for COX, HIF, PGC1, FIS, MFN, OPA, HK or PFK ( $p > 0.05$ ) gene expression. However, COX, HIF, PGC1, FIS, MFN, HK and PFK increased as a result of exercise regardless of trial ( $p < 0.05$ ) while OPA did not.

**CONCLUSION:** These data indicate that small differences in exercise intensity created by completing initial VO<sub>2</sub> peak tests at 975 m versus 3000 m environment have an effect on muscle glycogen but not on select metabolic genes.

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**1504** Board #285 MAY 30 11:00 AM - 12:30 PM

**Alterations in the Exercise-Induced Transcriptional Response Following Short-Term Aerobic Exercise Training**

J. Matthew Hinkley, Adam R. Konopka, Miranda K. Udem, Bozena Jemiolo, Todd A. Trappe, Scott W. Trappe, FACSM, Matthew P. Harber. Human Performance Laboratory, Ball State University, Muncie, IN.

(No relationships reported)

An acute bout of exercise induces transient changes in mRNA expression that, with training, lead to specific adaptations. Interestingly, little is known about the effects of short-term training on the exercise-induced transcriptional response of markers associated with skeletal muscle adaptation.

**PURPOSE:** To examine the effects of short-term training on whole body performance and associated exercise-induced molecular adaptations in skeletal muscle.

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**METHODS:** Ten recreationally active subjects ( $25 \pm 2$  yr,  $79 \pm 3$  kg) were studied before and after a ten day cycling protocol consisting of both steady state and interval days. Prior to training and 24 hours after the last exercise bout, subjects completed a 20 km cycle time trial. Skeletal muscle biopsies were taken from the vastus lateralis at rest and 3h following the time trial in both conditions to measure mRNA expression.

**RESULTS:** Time trial performance improved ( $P < 0.05$ ) by  $5 \pm 1\%$  following training, which was associated with an enhanced power output ( $P < 0.05$ ). MuRF-1 and PGC-1 $\alpha$  mRNA were elevated ( $P < 0.05$ ) after exercise before and after training, with an attenuated response ( $P < 0.05$ ) following training (11-fold vs. 3-fold and 33-fold vs. 12-fold for MuRF-1 and PGC-1 $\alpha$ , respectively). NF $\kappa$ B was elevated ( $P < 0.05$ ) 2-fold following the pre-training time trial, and unaltered after the post-training time trial. A significant interaction ( $P < 0.05$ ) was found for the exercise-induced mRNA expression of myostatin and TNF- $\alpha$ , suggesting a greater reduction in myostatin after training and a greater response in TNF- $\alpha$  prior to training.

**CONCLUSION:** These data suggest that short-term high-intensity aerobic exercise training alters the exercise-induced transcriptional response of genes involved in the regulation of skeletal muscle. Specifically, markers of myofibrillar degradation were attenuated, suggesting less susceptibility to post-exercise protein breakdown after training.

Supported by NIH Grant AG032127

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**1505** Board #286 **MAY 30** **11:00 AM - 12:30 PM**

### **DNA Methylation is Altered in Human Skeletal Muscle in Response to Exercise Training**

Shlomit Radom-Aizik<sup>\*1</sup>, Fadia Haddad<sup>\*1</sup>, Tomasz Owerkovicz<sup>2</sup>, Joseph M. Devaney<sup>3</sup>, Eric P. Hoffman<sup>3</sup>, Per A. Tesch<sup>4</sup>, Gregory R. Adams<sup>1</sup>\*These 2 individuals are joint first authors<sup>1</sup>. <sup>1</sup>University of California Irvine, Irvine, CA. <sup>2</sup>California State University, San Bernardino, CA. <sup>3</sup>Children National Medical Center, George Washington University, Washington, DC. <sup>4</sup>Mid Sweden University, Ostersund, Sweden. (Sponsor: Kenneth M. Baldwin, FACSM)

(No relationships reported)

DNA methylation is an epigenetic modification, which is influenced by environmental stimuli (e.g., exercise), and can play an important role in the adaptive process involving altered gene expression. Currently, little is known on DNA methylation status in muscle undergoing remodeling in response to exercise training.

**PURPOSE:** To determine if exercise training would induce alteration in DNA methylation in human skeletal muscle.

**METHODS:** Thirty three subjects, 20-26 y/o, were assigned to one of two 5-week exercise protocols: a) Resistance Exercise (RE), 4x7 squats, 2 days a week, or b) Combined Aerobic and RE (AE+RE), 5 days a week: 3 days of AE: 4, 4-min bouts of rowing at  $\sim 90\%$   $\dot{V}O_{2\max}$  interspersed with 4, 4-min bouts of rowing at  $\sim 50\%$   $\dot{V}O_{2\max}$ , and 2 days of RE. DNA was extracted from the vastus lateralis muscle, treated with sodium bisulfite, and analyzed for methylation using the Infinium HumanMethylation450 BeadChip (Illumina). Statistical analysis was done using Partek Genomics Suite (version 6.6).

**RESULTS:** Both exercise protocols altered the methylation status in the vastus lateralis muscle, however the AE+RE protocol had a greater effect (6976 CpG sites compared to 970 CpG sites in the RE only ( $P < 0.0005$ )). These altered CpG sites correspond to 3323 and 692 genes respectively. Of these, only 197 genes were common in both paradigms. In the AE+RE group we identified Kegg pathways that were enriched with genes with altered methylation; e.g., insulin signaling, focal adhesion, phosphatidylinositol, MAPK, Notch signaling, and regulation of actin cytoskeleton ( $EASE < 0.05$ ). We scanned for 1000bp regions that were enriched with  $\geq 2$  CpG altered methylation sites ( $P < 0.005$ ) and found 47 regions in the AE+RE group and only 3 regions in the RE group.

**CONCLUSION:** Two different exercise protocols generated differential response in DNA methylation. The altered genes are part of important signaling and structural pathways that are involved in muscle plasticity. This is the first study demonstrating that only five weeks of training can alter DNA methylation in human skeletal muscle. This information can enhance our understanding of complex molecular mechanisms leading to muscle plasticity in response to exercise stimulus. Supported by NSBRI NCC 9-58-7, and by NIH grants #2R24HD050846-06 and UL1RR031985

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**1506** Board #287 **MAY 30** **11:00 AM - 12:30 PM**

### **The Effect Of Lactate On Primary Human Myoblasts And Potential Signalling Pathways**

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(No relationships reported)

Satellite cells (SCs) play a crucial role in embryonic myogenesis and skeletal muscle regeneration and adaptation. SCs can be activated by different stimuli and underlie a number of regulatory factors and proteins. In the past decades lactate (La) has been considered as a metabolic waste product, being responsible for the decrease in muscle pH and hence causing muscle fatigue. Nowadays La is better known as an intermediate of glucose metabolism and its ability to stimulate molecular pathways essential for skeletal muscle adaptation.

**PURPOSE:** The aim of this study was to analyse to what extent and how La can influence myoblast behaviour.

**METHODS:** Human myoblasts (HMB) were isolated from muscle biopsies, cultured and incubated with different La concentrations (0, 10, and 20 mM). Immunostainings and Western Blots were carried out for Ki67 (proliferation), activated Caspase-3 (apoptosis), Myogenin (early differentiation) and Myosin Heavy Chain (MHC; late differentiation). To investigate which signalling pathways are involved, activated beta-catenin, a molecule important in Wnt-mediated signalling, has also been analysed.

**RESULTS:** The results showed significant changes in proliferation and differentiation behaviour of the La treated cells. Regarding proliferation, La reduced the activity in a dose-dependent manner. Differentiation of primary HMB seemed to be timely delayed by La. Analysis of beta-catenin showed a decrease in its activation if cells were treated with La in a dose-dependent manner.

**CONCLUSIONS:** La has a negative or time-delaying influence on proliferation and differentiation of HMB. Although the literature suggests a strong involvement of redox signalling pathways, activated by La-dependent reactive oxygen species (ROS) production, beta-catenin could also play an influential role in the observed effects. However, further investigations are necessary to allow for a more precise estimation of La-induced regulation of proliferation, apoptosis, and differentiation in myogenic cell culture.

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**1507** Board #288 **MAY 30** **11:00 AM - 12:30 PM**

### **Skeletal Muscle Mitochondrial Respiration And Type 2 Diabetes Duration**

T P. Gavin, FACSM, J M. Ernst, S E. Kehe, M A. Reed, A H. Clark, R D. McKernie, M Dar, W E. Pofahl, G L. Dohm, H B. Kwak. *East Carolina University, Greenville, NC.*

(No relationships reported)

Type 2 diabetes (T2DM) resolution following Roux-en Y gastric bypass (RYGB) surgery is poorer in patients with longer duration T2DM and lower pre-RYGB insulin sensitivity. Skeletal muscle mitochondrial function is impaired in T2DM.

**PURPOSE:** It was hypothesized that skeletal muscle mitochondrial respiration (JO2) would be lowest in T2DM patients with long-duration (LD;  $\geq 8$  y) compared to medium-duration (MD; 4-7) and short-duration (SD;  $\leq 3$  y).

**METHODS:** Vastus lateralis biopsies were obtained from T2DM patients ( $N = 12$ ). Muscle mitochondrial JO2 was measured using the permeabilized fiber technique under basal (State 2) and ADP stimulated (State 3) conditions with glutamate+malate (GM) or palmitoylcarnitine+malate (PM) as substrate. Respiratory control index (RCI), an index of mitochondrial coupling, was calculated as State 3/State 2 JO2.

**RESULTS:** There was a non-significant ( $p = 0.10$ ) trend of lower GM State 2 JO2 with longer T2DM duration (LD:  $9.7 \pm 1.7$ ; MD:  $13.5 \pm 1.0$ ; SD:  $17.8 \pm 4.7$  pmol/sec/mg dry wt.). GM RCI was greater in LD than MD or SD (LD:  $21.3 \pm 1.8$ ; MD:  $12.6 \pm 2.4$ ; SD:  $13.8 \pm 1.3$ ). There was a significant correlation between T2DM duration and GM RCI ( $r = 0.59$ ;  $p \leq 0.05$ ). There was no difference in JO2 or RCI for PM conditions between groups.

**CONCLUSIONS:** Skeletal muscle mitochondrial coupling is higher in longer compared to shorter duration T2DM patients. Also, there may be a trend toward lower basal skeletal muscle mitochondrial respiration in patients with longer compared to shorter duration T2DM.

Supported by a Grant from the East Carolina Diabetes and Obesity Institute (ECDOI).

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1508 Board #289 MAY 30 11:00 AM - 12:30 PM

**Age-associated Declines In Mitochondrial Biogenesis And Protein Quality Control Are Minimized By Exercise Training**

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(No relationships reported)

Impairments of the mitochondrial reticulum or network, and its function have often been associated with aging. A decline in mitochondrial biogenesis and mitochondrial protein quality control in skeletal muscle, directly contributes to this problem, but exercise training has been suggested as a possible cure.

**PURPOSE:** In this report, we tested the effects of moderate intensity exercise training on young and old rats, and assessed mitochondrial biogenesis and mitochondrial protein quality control.

**METHODS:** Twelve young (three mo) and twelve old (26 mo) male Wistar rats were used in the study and grouped into young control (YC), young exercised (YE), old control (OC) and old exercised (OE). The investigation was carried out according to the requirements of The Guiding Principles for Care and Use of Animals, EU. Exercised rats were trained on treadmill for 6 weeks, 5 times per week, where the running speed and duration of the exercise were gradually increased. We examined in this study the gastrocnemius muscle by Western blot and fluorometric assays. Statistical significance was assessed by one-way ANOVA, followed by Tukey's post hoc test.

**RESULTS:** Exercise training prevented or attenuated significant age-associated (detrimental) declines in SIRT1 activity (437±174 v. 1166±109 rel. act. p<0.05), AMPK (0.21±0.11 v. 1.05±0.29 rel.dens. p<0.01), peroxisome proliferator-activated receptor gamma coactivator 1-alpha (PGC-1alpha) (0.35±0.04 v. 0.87±0.08 rel.dens. p<0.01) and the Lon protease, in the gastrocnemius muscle of rats. Exercise training also prevented the age-related (detrimental) increases in NRF1 (1.11±0.17 v. 0.67±0.1 rel.dens. p<0.01), TFAM, Mfn1 (0.98±0.31 v. 0.48±0.16 rel.dens. p<0.01), Fis1 and polynucleotide phosphorylase (PNPase) (1.52±0.42 v. 1.05±0.25 rel.dens. p<0.01) levels.

**CONCLUSION:** Our data suggest that regular exercise training can help minimize detrimental skeletal muscle aging deficits stimulating mitochondrial biogenesis through the PGC1[Unsuported Character - Symbol Font α] system, a rejuvenating the mitochondrial network via fission and fusion, and improving quality control of mitochondrial proteins by the Lon protease. All of these properties, working in conjunction with one another, would improve the overall functionality of mitochondria in aged cells.

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1509 Board #290 MAY 30 11:00 AM - 12:30 PM

**Interaction Of Mitochondria And Oxygen Binding Protein In L6, Rat Skeletal Muscle Cell Line**

Tatsuya Yamada<sup>1</sup>, Nobumasa Iwanaka<sup>1</sup>, Yasuro Furuichi<sup>1</sup>, Yukio Kato<sup>1</sup>, Takeshi Hashimoto<sup>2</sup>, Thomas Jue<sup>3</sup>, Kazumi Masuda<sup>1</sup>. <sup>1</sup>*Kanazawa University, Ishikawa, Japan.* <sup>2</sup>*Ritsumeikan University, Shiga, Japan.* <sup>3</sup>*University of California Davis, Davis, CA.*  
(No relationships reported)

**PURPOSE:** It has been for a long time believed that myoglobin (Mb), muscle specific oxygen binding protein, is a cytosolic protein. However, our recent immunohistochemical and biochemical analyses showed that Mb located not only in cytosol but also in mitochondria and that the mitochondrial Mb content was positively related to muscle oxidative potential. These results led us the hypothesis that mitochondrial Mb has a pivotal role in the regulation of mitochondrial respiration. In order to assess this idea, we determined protein-protein interaction between Mb and mitochondrial proteins in L6 skeletal myocytes in the present study.

**METHODS:** The recombinant pcDNA3-Myc tagged Mb was transfected to L6 myoblast. The myoblasts were cultured in the presence of G418 and a single colony was isolated, proliferated and differentiated. The expression of Myc-Mb was screened by Western blotting (WB). Cellular subfractions were separated by serial centrifugation, and WB assessed the presence of Mb protein in each fraction. Co-immunoprecipitation (Co-IP) was performed to confirm protein-protein interactions of Mb with mitochondrial proteins. Silver staining of the Co-IP samples was also performed to assess the existence of putative proteins that interact with mitochondrial Mb.

**RESULTS:** WB confirmed the presence of Mb protein in mitochondrial fraction in normal and Mb-overexpressed L6 myotube. Both VDAC and COX-IV, mitochondrial outer and inner membrane proteins, respectively, were detected from mitochondrial fraction but not from cytosolic fraction. COX-IV was co-precipitated with Myc-Mb by Co-IP, suggesting a protein-protein interaction between Mb and COX-IV in L6 myotube. On the other hand, VDAC-I was not co-precipitated with Myc-Mb. Thus, Myc-Mb did not have interaction with VDAC-I. Silver staining revealed several proteins might interact with mitochondrial Mb.

**CONCLUSIONS:** The present results suggested the possibility of the interaction of mitochondrial respiratory chain with Mb in skeletal myocytes. Further study including proteome analysis is necessary to determine the specific mechanism for the interaction between mitochondrial proteins and Mb.

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1510 Board #291 MAY 30 11:00 AM - 12:30 PM

**Effects Of Endurance Training And Immobilization On The Localization Of Myoglobin In Skeletal Muscle**

Hisashi Takakura<sup>1</sup>, Tatsuya Yamada<sup>1</sup>, Yasuro Furuichi<sup>1</sup>, Minoru Ojino<sup>1</sup>, Nobumasa Iwanaka<sup>1</sup>, Thomas Jue<sup>2</sup>, Kazumi Masuda<sup>1</sup>. <sup>1</sup>*Kanazawa University, Kanazawa City, Japan.* <sup>2</sup>*University of California Davis, Davis, CA.*  
(No relationships reported)

Myoglobin (Mb) supplies O<sub>2</sub> to mitochondria immediately at the onset of muscle contraction. The release rate of O<sub>2</sub> from Mb increases progressively with the rate of increase in muscle O<sub>2</sub> consumption and fluctuates in accordance with the level of physical activity. We recently reported the novel localization of Mb to mitochondria, suggesting a possible mechanism that Mb supplied O<sub>2</sub> to mitochondria immediately with the increase in mitochondrial O<sub>2</sub> demand, because Mb translational diffusion in the cell appears too low to have a significant role for O<sub>2</sub> transport in the basal PO<sub>2</sub> (above 10 mmHg). However, it remains unknown whether the localization of Mb to mitochondria is involved in the changed release rate of O<sub>2</sub> from Mb to the modulated physical activity level.

**PURPOSE:** The purpose of this study was to determine the effect of swimming endurance training (eTR) and hindlimb immobilization (IM) on the localization of Mb to mitochondria.

**METHODS:** Male Wistar rats were randomly assigned to the eTR, IM, or Control (Con) group. Rats in the eTR group underwent a 4-week swimming eTR (6 days/week, 30 min × 4 sets/day) with a weight of 2% body mass. Rats in the IM group had their left hindlimb immobilized at the full plantar flexion with a thermoplastic cast for 3 weeks. Citrate synthase (CS) activity and Mb concentration ([Mb]) in the hindlimb muscle were measured spectrometrically. Western blotting was performed to evaluate the amount of Mb in mitochondrial fraction of the m. gastrocnemius. Expression of Mb in the mitochondrial fraction was normalized by the amount of the voltage dependent anion channel (VDAC-I), which was mitochondrial protein.

**RESULTS:** 4-weeks eTR significantly increased [Mb], CS activity and Mb/VDAC-I (p < 0.05), while 3-weeks IM did not show any change in [Mb], CS activity and Mb/VDAC-I.

**CONCLUSIONS:** The eTR increased the expression of Mb in the mitochondrial fraction in the skeletal muscle, suggesting the formation of more efficient O<sub>2</sub> transport mechanism at the onset of muscle contraction. On the contrary, the IM did not change the co-localization of Mb with mitochondria. In order to clarify the interaction of Mb with mitochondria, it is necessary to measure the changes in the mitochondrial respiration in response to changes in physical activity.

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1511 Board #292 MAY 30 11:00 AM - 12:30 PM

**Effect of Hydrogen Peroxide on Mitochondrial Motility Protein Miro1 in C2C12 Cells**

Yong Zhang<sup>1</sup>, Huijun Liu<sup>1</sup>, Ning Jiang<sup>1</sup>, Fei Zhao<sup>1</sup>, Hu Ding<sup>1</sup>, Li Li Ji, FACSM<sup>2</sup>. <sup>1</sup>*Tianjin University of Sport, Tianjin, China.* <sup>2</sup>*University of Minnesota, Minneapolis, MN.* (Sponsor: Li Li Ji, FACSM)  
(No relationships reported)

**OBJECTIVE:** The dynamic changes of mitochondria morphology and distribution have a profound influence on mitochondrial function. The mitochondria movement and distribution is still unclear. It was studied that mitochondrial motility and its regulation mechanism with moderate oxidative stress caused by exogenous H<sub>2</sub>O<sub>2</sub> in present research.

**METHODS:** C2C12 myoblast model of mild oxidative stress was induced by exogenous H<sub>2</sub>O<sub>2</sub>. Cell survival rate was detected by MTT. The colorimetry was used for measure of MDA. Oxygen consumption rate and ATP content were detected by using Oxytherm liquid oxygen electrode and fluorospectrophotometer. The western blotting and realtime-PCR were used to measure the contents of Miro1 protein and mRNA express in C2C12 myoblast. EGTA was used as chelator for Ca<sup>2+</sup>. **RESULTS:** 1) Cell survival rate of myoblast stimulated by low concentration (1-100μM) H<sub>2</sub>O<sub>2</sub> had no obvious change, and showed significantly low level when stimulated by higher concentrations of H<sub>2</sub>O<sub>2</sub> (1 mM or 10mM). The MDA level showed the



same trend. 2) The rates of respiration of myoblast cells were transient reversibly inhibited when stimulated by low concentrations of H<sub>2</sub>O<sub>2</sub> (100nM-1mM). H<sub>2</sub>O<sub>2</sub> of 100µM-10mM decreased the ATP content, nevertheless there were no significant effects when myoblasts were treated with 1µM or 10µM H<sub>2</sub>O<sub>2</sub>. 3) Miro1 mRNA of C2C12 cells treated with 10µmol / L H<sub>2</sub>O<sub>2</sub> for 0.5h, 1h, 1.5h increased by 44.1%, 49.0%, 54.9% respectively compared with the control group. The Miro1 protein expression increased 26.7% (P<0.05) after the treatment with the 10µmol / L H<sub>2</sub>O<sub>2</sub> for 1h. But the miro1 mRNA and protein expression in the EGTA+H<sub>2</sub>O<sub>2</sub> treated group decreased significantly (P<0.05) compared with the H<sub>2</sub>O<sub>2</sub> treated group.

**CONCLUSIONS:** H<sub>2</sub>O<sub>2</sub> had bidirectional for mitochondrial motility in myoblast. Lower H<sub>2</sub>O<sub>2</sub> promoted mitochondrial motility, high H<sub>2</sub>O<sub>2</sub> inhibited those. Ca<sup>2+</sup> involved in mitochondrial motility induced by H<sub>2</sub>O<sub>2</sub>. Supported by NSFC(No. 31071040)

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**1512** Board #293 **MAY 30 11:00 AM - 12:30 PM**

**Reactive Oxygen Species Markers After Multiple Wingate Bouts in Trained and Untrained Subjects**

Jason R. Boynton, Lynn Shetron-Rama, Chris Herman, Andrea D. Workman, Tim Muth, Josh Gordon, Ian Ratz, Zack Maino, Stephen J. McGregor. *Eastern Michigan University, Ypsilanti, MI.*  
(No relationships reported)

Reactive oxygen species (ROS) are reactive molecules in the body that contain oxygen and unpaired valence electrons. Previous research has shown that ROS increase with acute exercise, but levels in untrained (UT) vs. trained (T) subjects vary in the literature in cross sectional vs. longitudinal studies.

**PURPOSE:** To study changes in ROS markers over time following multiple 30 s supra-maximal efforts in UT and T subjects.

**METHODS:** All procedures were approved by the Eastern Michigan University Human Subjects Review Committee. 11 UT subjects (22 ± 4 yr, weight 83.8 ± 11.8 kg, VO<sub>2peak</sub> = 40.05 ± 6.96 ml/kg/min) and 9 T cyclists (age 25 ± 4 yr, weight 77.8 ± 9.26 kg, VO<sub>2peak</sub> = 59.56 ± 5.66) performed three consecutive Wingates with 4 min of rest between each bout (MW). Exercise was performed on an electronically braked ergometer (Velotron, Racermate WA). Blood was collected by antecubital venipuncture: pre, immediate, 1 hr, 24 hr & 48 hr post MW. Samples were quantitatively analyzed for malondialdehyde (MDA) and 4-hydroxynonenal (4-HNE) with enzyme-linked immunosorbent assays (ELISAs; Cell Biolabs, inc., CA). Differences between the blood draw timepoints were analyzed using ANOVA. MDA and 4-HNE concentrations for all timepoints were compared using a 2 x 5 analysis of variance (ANOVA) to account for differences by training status as well as time (SPSS, IBM, NY).

**RESULTS:** Lactate values were higher on average in T vs UT, but increased significantly and similarly between groups immediately post for both the UT and T groups (1.14 ± 0.78 to 12.58 ± 1.75 mmol, 1.34 ± 0.54 to 12.62 ± 0.95 mmol, respectively; p<.05). There was a significant difference in MDA and 4-HNE levels between the UT group (7.45 ± 1.66 µg/mL, 6.73 ± 2.83 µg/mL) and T group (17.32 ± 2.07 µg/mL, 7.88 ± 0.81 µg/mL) at basal and across all the time points (p=.001; p=.015). There was no significant change from basal MDA and 4-HNE levels over the course of the blood draws in either the UT or T group. There was no significant interaction between the groups.

**CONCLUSION:** MDA and 4-HNE blood serum levels do not change acutely after multiple Wingate efforts, but are higher in T subjects than UT subjects at basal levels and after exercise. This indicates that ROS levels may change with chronic training over longer time frames than were examined in this study.

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**1513** Board #294 **MAY 30 11:00 AM - 12:30 PM**

**Aged Skeletal Muscle Inflammation Susceptibility**

Edward K. Merritt, Anna Thalacker-Mercer, Michael J. Stec, David P. Shelley, Marcos M. Bamman, FACSM. *University of Alabama at Birmingham, Birmingham, AL.*  
(No relationships reported)

**BACKGROUND:** The regenerative response of skeletal muscle to mechanically induced damage is impaired with age. Previous work in our laboratory indicates that the impairment likely results from a differential inflammatory response in old relative to young, although the specific signaling mechanisms and their magnitudes are unknown.

**PURPOSE:** To examine the effects of age on the mRNA expression and protein signaling of putative pro-inflammatory and catabolic pathways in skeletal muscle at rest and after mechanically induced damage.

**METHODS:** Young (40.4 ± 1.1 y), older (61.2 ± 0.6 y), and old (75.5 ± 0.7 y) adults performed nine sets x 10 repetitions of unaccustomed, high-intensity leg extensions to induce modest muscle damage. A blood sample and a biopsy of the vastus lateralis muscle were obtained before and 24 h after the bout. Muscle mRNA expression and protein signaling within the interleukin-6 (IL-6) and tumor necrosis factor-α (TNF-α) pathways were determined by qPCR and Western blot analysis.

**RESULTS:** All subjects experienced similar levels of muscle damage as indicated by serum creatine kinase levels. Baseline expression of several analyzed genes was higher in older and old adults relative to young: IL-6 (1.64 - 2.70 fold higher); TNF-α (1.38 - 4.06 fold higher); and TWEAK (1.30 - 1.74 fold higher). TWEAK receptor expression was significantly increased in all groups after muscle damage and tended to be higher in older and old. STAT3 and NFκB protein expression were 17% and 35% higher in the old at baseline. Of all of the markers of inflammation, none were higher in young adults at baseline or after muscle damage.

**CONCLUSION:** The overall lower inflammatory state of skeletal muscle before and after muscle damage in young adults indicates that a higher sensitivity to inflammation signaling occurs in the muscle with age. Higher muscle inflammation susceptibility likely contributes to the impaired regenerative capacity of skeletal muscle in the older population, and should be considered when designing exercise programs to promote skeletal muscle recovery following damage or surgery.

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**1514** Board #295 **MAY 30 11:00 AM - 12:30 PM**

**Effects Of H2O2 On Oxidant Generation And NF-κB Pathway Activity In C2C12 Muscle Cells**

Kevin S. O'Fallon, Lawrence M. Schwartz, Priscilla M. Clarkson, FACSM. *University of Massachusetts, Amherst, MA.*  
(No relationships reported)

Reactive oxygen and nitrogen species (RONS) production increases during exercise and following muscle injury. In vitro studies have shown that H<sub>2</sub>O<sub>2</sub> activates the canonical NF-κB pathway involved in transcription of antioxidant defenses in response to exercise. However, the effects of RONS on the alternative NF-κB pathway, which is involved in mitochondrial biogenesis, are currently unknown. Understanding the mechanisms of RONS-induced NF-κB activation will elucidate how NF-κB regulates the responses to exercise and muscle injury.

**PURPOSE:** To test the hypothesis that elevated RONS by H<sub>2</sub>O<sub>2</sub> induces changes in alternative NF-κB pathway activation in cultured muscle cells.

**METHODS:** C<sub>2</sub>C<sub>12</sub> myotubes were loaded with a fluorescent probe to quantify intracellular RONS levels. Culture media was supplemented with 100µM H<sub>2</sub>O<sub>2</sub> and fluorescence was measured hourly for 1-4 hrs, then again at 24 hrs. In a separate experiment, myotubes were exposed to H<sub>2</sub>O<sub>2</sub> for 1, 5 and 24 hrs and then harvested for total nuclear protein. Changes in the DNA binding activity of canonical (via the p65 subunit) and alternative (via the Rel B subunit) NF-κB pathways were quantified via ELISA assay.

**RESULTS:** Myotubes treated with H<sub>2</sub>O<sub>2</sub> showed higher RONS levels at 1 hr (42%), 2 hrs (33%), 3 hrs (30%), 4 hrs (28%), and 24 hrs (14%) relative to untreated controls (p<0.05). Fold changes in DNA binding activity of p65 (1.96 fold at 1 hr) and Rel B (0.71 fold at 1 hr and 0.61 fold at 5 hrs) were observed relative to controls (p<0.05).

**CONCLUSIONS:** H<sub>2</sub>O<sub>2</sub> stimulates RONS production in cultured muscle cells and alters the DNA binding activities of canonical and alternative NF-κB complexes within 5 hrs of exposure. The decrease in Rel B DNA binding indicates that elevated RONS reduces the transcriptional activity of the alternative NF-κB complex, which may be intended to temporarily restrict processes involved in mitochondrial biogenesis while intracellular redox homeostasis is being restored.

Funding Source: US Army

1515 Board #296 MAY 30 11:00 AM - 12:30 PM

**Age- And Load-dependent Variations In Apoptotic Quantification And Localization With Skeletal Muscle Adaptation And Maladaptation**

Brent A. Baker<sup>1</sup>, Melinda S. Hollander<sup>2</sup>, Robert G. Cutlip<sup>2</sup>. <sup>1</sup>NIOSH, Morgantown, WV. <sup>2</sup>West Virginia University, Morgantown, WV. (Sponsor: Stephen E. Alway, Ph.D., FACSM)

(No relationships reported)

Increased skeletal muscle nuclear apoptosis has been suggested to be involved with age-related pathological remodeling that contributes to sarcopenic states.

**PURPOSE:** The purpose of this study was to determine if apoptosis plays a role in age-dependent adaptation and maladaptation in young and old skeletal muscle of rats, respectively, following chronic high-intensity mechanical loading via stretch-shortening contractions (SSCs).

**METHODS:** Left dorsiflexor muscles of young (3 mo, N=6) and old (30 mo, N=6) Fischer 344 x BN rats, were loaded 3 times/week for 4.5-weeks using a protocol of 80 maximal SSCs per exposure *in vivo*. Twenty-four hours after the last training session, tibialis anterior (TA) muscles were harvested and individual muscle regions were allocated for biochemical or histological analyses. TA muscle was homogenized and prepared for cell death enzyme-linked immunosorbent assay (ELISA), while histomorphology was conducted on transverse sections of the TA muscle mid-belly prepared for terminal dUTP nick-end labeling (TUNEL) and laminin dual immunofluorescence and quantified via standard stereology.

**RESULTS:** Cell death was increased in both old control (~50%) and old SSC-loaded (~105%) skeletal muscle versus young muscle, as quantified by ELISA ( $p < 0.05$ ). Moreover, ELISA data revealed chronic SSC-loading increased cell death ~95% in young rats' skeletal muscle, while old rats' cell death significantly increased ~105% ( $p < 0.05$ ), compared with control muscle. Additionally, aging increased the volume density of TUNEL-positive myonuclei in both control (~125%) and SSC-loaded (~200%) TA muscles compared with young rats ( $p < 0.05$ ). Interestingly, no increase in TUNEL-positive myonuclei was observed following chronic SSC loading in young or old rats.

**CONCLUSION:** Our data suggest that adaptation and maladaptation following chronic SSC loading is significantly impacted by apoptosis; however apparent differences exist with the individual cell types undergoing apoptosis; specifically, nuclei distinct from skeletal muscle may contribute to these findings. Collectively, these results indicate that apoptotic-related events contribute significantly to age-dependent adaptive and maladaptive remodeling in young and old soft tissue, respectively, following chronic mechanical loading.

1516 Board #297 MAY 30 11:00 AM - 12:30 PM

**The Role Of Wound Healing Macrophages In Acute Muscle Injury**

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(No relationships reported)

Macrophages are recruited to sites of acute skeletal muscle injury and depletion of macrophages has been shown to hinder muscle regeneration. The mechanisms by which macrophages promote muscle regeneration remain to be elucidated.

**PURPOSE:** To investigate temporal changes in the expression of transcripts indicative of macrophage phenotypic specialization in response to cardiotoxin-induced acute myonecrosis.

**METHODS:** Cardiotoxin (CTX) was injected into the gastrocnemius of 8-wk old C57BL/10 mice on day 0. Bilateral sections of the belly of the gastrocnemius were taken at 27-time points (0-40d) for RNA extraction and profiling using murine U74A Ver. 2 chips. Expression profiling data were analyzed via the dChip differential algorithms. To assess the effects of differential macrophage activation on myogenesis, an *in vitro* co-culture system was used. Bone marrow-derived macrophages (M $\phi$ ) were stimulated with IL-4 or LPS to promote a wound healing (M2a) or classical activation phenotype (M1), respectively. M $\phi$  were plated onto transwells on top of myoblasts. Myoblasts were then induced to differentiate and myotube formation was compared between co-culture conditions.

**RESULTS:** M2a and M1 M $\phi$  markers were upregulated 1-3 days following CTX-induced injury. The increased expression of M1 M $\phi$  markers (CD11b: 3.6-fold, 1d; IFN $\gamma$ : 2.9-fold, 1d; CXCL9: 4.4-fold, 1d; CD68: 13.8-24.2-fold, 1-3d) and M2a M $\phi$  markers (arginase-1: 4800-fold, 1d; YM-1: 37-fold, 1d; STAT6: 5-6.8-fold, 1-2d; RELM $\alpha$ : 46.9-fold, 2d) was observed. Myogenic markers were upregulated following increases in M2a and M1 M $\phi$  transcripts (MyoD: 4.9-fold, 3d; myogenin: 12.0-12.5-fold, 3-3.5d; Myf5: 4.0-4.5-fold, 3.5-5d). Co-culture of H2K cells with M2a M $\phi$  resulted in a myotube fusion index of 13% vs. 5% in M1 co-cultures.

**CONCLUSIONS:** Our findings suggest that muscle injury by CTX results in the acute upregulation of M1 and M2a M $\phi$  transcripts. Our *in vivo* findings suggest a complex interplay of Th1 and Th2 immunological responses promote myogenesis following acute muscle injury. Additionally, our *in vitro* findings suggest that M2a macrophages are capable of potentiating myotube formation. Further research is needed to elucidate mechanisms by which acute adaptive immune responses promote myogenesis following acute muscle injury.

1517 Board #298 MAY 30 11:00 AM - 12:30 PM

**The Effect Of Myosin Light Chain 3f On Inactivity-induced Decline In Contractile Velocity In Type II Single Muscle Fibers**

Jong-Hee Kim, Ted G. Graber, Lisa F. Stegall, Haiming Liu, Atsushi Asakura, LaDora V. Thompson. University of Minnesota, Minneapolis, MN.

(No relationships reported)

A period of inactivity is associated with muscle atrophy and impaired contractility (e.g., power, force, velocity); however, the mechanism that underlies inactivity-induced changes in contractile velocity is unknown. Recent evidence suggests that inactivity-induced decline in contractile velocity is related with a decrease in the relative content of essential myosin light chain 3f (MLC3f) isoform.

**PURPOSE:** The purpose of this study was to examine whether 1) inactivity-induced decline in contractile velocity in type II single muscle fibers is associated with a decreased relative MLC3f content, 2) increased MLC3f via recombinant adenovirus gene (rAd) transfer technology can ameliorate inactivity-induced decrease in contractile velocity, 3) MLC3f-induced changes in  $V_o$  are dose and time dependent.

**METHODS:** F344 rats (10 mo. old) were randomly assigned to one of experimental groups: weight-bearing control (CON), hindlimb suspension (HS), and hindlimb suspension plus rAd-MLC3f (HSM). Rats were hindlimb-suspended for 7 days. The rAd-MLC3f ( $1 \times 10^{11}$ - $1 \times 10^{12}$  ifu/ml) was injected into semimembranosus (SM) muscles with different timing (one day before HS, 2<sup>nd</sup> day of HS, 4<sup>th</sup> day of HS) and volume (250, 375, 500 $\mu$ l). The fiber size, isometric maximal force ( $P_o$ ), and shortening velocity ( $V_o$ ) were determined using single fiber physiology test. Myosin heavy chain (MHC) and MLC isoforms were determined by SDS-PAGE gel electrophoresis and silver staining. Densitometry using molecular multi-imaging system (GS-800) was used to determine the relative content of MLC1f, MLC2f, and MLC3f in MHC type II fibers.

**RESULTS:** HS resulted in a significant decline in fiber size (-17%) and  $P_o$  (-51%). The rAd-MLC3f injection did not affect fiber size and  $P_o$ . HS significantly decreased relative MLC3f content [%MLC3f (-4.2%), MLC3f/MLC2f (-27%), and MLC3f/(MLC1f+MLC3f) (-39%)]. The rAd-MLC3f injection significantly increased MLC3f content dependant on injection timing and. HS significantly decreased  $V_o$  (-27%). The rAd-MLC3f injection increased  $V_o$  and the increase was associated with rAd-MLC3f injection timing and volume.

**CONCLUSIONS:** Increasing MLC3f content provided significant protection against inactivity-induced decline in  $V_o$  of type II single muscle fibers.

1518 Board #299 MAY 30 11:00 AM - 12:30 PM

**Fiber Type Conversion *in vivo*: The Effects of Six1 Gene Expression in Murine Skeletal Muscle**

Kimbell L. Hetzler, Matthew C. Kostek. University of South Carolina, Columbia, SC. (Sponsor: James Carson, FACSM)

(No relationships reported)

Six1 is a gene necessary for the development of several tissues, but in adults is expressed solely in skeletal muscle. Six1 gene and protein levels decrease in response to acute exercise in humans and mice. Overexpression of Six1 can cause a slow-to-fast fiber type transition, but the effect of Six1 decrease on fiber type proportion and size is unknown.

**PURPOSE:** To determine the effect of Six1 overexpression and knockdown on muscle fiber type in mice.

**METHODS:** The tibialis anterior muscles of 30 mice were transfected with vectors to increase or knockdown Six1 gene expression, or empty vector control. Muscles were collected at 2 and 14 days after transfection (n=4 or 6 mice per group at each time point). Six1 gene expression was quantified by qRT-PCR. Number of fibers and total cross-sectional area are being calculated using fluorescent microscopy for Type I, IIA, and IIB fibers.

**RESULTS:** Electroporation efficiency was >50% (green fluorescent protein). The Six1 vector increased Six1 mRNA expression 11.2-fold ( $\pm 2.7$ ,  $p < .01$ ) compared to control, and the siRNA vector decreased Six1 mRNA expression 1.37-fold ( $\pm .09$ ,  $p = .04$ ). Preliminary analysis suggests that the proportion and cross-sectional area of IIB fibers decrease in response to decreased Six1.  
**CONCLUSIONS:** A decrease in Six1 expression affects the expression of different muscle fiber types and may be responsible for fiber type conversions after exercise.

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**1519 Board #300 MAY 30 11:00 AM - 12:30 PM**  
**Fast-To-Slow: Muscle Fiber Type Transformation In Response To Altered Six1 Gene Expression**

Brittany C. Collins, Bradley S. Gordon, Matthew C. Kostek. *University of South Carolina, Columbia, SC.* (Sponsor: James Carson, FACSM)  
(No relationships reported)

Muscle activation patterns, like exercise and disuse, can cause alterations in muscle fiber type proportions in skeletal muscle. However, little is known of the molecular events that cause this shift. Six1 is a developmental gene that has been shown to be altered by exercise in humans. Further, Six1 causes a fiber type shift in mice. Yet, little is known of how it functions.

**PURPOSE:** Examine the effect of Six1 expression on the myosin heavy chain (MyHC) genes during muscle fiber formation.

**METHODS:** C2C12 mouse myoblasts were grown in standard conditions. When cells reached 80% confluence, they were transfected with Six1 expression vectors, to increase Six1 expression, or empty vector control. 24 hours later, cells were switched to differentiation medium. After four days, cells were harvested. Six1 and MyHC gene expression was analyzed by qRT-PCR.

**RESULTS:** Six1 expression vector (A) increased Six1 expression  $700 \pm 243.4$  fold ( $p = 0.02$ ) and Six1 expression vector (B) increased Six1 expression  $875 \pm 83.7$  fold ( $p < 0.01$ ). MyHC-IIB expression decreased 2.02 fold ( $p = 0.01$ ) and 3.02 fold ( $p < 0.01$ ) by vectors (A) and (B) respectively. MyHC-IIx decreased 1.50 fold ( $p = 0.05$ ) and 1.50 fold ( $p = 0.02$ ) by vectors (A) and (B) respectively. MyHC-I increased 2.24 fold ( $p = 0.03$ ) and 1.50 fold ( $p = 0.05$ ) by vectors (A) and (B) respectively. MyHC-IIa expression was not affected.

**CONCLUSION:** Six1 overexpression alters the muscle fiber-type gene program during the formation of a muscle fiber. This suggests that altered Six1 expression, in response to exercise, controls muscle fiber-type in humans.

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**1520 Board #301 MAY 30 11:00 AM - 12:30 PM**  
**Modification Of Skeletal Muscle Fiber Type Induced By Aerobic Exercise. Proposal Of A Peripheral Marker**

Paula Tavares. *Faculty of Sport Science and Physical Education, University of Coimbra, Coimbra, Portugal.*  
(No relationships reported)

It is known that exercise has the ability to change the skeletal muscle fiber type. In sport these changes may result from the applied training, which brings athletic advantage. However, the only technique available for fiber type monitoring is the muscle biopsy. In addition to the ethical issues, we also believe that this invasive method has a low accuracy in certain types of muscle evaluation.

**PURPOSE:** The aim of this work is to propose a peripheral marker that can show the skeletal muscle fiber type dominance in a subject. In order to achieve our goal we looked for changes in the nitric oxide synthase (NOS) that is expressed in skeletal muscle fibers and platelets.

**METHODS:** We used male Wistar adult rats that were trained during 8 weeks with a treadmill aerobic protocol. The animals were divided in two groups: exercise and control. The control group was submitted to a slight exercise just to maintain motor skills and avoid central nervous system interferences. Platelets were isolated from blood collected in the jugular vein (after anaesthesia) before and at the end of the exercise protocol. At the end of the experiments the animals were sacrificed by anaesthetic overdose, and the skeletal muscles (soleus and gastrocnemium) were removed for histological analysis and determination of NOS expression. The histological analysis included a hematoxylin-eosin staining and an ATPase staining to identify and measure the different fiber types. The expression of both NOS isoforms, in skeletal muscle and platelets, was determined by Western-blot with NOS specific antibodies.

**RESULTS:** The results showed that aerobic exercise changes the muscle fiber type. These changes were more evident in the soleus muscle which is mainly composed by type I muscle fibers. Moreover, our results also suggest that exercise induces muscle fibre necrosis and the consequent formation of new fibers through satellite cells division. This stimulation is induced by exercise, and allows the replacement of the damaged fibres.

**CONCLUSIONS:** The result stresses the correlation between NOS expression in muscle and platelets, suggesting the usefulness of cNOS in platelets for the study of exercise induced fibre change without the need for muscle biopsy. Other studies are needed to confirm our findings. This project was partially financed by FCT.

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**1521 Board #302 MAY 30 11:00 AM - 12:30 PM**  
**Satellite Cell And Myonuclear Content In Older Adults Following 7 Days Of Inactivity**

Dillon Walker, Micah Drummond, Jared Dickinson, Elena Volpi, Blake Rasmussen. *UTMB, Galveston, TX.* (Sponsor: Elizabeth Protas, FACSM)  
(No relationships reported)

Skeletal muscle atrophy is linked to a number of pathological and physiological conditions and is characterized by a loss of protein and muscle nuclei. However, it is not known if changes in satellite cell and myonuclear content occur as early as 7 days following inactivity in older adults.

**PURPOSE:** To determine if changes occur in satellite cell (SC) and myonuclear content following 7 days of physical inactivity in older adults.

**METHODS:** Healthy, older adults participated in a strict best rest model for 7 days. Muscle biopsies were collected from the vastus lateralis before and after best rest. Immunohistochemical analysis was used to assess satellite cell content (anti-Pax7), muscle nuclei (Hoechst 33342), basal lamina (anti-laminin), and slow twitch fibers (anti-MHC type I).

**RESULTS:** In slow twitch fibers, we observed no change in SC/fiber, % SC, and myonuclear domain after 7 days of inactivity; however, myonuclei/fiber decreased by 18% and the % of fibers with centrally located nuclei decreased by 69%. In fast twitch fibers, SC/fiber increased by 50% and % SC increased by 79% whereas % fibers with centrally located nuclei, myonuclei/fiber, and myonuclear domain were unaffected after 7 days of inactivity.

**CONCLUSIONS:** Short-term physical inactivity results in the loss of muscle nuclei and appears to impair ongoing regeneration as indicated by a reduction in the % of fibers with centrally located nuclei in slow twitch muscle fibers. On the other hand, in fast twitch muscle fibers, an increase in satellite cell content may play a role in the bed rest induced transition of slow to fast twitch fibers. Future studies are warranted to determine the role of satellite cells in the regulation of physical inactivity induced muscle atrophy.

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**1522 Board #303 MAY 30 11:00 AM - 12:30 PM**  
**Training Effect on Satellite Cell Response after Exhaustive Exercise in Thoroughbred Horses**

Minako Kawai<sup>1</sup>, Atsushi Hiraga<sup>2</sup>, Hiroko Aida<sup>2</sup>, Hirofumi Miyata<sup>1</sup>. <sup>1</sup>*Yamaguchi Univ., Yamaguchi, Japan.* <sup>2</sup>*Japan Racing Association, Utsunomiya, Japan.*  
(No relationships reported)

**PURPOSE:** Satellite cells are muscle stem cells capable of increasing myonuclear number during repair from injury and hypertrophy. The purpose of this study was to investigate the training effect on the short-term response of satellite cell activation in thoroughbred horse muscles.

**METHODS:** Six horses (3 years old) had acclimatized to exercise on a treadmill before experiments and then were subjected to conventional training for 10 weeks. Before (PRE) and after (POST) training, an incremental exercise test (IET) was performed on a 6% inclined treadmill to measure maximum oxygen consumption ( $VO_{2max}$ ) and the velocity at a plasma lactate of 4 mmol/l (VLA4). Biopsy samples from gluteus medius muscle was obtained before and at 1 min, 3 (3h), 6 (6h) and 24 hours (24h) after each IET. Total RNA was extracted from each muscle sample and the levels of SDHa, Pax7, MyoD, myogenin, PCNA, IGF-1 and HGF mRNA expression were determined using real time RT-PCR.

**RESULTS:** Ten-week training increased the mean values of  $VO_{2max}$  (from 144 to 168 ml/min/kg,  $P < 0.05$ ) and VLA4 (from 7.3 to 8.5 m/s). IL-6 mRNA expression increased remarkably at 6h after IET ( $P < 0.05$ ) in both PRE and POST. Unexpectedly, MyoD mRNA was significantly decreased at 6h after IET in both PRE and POST ( $P < 0.05$ ), and myogenin mRNA was also decreased at 3h after IET in POST ( $P < 0.05$ ). PCNA mRNA was increased at 24h ( $P < 0.05$ ) in both PRE and POST. In addition this mRNA in POST was also increased at an earlier point (3h) than that in PRE. When the correlations between performance level ( $VO_{2max}$  and VLA4) and mRNA expressions of each horse was investigated in PRE, the horses with higher  $VO_{2max}$  had

higher expression levels of MyoD and myogenin mRNAs ( $r = 0.97$  and  $0.85$ ,  $P < 0.05$ , respectively). In addition, the horses with higher VLA4 had higher expression level of IGF-I mRNA ( $r = 0.85$ ,  $P < 0.05$ ). After the 10-week training, interestingly, the horses with a greater  $\text{VO}_{2\text{max}}$  improvement had a greater increase in the expression level of IL-6 mRNA ( $r = 0.82$ ,  $P < 0.05$ ) at 1d after IET.

**CONCLUSIONS:** The activation and proliferation of satellite cells in response to exhaustive exercise were slightly different between pre and post training. There were significant correlations between the performance level of each horse and these mRNA expression patterns in response to exhaustive exercise.

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**1523** Board #304 MAY 30 11:00 AM - 12:30 PM  
**Transient Satellite Cell Response to Acute 'Non-Injurious' Resistance Exercise in MHC I and MHC II Skeletal Muscle Fibers**

Nicholas Luden, Lyle Babcock, Matt Escano, Andrew D'Lugos, Kent Todd, FACSM, Kevin Murach. *James Madison University, Harrisonburg, VA.*  
(No relationships reported)

Skeletal muscle satellite cells (SC) have been implicated in the hypertrophic response to resistance training. Satellite cell proliferation is also likely involved in repair processes following skeletal muscle injury. Elevated satellite cell counts have been documented as early as 6 hours and as late as 8 days following acute resistance exercise. However, these studies have exclusively utilized exercise protocols characterized by a high volume of supramaximal eccentric muscle contractions.

**PURPOSE:** To assess the general and fiber-type specific [Myosin Heavy Chain (MHC I and II)] SC response to a more conventional, 'non-injurious', exercise protocol at 4 and 10 days following exercise.

**METHODS:** Immediately following one-repetition max (1RM) testing, eight recreationally active college-aged males ( $23 \pm 1$  yr,  $83 \pm 4$  kg,  $49 \pm 2$  ml/kg/min) performed 4 sets of unilateral leg-extensions and presses (4 sets of 10 repetitions at 75% 1RM). Skeletal muscle biopsies were obtained from the vastus lateralis immediately before, 4 days, and 10 days following exercise. Muscle samples were cross-sectioned, stained with NCAM, Ki-67, and MHC I antibodies, counterstained with DAPI, and analyzed via immunohistochemistry to determine SC density (SC per muscle fiber), satellite cell activation and muscle fiber type.

**RESULTS:** SC density (not fiber type specific) was elevated 4 days following exercise but returned to baseline at 10 days post-exercise. MHC I muscle fiber SC density remained unaltered with exercise when compared across all three time points, whereas MHC II muscle fiber SC density tended to be elevated at 4 days ( $p = 0.09$ ), but not 10 days post-exercise. No alterations in the quantity of activated SC were observed.

**CONCLUSIONS:** Our data indicate that a single session of one-legged resistance exercise increases the SC population at 4 but not 10 days following exercise. Further, this response seems to be primarily manifested in MHC II muscle fibers. These data have implications for future satellite cell research, as the SC proliferative response to acute exercise is not detectable 10 days following a relatively conventional exercise protocol.

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**1524** Board #305 MAY 30 11:00 AM - 12:30 PM  
**Concurrent Aerobic Exercise Interferes With the Satellite Cell Response to Acute Resistance Exercise in MHC I Muscle Fibers**

Lyle Babcock, Matt Escano, Andrew D'Lugos, Kent Todd, (FACSM), Kevin Murach, Nicholas Luden. *James Madison University, Harrisonburg, VA.*  
(No relationships reported)

The addition of aerobic exercise (AE) to a resistance exercise program (RE) (concurrent exercise; CON) can interfere with maximum muscle fiber size gains achieved with RE alone. Further, CON appears to interfere with myosin heavy chain (MHC) I, but not MHC IIa muscle fibers. The underlying mechanism responsible for this 'interference' is unknown. The magnitude of satellite cell (SC) proliferation following exercise has been shown to influence muscle adaptation, but these dynamics have not been examined following acute concurrent exercise.

**PURPOSE:** To assess the fiber-type specific SC response to RE, AE, and CON exercise.

**METHODS:** Eight recreationally active college-aged males completed the following two exercise trials separated by a 10-day washout: RE -unilateral leg-extensions and presses (4 sets of  $\geq 10$  repetitions at 75% 1RM); AE/CON - immediately following an identical RE protocol with the opposite leg, subjects completed 90 min of cycling (60%  $\text{VO}_{2\text{max}}$ ). Skeletal muscle biopsies were obtained from the exercised vastus lateralis immediately before and 4 days after each session. Muscle samples were cross-sectioned, stained with NCAM, Ki-67, MHC I antibodies, counterstained with DAPI, and analyzed via immunohistochemistry to determine SC density (SC per muscle fiber), satellite cell activation and muscle fiber type.

**RESULTS:** SC density increased to a greater extent ( $p < 0.05$ ) following RE ( $38 \pm 10\%$ ), compared to AE ( $10 \pm 10\%$ ) and CON ( $-9 \pm 10\%$ ). Similarly, MHC I muscle fiber SC density displayed a greater increase following RE ( $46 \pm 16\%$ ), compared to AE ( $-22 \pm 10\%$ ) and CON ( $-7 \pm 17\%$ ). No exercise mode differences were observed among MHC IIa fibers.

**CONCLUSIONS:** Our data indicate that CON blunts the SC response to RE, specifically in MHC I muscle fibers. The satellite cell response observed here mimics the fiber type growth response to RE and CON training. This suggests that SC physiology contributes to the interference effect that concurrent AE has on MHC I fiber growth.

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**1525** Board #306 MAY 30 11:00 AM - 12:30 PM  
**Therapeutic Ultrasound Affects Muscle Cell Proliferation: Implications For Muscle Rehabilitation**

Diana C. Delgado-Diaz<sup>1</sup>, Matthew C. Kostek<sup>2</sup>. <sup>1</sup>University of South Carolina, Columbia, SC. <sup>2</sup>University of South Carolina, Columbia, SC.  
(No relationships reported)

Therapeutic ultrasound (TUS) is a common modality in the rehabilitation of muscle injuries. In-vivo models of skeletal muscle have demonstrated that TUS increases satellite cell proliferation, a requirement for skeletal muscle repair. Current studies have attempted to determine the autonomous response of muscle cells to TUS; however their results are controversial due to the diversity of techniques and parameter used to deliver TUS (indirect sonification).

**PURPOSE:** To examine the dose-response of muscle cell proliferation due to TUS.

**METHODS:**  $\text{C}_2\text{C}_{12}$  cells were propagated in 10% FBS growth medium and incubated under sterile standard conditions. Equal numbers of cells were seeded in 100-mm culture dishes. Once cells achieved 50% confluence, TUS was delivered for 5 consecutive days. 24-h after the last treatment, cells were collected and counted with a hemocytometer. TUS delivery (continuous; 3MHz) was performed under sterile conditions; the ultrasound probe was positioned perpendicular to the dish and lowered to full contact with the medium (distance between the probe and the bottom of the dish = 4-5 mm). Nine combinations of output intensities and treatment durations were studied. Intensities: 0.2, 0.5 and 1.0W/cm<sup>2</sup>. Treatment durations: 2, 5, and 10 min. The sham cells was exposed to TUS as described with output intensity of 0W/cm<sup>2</sup> for 5min and control cells were untreated. Media temperature was measured immediately before and after each TUS exposure.

**RESULTS:** Temperature increased only in response to the highest intensity (1.0W/cm<sup>2</sup>) when delivered for 5 or 10 min. TUS increased cell proliferation when compared to Sham and control in all groups, being greater at lower output intensities (0.2 and 0.5W/cm<sup>2</sup>).

**CONCLUSION:** These data demonstrate that the direct delivery of ultrasonic waves to muscle cells in culture is feasible and produces positive effects. TUS enhances muscle cell proliferation in an autonomous manner by a mechanism other than heating. Our results support an evidence-based mechanism for the use of TUS for the treatment of skeletal muscle injuries.

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**1526** Board #307 MAY 30 11:00 AM - 12:30 PM  
**Essential Amino Acid Ingestion After Exercise Enhances Amino Acid Transporter Expression In Human Skeletal Muscle**

Jared M. Dickinson, Micah J. Drummond, Jennifer R. Coben, Elena Volpi, Blake B. Rasmussen. *University of Texas Medical Branch, Galveston, TX.* (Sponsor: Elizabeth Protas, FACSM)  
(No relationships reported)

An increase in amino acid transporter expression is a proposed mechanism contributing to increases in muscle protein synthesis following essential amino acid ingestion (EAA) or resistance exercise (RE).

**PURPOSE:** To determine whether the expression of amino acid transporters in human skeletal muscle is increased in response to the combination of RE and EAA ingestion, and whether a differential response occurs with aging.

**METHODS:** Young (n=7, 30±2yr) and older males (n=6, 70±2yr) ingested 20g of EAA 1 h after performing a single bout of leg extension RE (8 sets, 10 reps, ~70% 1RM). Muscle biopsies (*vastus lateralis*) were obtained at rest and at 3 and 6h postexercise for examination of amino acid transporter mRNA and protein expression via qPCR and immunoblotting, respectively.

**RESULTS:** In both young and older males, the combination of RE+EAA elicited an increase in mRNA expression (fold change) of L-type amino acid transporter 1 (LAT1)/solute linked carrier (SLC)7A5 (Y: 3h, 4.0±0.8; 6h, 3.7±0.9; O: 3h, 3.9±1.4; 6h, 5.9±2.3) sodium-coupled neutral amino acid transporter 2 (SNAT2)/SLC38A2 (Y: 3h, 2.0±0.4; O: 3h, 1.79±0.5), and cationic amino acid transporter 1 (CAT1)/SLC7A1 (Y: 6h, 3.9±0.9; O: 3h, 3.5±0.9; 6h, 5.0±1.2) (P<0.05), whereas no changes were observed for proton-assisted amino acid transporter 1 (PAT1)/SLC36A1 or CD98/SLC3A2 in either group (P>0.05). Additionally, SNAT2/SLC38A2 protein was increased only in young adults at 3 and 6h postexercise (P<0.05), whereas older adults maintained higher LAT1/SLC7A5 protein expression compared to young following exercise (P<0.05).

**CONCLUSION:** These results suggest that both young and older males experience an increase in skeletal muscle amino acid transporter expression following the combination of RE+EAA, however, there appears to be a differential response with aging for SNAT2/SLC38A2 and LAT1/SLC7A5. These data support the hypothesis that amino acid transporters are involved in the regulation of human skeletal muscle protein synthesis in young and older adults.

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1527 Board #308 MAY 30 11:00 AM - 12:30 PM

**Low Magnitude Vibration To Improve Musculoskeletal Health In A Mouse Model Of Muscle Disease**

Susan A. Novotny, Brian C. Eby, David J. Nuckley, Jarrod A. Call, Michael D. Eckhoff, Dawn A. Lowe, FACSM. *University of Minnesota, Minneapolis, MN.*

(Sponsor: Dawn Lowe, FACSM)

(No relationships reported)

Low-magnitude, high-frequency vibration (VIB) can benefit bone and skeletal muscle. These beneficial effects arise from the application of mechanical loads equivalent to those produced during postural muscle contraction. Therefore, VIB is particularly attractive as a therapeutic modality in diseases such as Duchenne muscular dystrophy (DMD) to preserve muscle and bone strength, as patients are often advised to minimize exercise.

**PURPOSE:** We devised and constructed a vibration platform for mice and using the mdx model of DMD, our initial experiments were aimed to: 1) select the frequency and acceleration of VIB that provoked an osteogenic response, 2) determine if three bouts of VIB are injurious to diseased muscle and 3) assess the myogenic potential of 7d VIB.

**METHODS:** Mdx mice were exposed to VIB for 15min/d for 7d at either 30, 45, or 90 Hz with an acceleration of either 0.3 or 0.6 g. Tibial bone RNA was extracted and compared to non-vibrated mice for genes along the osteoblast lineage. To assess if VIB was injurious, muscle strength and markers of inflammation (CCL2 and Itgam by RTPCR) were compared between mdx mice that received three bouts of VIB (45 Hz, 0.6 g), non-VIB mice, and eccentrically-injured mdx mice. The myogenic potential of VIB was assessed by RTPCR (MyoD, myogenin, and Pax7) following 7d of VIB (45 Hz, 0.6 g).

**RESULTS:** VIB at 45 Hz and 0.6 g had the largest effect in stimulating an osteogenic response; collagen type 1 mRNA was upregulated 31%, and alkaline phosphatase mRNA trended toward upregulation (p=0.09). Following three VIB bouts, muscle strength was equivalent to non-VIB mice (p=0.94) and significantly greater than eccentrically-injured mice (p>0.65), indicating that VIB is not injurious to diseased muscle. Following 7d of VIB, MyoD expression was elevated 7% (p<0.05).

**CONCLUSIONS:** These data highlight that VIB exposure at 45 Hz and 0.6 g in the mdx mouse is not injurious to muscle and has the modest potential to elevate the expression of genes involved in osteogenesis and myogenesis. Chronic studies of VIB in mdx mice are in progress to further determine the therapeutic potential of VIB for musculoskeletal health.

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1528 Board #309 MAY 30 11:00 AM - 12:30 PM

**Effects Of Pre-habilitative Conditioning On Unloading-induced Remodeling Of Young And Aged Neuromuscular Systems.**

Michael R. Deschenes, FACSM, Emily K. Glass, Elizabeth G. Sherman. *College of William & Mary, Williamsburg, VA.*

(No relationships reported)

**PURPOSE:** To determine if pre-habilitative conditioning effectively mitigates adaptations to muscle unloading in young and aged neuromuscular systems.

**METHODS:** Forty young (9 mo), and 40 aged (25 mo) male rats were randomly assigned to one of four treatment groups within each age category (N=10/group). Treatment groups were: 1) hindlimb suspension for 2 wks (HS); 2) pre-habilitative exercise (i.e. treadmill running) for 2 wks prior to 2 wks of hindlimb suspension (PH-HS); 3) 2 wks of treadmill running without hindlimb suspension (PH), or 4) no intervention (CTL). Neuromuscular junctions (NMJs) of soleus muscles were stained with Bungaroxin (postsynaptic acetylcholine receptors) and RT 97 (presynaptic nerve terminals), and fluorescently stained images were captured with confocal microscopy. Myofiber profiles of those same muscles were assessed with histochemical staining for ATPase activity.

**RESULTS:** In neither age group did NMJ morphology differ (P>0.05) among the 4 treatment groups. However, young and aged rats displayed different patterns of myofiber remodeling as a result of the various experimental treatments. Among young rats, HS resulted in a 22% decline (P<0.05) in myofiber cross-sectional area; this atrophy was significantly exacerbated in the PH-HS group (40% decrease), while PH training alone had no significant effect on myofiber size. But among aged rats, PH training significantly attenuated unloading-induced myofiber atrophy (32% vs. 45%), and average myofiber size of PH rats was 14% larger than the CTL group (P<0.05).

**CONCLUSIONS:** Two weeks was too brief a period to elicit reconfiguration of the NMJ regardless of age, or treatment. In contrast, myofibers were significantly remodeled following the 2 wk intervention, with age significantly influencing those adaptations. Among young rats, pre-habilitative endurance training exaggerated unloading-induced fiber atrophy, but among aged rats - where sarcopenia was evident - the same pre-habilitative protocol significantly abated unloading-induced atrophy. We conclude that not all components of the neuromuscular system (NMJs and myofibers) are equally sensitive to unloading, and that among myofibers, aging impacts the value of pre-habilitative conditioning prior to muscle unloading.

Supported by NIH Grant R15 AG017440.

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1529 Board #310 MAY 30 11:00 AM - 12:30 PM

**Nuclear Factor-KappaB Activity in Human Primary Pericytes Affects Proliferation and Differentiation of Co-Cultured Skeletal Muscle Myoblasts**

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(No relationships reported)

Skeletal muscle regeneration following damage relies on the activation, proliferation and differentiation of muscle precursor cells. We recently observed altered NF-kB signaling in human skeletal muscle-resident pericyte cells following eccentric contractions, a stimulus known to induce a muscle regenerative response.

**PURPOSE:** This study determined how alterations in pericyte NF-kB activity affected the proliferation and differentiation response of local muscle precursor cells (myoblasts) in an in vitro co-culture system.

**METHODS:** Human primary pericytes (HPPs) were transiently induced to express DNA vectors designed to both increase and decrease NF-kB activity. An empty vector was used as a control. HPPs expressing the NF-kB DNA vectors were then co-cultured with C2C12 myoblasts for 4 days in a culture medium designed to promote the differentiation of myoblasts into mature muscle fibers (myotubes). Myoblast proliferation and differentiation were measured using immunocytochemistry and Western blot.

**RESULTS:** The DNA vectors were effective at both increasing and decreasing NF-kB activity in HPPs. When HPPs with increased NF-kB activity were co-cultured with myoblasts, we observed a 50% increase in myoblast proliferation (p<0.001), and inhibition of myoblast differentiation, evidenced by a 32% reduction in myotube diameter (p<0.001) and a decrease in myotube nuclei. Western blot also showed a decrease in the expression of the muscle specific marker myosin heavy chain when HPPs with increased NF-kB activity were co-cultured with myoblasts.

**CONCLUSIONS:** Taken together, these data suggest that NF-kB dependent signaling in pericytes may indirectly regulate the regenerative response following damage by promoting proliferation of muscle precursor cells.

1530 Board #311 MAY 30 11:00 AM - 12:30 PM

**Cyclooxygenase-Inhibiting Drug Effects on Skeletal Muscle Exercise Adaptations in Older Adults: Potential Mechanisms of Action**

Robert A. Standley, Bozena Jemioło, Chad C. Carroll, Scott W. Trappe, FACSM, Todd A. Trappe. *Human Performance Laboratory, Ball State University, Muncie, IN.*

(No relationships reported)

We recently reported that 12 weeks of knee extensor resistance training (3d/wk) combined with daily consumption of the cyclooxygenase (COX) inhibiting drugs acetaminophen (4.0g/d; n=11, 64±1y) or ibuprofen (1.2g/d; n=13, 64±1y) unexpectedly promoted muscle mass and strength gains 25-50% above those obtained on placebo (n=12, 67±2y).

**PURPOSE:** To further investigate the mechanism of action of these drugs.

**METHODS:** Vastus lateralis biopsies obtained before and ~72h following the last training bout were analyzed for mRNA levels of components of the COX pathway (arachidonic acid synthesis: cPLA<sub>2</sub> and sPLA<sub>2</sub>-X; prostaglandin (PG)F<sub>2α</sub> synthesis: AKR1C3 and CBR1; PGE<sub>2</sub> synthesis: PTGES, PTGES-2; PGF<sub>2α</sub> and PGE<sub>2</sub> receptors: FP and EP4), regulators of muscle proteolysis (MuRF-1, Atrogin-1, FOXO3A, IKKβ) and growth (Myogenin, MRF4, myostatin), and cytokines involved in skeletal muscle adaptation (TNF-α, IL-1β, IL-6, IL-8, IL-10).

**RESULTS:** Several components were increased with training (cPLA<sub>2</sub>, AKR1C3, CBR1, EP4, IKKβ, TNF-α, IL-1β, IL-8). However, IL-6, IL-10, and MuRF-1 were differentially upregulated (P<0.05) in the placebo group compared to both drug groups, and FP was upregulated (P<0.05) only in the drug groups.

**CONCLUSION:** Considering PGE<sub>2</sub> stimulates the production of IL-6, which has been shown to promote muscle atrophy, suppression of IL-6 and MuRF-1 in both drug groups support our previous hypothesis that inhibition of COX-derived PGE<sub>2</sub> and muscle proteolysis following the repeated exercise bouts may have been the basis for the additional muscle mass gains. Thus, we extend our hypothesis to suggest acetaminophen and ibuprofen suppression of PGE<sub>2</sub>-induced IL-6 production contributed to the additional muscle mass gains in the drug groups. Finally, the drug-induced PGF<sub>2α</sub> receptor upregulation may have restored or enhanced the protein synthesis response after each exercise bout and influenced the muscle mass gains in the drug groups.

NIH Grant AG020532

1531 Board #312 MAY 30 11:00 AM - 12:30 PM

**Effect of Prior Physical Exercise on Autophagy During MPTP-Induced Parkinson's Disease in Mice**

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(No relationships reported)

**OBJECTIVE:** To investigate if prior chronic treadmill running could be a protective way in delaying the procedure of PD in mice. And to find the corresponding mechanism(s) about autophagy and mitochondrial fusion and fission.

**METHODS:** 40 C57BL/6 (6-8weeks) mice were randomly divided into sedentary or exercise group (12m/min, 20 minutes/day, running on treadmill for 6 weeks). After 6 weeks each group were divided into two groups which were injected with moderate dose of 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine (MPTP) (30mg/kgx2, ip, 16 hr apart) or saline. Finally mice were divided into the following groups: (1) saline injected (N); (2) exercise and saline injected (NE); (3) MPTP injected (M); (4) exercise and MPTP injected (ME). Behavioral tests (pole climbing, hanging and swimming) were conducted in succession 1 day before MPTP injection, and 2, 5, 8 day after MPTP injection. Then all animal was sacrificed. Brain mitochondrial respiratory capacity (state3, state4, RCR) was measured. The expression of proteins (LC3, Beclin1, Drp1, Fis1, OPA1) were detected by western-blotting. TEM was used to observe the autophagic vacuole in brain. Two-way ANOVA with repeated measures was used for statistics.

**RESULTS:** The behavioral outcomes showed from the second day after MPTP injection, M got the lower score compared with N (p<0.05) and the figures showed a continuous rising. ME got higher score than M. Mice brain mitochondrial RCR attenuated in ME compared with M (p<0.05). Drp1 protein expression elevated notably in exercise groups compared with non-exercise groups (increasing 13% for NE vs. N and 11% for ME vs. M, p<0.05), which was similar with Fis1, whereas OPA1 indicated an opposite pattern (reducing 37% for NE vs. N and 39% for ME vs. M, p<0.01). LC3 and Beclin1 Protein increased without significance in NE vs. N. But they increased 13% (p<0.05) and 30% (p<0.01) respectively in ME vs. M. No typical autophagic vacuole was found in each group.

**CONCLUSIONS:** Prior moderate exercise may delay the development of PD by enhancing the mice brain mitochondrial respiration capacity in PD mice, which may due to exercise up-regulate the abilities of autophagy accompanied with the higher level of mitochondrial fission and lower fusion level.

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1532 Board #313 MAY 30 11:00 AM - 12:30 PM

**MARCH-V: A Possible Regulator of Mitochondrial Fusion and Fission in Aerobic Training Reducing Insulin Resistance?**

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(No relationships reported)

**PURPOSE:** To explore the MARCH-V gene expression changes in long-term aerobic training improving insulin resistance induced by high fat diet. It might have an essential role in the control of mitochondrial dynamics as a dual modulator of MFN2 and DRP1 which regulate mitochondrial dynamics and function.

**METHODS:** 40 mice were randomly divided into normal chow and high-fat diet group. After 8 weeks, each group was divided into 2 groups: normal diet control (NC), normal diet plus exercise (NE), high-fat diet control (HC) and high-fat diet plus exercise (HE). Mice were fed and/or trained for another 8 weeks. Respiratory control ratio and ATP synthesis activity in isolated skeletal muscle mitochondria were detected. Skeletal muscle mRNA and Protein levels of MARCH-V, MFN2 and DRP1 were measured by Realtime PCR and Westernblot respectively.

**RESULTS:** 1) The Fins, HOMA-IR of HC group mice were significantly lower than NC group, HE group were significantly lower than HC and significantly higher than NC (p<0.01). 2) Skeletal muscle mitochondria in HC group mice showed lower state 3 respiration and higher state 4 respiration with lower RCR than NC group (p<0.01), HE group had higher state 3 respiration and RCR than HC group (p<0.05, p<0.01), and had no difference with NC (p>0.05). 3) The size and number of mitochondria are decreased in HC group and increased in NE, HE group. 4) MFN2 mRNA and protein in NE group were higher than that of NC group (p<0.05, p<0.01). HC group were lower than NC and NE group (p<0.01). HE group were higher than the HC and NC group (p<0.01). 5) DRP1 mRNA and protein in NE group were higher than the NC group (p<0.05, p<0.01), HC were also higher than NC (p<0.05, p<0.01), HE were significantly higher than HC and NC group (p<0.01). 6) MARCH-V mRNA and protein expression in NE group were significantly higher than NC group (p<0.01), HE group were higher than NC and HC group (p<0.01).

**CONCLUSIONS:** MARCH-V may be one of the regulators for mitochondrial dynamics and function in the mechanism of aerobic training reducing IR. But it may not participate in the regulation the mitochondrial fusion and fission during development of diet induced IR.

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1533 Board #314 MAY 30 11:00 AM - 12:30 PM

**The Effect Of Aerobic And Resistance Exercise On Cardiac And Mitochondrial Function In Oletf Rats**

Tae hee Ko, Dae Yun Seo, Sung Ryul Lee, Hyoung kyu Kim, Na ri Kim, Byoung Doo Lee, Kyung Soo Ko, Jin Han. *Inje University, Busan, Korea, Republic of.*

(No relationships reported)

Type 2 diabetes (T2DM) is the metabolic disease from the failure of insulin secretion and accompanied by obesity and hyperlipidemia, cause cardiovascular disease. To prevent or cure, exercise helps regulate blood sugar and also significantly reduced the risk of cardiovascular disease (CVD).

**PURPOSE:** The purpose of this study was to investigate the effect of aerobic and resistance exercise on cardiac and mitochondrial function in OLETF rats.

**METHODS:** OLETF (Otsuka Long-Evans Tokushima Fatty) rats, an animal model of T2DM are occurred at 25 weeks. Twenty four OLETF rats were divided into treadmill exercise (EXT, n=8), resistance exercise (EXR, n=8) and control (SED, n=8) groups after 25weeks. EXT and EXR groups were exercised 5 day/week for 12 weeks. EXT groups were exercised at 5m/min for 10minutes as adaptation for 2 weeks. And then, speed and duration were increased gradually. EXR groups were climbed ladder 5 repetition without weight as adaptation for 2 weeks. And then, repetition and weight were increased gradually.

**RESULTS:** The left ventricular (LV) function of diastolic in echocardiogram, EXT groups are improved EDV (End of Diastolic Volume, EXT: 1.24±0.06 vs SED: 0.68±0.05, p<0.005), LVIDd (Left Ventricular Internal Dimension, diastolic, EXT: 8.28±0.16 vs SED: 6.65±0.19, p<0.005) and SV (stroke volume, EXT: 1.09±0.04 vs SED: 0.6±0.04, p<0.005) compared with SED rats. In EXR, LVPWD (Left Ventricular Posterior Wall Thickness, diastolic, EXR: 1.48±0.09 vs SED: 2.02±0.05, p<0.05) was decreased, and EDV (EXR: 0.99±0.04 vs SED: 0.68±0.05, p<0.005), LVIDd (EXR: 7.41±0.26 vs SED: 6.65±0.19, p<0.05) and SV (EXR: 0.86±0.08 vs SED: 0.6±0.04, p<0.05) were increased compared with SED rats. In mitochondria function, oxygen consumption was higher in EXT and EXR without significance. In ROS production, there was no significant change. Mitochondria membrane potential was not significantly different among OLETF groups.

**CONCLUSION:** We are suggested that improved by aerobic and resistance exercise may be positive effects on inhibiting aberrant morphological change of diabetic heart. Different function in echocardiogram between aerobic and resistance exercise, it may be different function physiologically in T2DM. However, more precise evaluations on change in cardiac mitochondria will be required.

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**1534** Board #315 MAY 30 11:00 AM - 12:30 PM

**Exercise Enhances Myogenic Differentiation through Regulating Reactive Oxygen Species Mediated Mitochondrial Fusion**

Hai Bo<sup>1</sup>, Xun Wang<sup>1</sup>, Qixiang Chen<sup>1</sup>, Yong Zhang<sup>1</sup>, Li Li Ji, FACSM<sup>2</sup>. <sup>1</sup>Tianjin University of Sport, Tianjin, China. <sup>2</sup>University of Minnesota, Minneapolis. (Sponsor: Li Li Ji, FACSM)

(No relationships reported)

Muscle precursor cell (MPC) proliferation and differentiation has been shown to play a key role in muscle plasticity following exercise. During myogenic differentiation the short mitochondria of myoblasts change into the extensively elongated network observed in myotubes, suggesting that mitochondrial fusion may have a role in myogenesis.

**PURPOSE:** To determine the functional relevance and the molecular mechanisms driving the formation of this mitochondrial network.

**METHODS:** MPC were isolated from both trained (T) and sedentary (S) mouse skeletal muscle with a high degree of myogenic purity. Mitochondrial membrane potential, ROS generation, ATP amount, fusion protein (OPA1 and Mfn2), p-mTOR and mitochondrial prohibitin2 expression were measured. We also examined the effects of exogenous low doses H<sub>2</sub>O<sub>2</sub> (100 μM) exposure for 1h on differentiation of cultured MPC isolated from 3-month-old C57BL/6J mouse.

**RESULTS:** MPCs isolated from T mouse exhibited increased differentiation into myotubes and demonstrated increased myosin heavy chain (+117%, p<0.01) and creatine kinase (+135%, p<0.01) expression compared with S mouse. Mitochondrial membrane potential (+18%, p<0.05), ROS generation (+41%, p<0.05), ATP amount (+65%, p<0.05), OPA1 (+68%, p<0.05), p-mTOR (+34%, p<0.05) and mitochondrial prohibitin2 (+85%, p<0.01) were higher in MPC isolated from T mouse than from S mouse. We also demonstrated that H<sub>2</sub>O<sub>2</sub> enhanced MPC differentiation, while treatment with a ROS trapping agent (N-acetyl-L-cysteine, NAC) slowed MPC differentiation. H<sub>2</sub>O<sub>2</sub> exposure increased mTOR phosphorylation (+75%, p<0.01), mitochondrial membrane potential (+19%, p<0.05), ROS generation (+169%, p<0.01), ATP amount (+53%, p<0.05) and OPA1 expression (+51%, p<0.05). mTOR antagonist (Rapamycin) inhibits H<sub>2</sub>O<sub>2</sub>-induced mTOR phosphorylation (185.6±17.6% vs. 95.9±11.2, p<0.01), MPC differentiation and OPA1 expression (142.4±15.4 vs. 110.6±13.3%, p<0.05).

**CONCLUSION:** OPA1-mediated mitochondria fusion is required for exercise induced myogenic differentiation, and this event depends on generation of ROS and mTOR activation.

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**1535** Board #316 MAY 30 11:00 AM - 12:30 PM

**NAD-Linked Isocitrate Dehydrogenase Activity is Phosphate Dependent in Sparrow Mitochondria**

Doree Lynn Gardner, Sarah Kuzmiak, Wayne T. Willis. Arizona State University, Tempe, AZ.

(No relationships reported)

Flying birds are highly aerobic athletes, yet literature values indicate low activities of NAD-linked isocitrate dehydrogenase (IDH) in avian flight muscle. IDH is an important locus of rate control in the citric acid cycle (CAC) in most species, but calculations revealed that literature values of avian IDH V<sub>max</sub> could account for < 5% of the oxygen consumed by avian mitochondria oxidizing pyruvate + malate. Therefore carbon flux through the CAC might fundamentally differ in avian compared to mammalian mitochondria. It is conceivable that NADP-linked IDH plays a more important role in the routine flux of the avian CAC or that NAD-linked IDH of avian flight muscle may have different kinetic requirements than its mammalian counterpart.

**PURPOSE:** To determine physiologic co-factors which might influence NAD-IDH activity in avian skeletal muscle and to assess NAD- and NADP-IDH activity in whole muscle homogenate and isolated mitochondria from avian and mammalian locomotory muscles.

**METHODS:** Rat mixed hindlimb and English sparrow pectoralis muscle were excised and mitochondria were isolated. A 10% muscle homogenate in 10 mM KPO<sub>4</sub> (pH 7.4) was made from a second tissue sample. IDH activity was spectrophotometrically assayed in whole muscle homogenate and mitochondrial fractions following NAD(P)H appearance at 340 nm. Cofactor additions included MnCl<sub>2</sub> (1.3mM), MgCl<sub>2</sub> (10mM), K<sub>2</sub>PO<sub>4</sub> (10mM), ADP (100 mM), and dithiothreitol (DTT) (1mM).

**RESULTS:** The highest NAD-IDH activity was observed when MnCl<sub>2</sub>, K<sub>2</sub>PO<sub>4</sub>, ADP, and DTT were included in the assay medium. NAD-IDH activity was higher in sparrow than rat muscle homogenate (10.1 ± 1.4 vs. 2.9 ± 0.4 μmol/g/min), while NADP-IDH activity was higher in rat than in sparrow (20.9 ± 4.2 vs. 11.4 ± 1.4 μmol/g/min). Rat mitochondrial NAD and NADP-IDH activities were 208.0 ± 17.0 and 1105 ± 152.7 nmol/mg/min, respectively, while sparrow mitochondrial NAD and NADP-IDH values were 389.6 ± 74.4 and 152.5 ± 27.9 nmol/mg/min.

**CONCLUSIONS:** While rodent muscle NAD-IDH exhibits no phosphate dependence, sparrow IDH activity was highly dependent upon K<sub>2</sub>PO<sub>4</sub>, revealing a different metabolic control mechanism in the avian system. In the presence of phosphate, avian NAD-IDH was fully competent to account for the apparent CAC flux during pyruvate + malate oxidation by flight muscle mitochondria.

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**1536** Board #317 MAY 30 11:00 AM - 12:30 PM

**Electron Conductance in Rat and Sparrow Skeletal Muscle Mitochondrial Electron Transport Chain**

Sarah Kuzmiak, Wayne T. Willis. Arizona State University, Tempe, AZ.

(No relationships reported)

Flying birds utilize fat for fuel during flight, a moderate-high intensity exercise, while mammalian reliance on carbohydrate increases with increasing exercise intensity. Previous investigations in our lab have shown this pattern of fuel selection persists even when saturating fuels are provided to the inner membrane transporters of intact respiring mitochondria, suggesting a fuel selection mechanism at the level of the matrix.

**PURPOSE:** To compare the maximal rates of complete substrate oxidation to the oxidation of electrons as well as electron conductance in rat and sparrow mitochondria to elucidate differences between the species in the ability to produce electrons (via dehydrogenase enzymes, β-oxidation, and the citric acid cycle) and the capacity for these electrons be consumed (via travel down the electron transport chain (ETC)).

**METHODS:** Intact mitochondria were isolated, provided saturating fuels (pyruvate, glutamate, and malate), and the maximal rate of oxygen consumption (J<sub>o</sub>) was determined. Mitochondria were then sonicated and maximum NADH oxidation was measured following the rate of oxygen reduction to water. The slope of the oxidation:reduction (redox) potential difference (ΔEh):J<sub>o</sub> relationship, a measure of the conductance of electron flow down the ETC, was also determined.

**RESULTS:** Intact maximal J<sub>o</sub> were 636 ± 87 and 641 ± 83 nmol·mg<sup>-1</sup>·min<sup>-1</sup> in rat and sparrow, respectively, while the ETC V<sub>max</sub> were 731 ± 76 and 1020 ± 108 nmol·mg<sup>-1</sup>·min<sup>-1</sup>. Combined, these data indicate greater relative ETC activity in the sparrow; the (intact oxidase pathway)/(ETC only) ratio was .86 ± .04 in the rat and .65 ± .07 in the sparrow. Additionally, the slope of the ΔEh: J<sub>o</sub> relationship was 1.7x greater in sparrow than the rat mitochondria, 12306 ± 1538 and 7196 ± 924, respectively.

**CONCLUSIONS:** These data indicate avian mitochondria have greater ETC “excess capacity” as well as greater conductance down the ETC compared to mammalian mitochondria. As a high reduction level of the mitochondrial matrix has been associated with an inhibition of β-oxidation, we posit rat fatty acid oxidation is inhibited by high reduction in the mitochondrial matrix while birds, via a high ETC conductance, are able to maintain lower matrix reduction, allowing fatty acid oxidation to proceed.

1537 Board #318 MAY 30 11:00 AM - 12:30 PM

**Endurance Training and Chronic Intermittent Hypobaric-Hypoxia Modulate Liver Mitochondrial Bioenergetics. Role Against Salicylate-Induced Mitochondrial Dysfunction**

Antonio A. Ascensao<sup>1</sup>, Ines O. Goncalves<sup>1</sup>, Jose Lumini-Oliveira<sup>1</sup>, Ines M. Aleixo<sup>1</sup>, Emanuel Passos<sup>1</sup>, Silvia Rodrigues<sup>1</sup>, Nuno G. Machado<sup>2</sup>, Ana C. Moreira<sup>2</sup>, Paulo J. Oliveira<sup>2</sup>, Juan R. Torrella<sup>3</sup>, Jose Magalhaes<sup>1</sup>. <sup>1</sup>CIAFEL, Faculty of Sport, University of Porto, Porto, Portugal. <sup>2</sup>CNC, Coimbra, Portugal. <sup>3</sup>Faculty of Biology, University of Barcelona, Barcelona, Spain.  
(No relationships reported)

Endurance-training (ET) and chronic intermittent hypobaric-hypoxia (CIHH) are strategies for preventing and treating metabolic and cardiovascular diseases. Salicylate is an anti-inflammatory metabolite that causes liver injury by mitochondrial-mediated mechanisms. Whether ET and CIHH modulate liver mitochondrial (LM) bioenergetics altering the resistance against toxic conditions is not known.

**PURPOSE:** To analyze the effects of ET and CIHH on LM bioenergetics under basal conditions and with salicylate.

**METHODS:** Twenty-eight young-adult male rats were divided into normoxic-sedentary (NS), normoxic-exercised (NE), hypoxic-sedentary (HS) and hypoxic-exercised (HE). ET consisted of 1h/d of treadmill running and CIHH of 5wks, 5h/d simulated atmospheric pressure of 49.3kPa. Oxygen consumption, transmembrane potential and calcium-induced mitochondrial permeability transition pore (MPTP) were evaluated in isolated LM in the presence and absence of salicylate (0.5mM). Aconitase, MnSOD, -SH, MDA, SIRT3, Cyp D, HSP70, OXPHOS subunits, caspase 3 and 8 were assessed. Group comparisons were made using one-way ANOVA.

**RESULTS:** ET and CIHH decreased basal state 3 (NS-249 vs. NE-161, HS-168, HE-170 natomsO/min/mg,p<0.05) and state 4 (NS-74 vs. NE-46, HS-33, HE-45 natomsO/min/mg,p<0.05). No alterations were observed in membrane potential endpoints evaluated under basal conditions. In the presence of salicylate, ET and CIHH decreased state 4 and lag phase of ADP phosphorylation (NS-105 vs. NE-56, HS-62, HE-66 natomsO/min/mg; NS-151 vs. NE-130, HS-107, HE-105 sec,p<0.05). Neither ET nor CIHH altered the susceptibility to calcium-induced MPTP. CIHH lowered MnSOD (NS-12 vs. NE-11, HS-8, HE-8 U/mg,p<0.05) and increased aconitase (NS-0.63 vs. NE-0.24, HS-0.85, HE-0.80 U/mg,p<0.05) activities. ET and CIHH decreased caspase 8 activity (NS-1150 vs. NE-864, HS-545, HE-537 pNa/ug,p<0.05) whereas no effect was observed on caspase 3. The levels of SIRT3 increased with ET and CIHH (NS-100 vs. NE-150, HS-128, HE-151%,p<0.05) and Cyp D decreased with CIHH per se (NS-100 vs. HS-83%,p<0.05). No differences were observed in HSP70 and OXPHOS subunits.

**CONCLUSION:** ET and CIHH modulate basal LM bioenergetics and may antagonize some adverse effects of salicylate. Supported by FCT grant PTDC/DES/113580/2009.

**A-44 Free Communication/Poster - Sports Science I: Individual Sports**

MAY 30, 2012 7:30 AM - 12:30 PM  
ROOM: Exhibit Hall

1538 Board #319 MAY 30 9:30 AM - 11:00 AM

**Seven Weeks Of 10-20-30 Running Effectively Improves Health Profile And Performance In Trained Runners**

Thomas P. Gunnarsson, Stine S. Johansen, Rasmus Jørgensen, Jacob Vorup, Jonas T. Nielsen, Martin R. Krisitansen, Jens Bangsbo, Professor. *University of Copenhagen, Copenhagen, Denmark.*  
(No relationships reported)

An intense training regime ( $\geq 100\%$  of maximal oxygen uptake ( $VO_2$ -max)) is known to be an effective way to improve performance in already trained subjects. However little is known about how such training affects the health profile of trained subjects.

**PURPOSE:** To examine whether an intensified training regime (10-20-30 training) can improve the health profile and performance in moderately trained runners.

**METHODS:** Eighteen trained runners (6 females and 12 males with  $VO_2$ -max of  $50.9 \pm 2.0$  and  $52.4 \pm 1.6$  ml·kg<sup>-1</sup>·min<sup>-1</sup>, respectively) were divided into two matched groups; an intermittent training group (INT; n=10) and a control group (CON; n=8). INT replaced all regular training sessions with 3 weekly sessions of 10-20-30 training reducing training volume by 54% (from  $30.4 \pm 2.3$  to  $14 \pm 0.9$  km per week) while CON continued the normal training. The 10-20-30 training consisted of 3-4 5-min blocks interspersed by 2 min of rest per training session. Each 5-min block consisted of 30 seconds of jogging followed by 20 seconds of normal running and 10 seconds of sprinting. The training progressed from 3 blocks during the first 4 weeks to 4 blocks in the last 3 weeks per training session. All tests were preceded by at least 36-h of rest and the subjects were familiarized to testing procedures. On a separate day, in the morning after an overnight fasting, blood pressure (BP) was measured after 10 min of supine resting and blood samples were drawn from v. brachialis. Data are presented as means $\pm$ SE and data are compared pre vs. post using a students paired t-test.

**RESULTS:** After 7 weeks of 10-20-30 training total and LDL cholesterol were lowered (p<0.05) in INT ( $4.8 \pm 0.4$  vs.  $4.3 \pm 0.3$  and  $2.7 \pm 0.3$  vs.  $2.3 \pm 0.3$  mmol·l<sup>-1</sup>, respectively) as well as systolic BP ( $125 \pm 3$  vs.  $120 \pm 4$  mmHg p<0.05). In CON, BP and LDL cholesterol were unaltered, but total cholesterol was higher (p<0.05) after the training period ( $5.0 \pm 0.4$  vs.  $5.4 \pm 0.4$  mmol·l<sup>-1</sup>). In INT,  $VO_2$ -max and 5-K performance was improved (p<0.05) by 4% ( $51.6$  vs.  $53.8$  ml·kg<sup>-1</sup>·min<sup>-1</sup>) and 3% ( $23:22 \pm 1:04$  vs.  $22:40 \pm 0:54$  min:s), respectively, whereas no changes were observed for CON.

**CONCLUSION:** Seven weeks of 10-20-30 training enhanced the health profile and improved performance in moderately trained male and female runners, despite a marked reduction in training volume.

Supported by Nordea-fonden, Denmark.

1539 Board #320 MAY 30 9:30 AM - 11:00 AM

**A Harness Safety Spotting System During Treadmill Vo2max testing in collegiate runners**

Micah Zuhl, Ailish C. White, Roy M. Salgado, Jason R. Beam, M. Virginia Wilmerding, Christine M. Mermier. *University of New Mexico, Albuquerque, NM.*  
(No relationships reported)

A maximal exercise test on a treadmill is commonly used to assess aerobic capacity ( $VO_2$ max), maximal running velocity ( $vVO_2$ max), and either ventilatory (VT) or lactate threshold (LT). As the speed and grade of the treadmill increase during the test, there is an increased risk of a falling injury. The termination of a maximal treadmill exercise test may be due to the subject's concern for safety while running at high velocities. The premature termination may result in an inaccurate assessment of maximal exercise capacity.

**PURPOSE:** To compare the results of maximal treadmill testing with and without a safety harness system in collegiate middle and long distance runners.

**METHODS:** Eighteen (n = 10 M, n = 8 F) collegiate runners completed two randomly selected maximal treadmill tests: one trial using a safety harness (SH) and one trial without a safety harness (NSH), all tests were separated by at least 48 h. The subjects began the test at a velocity of 14.5 km/hr or 12 km/hr with 1% grade for men and women, respectively. Speed increased by 0.806 km/hr per minute until volitional fatigue.  $VO_2$ max,  $vVO_2$ max, VT, test time (TT), RPE, HR, and  $VO_2$  plateau were measured for each trial. A questionnaire was administered after each trial to assess safety.

**RESULTS:** No significant difference was found for  $VO_2$ max,  $vVO_2$ max, RPE, and HR between trials. TT was significantly longer in the NSH trial (NSH = 590s vs. SH = 536s, p< 0.05). Questionnaire responses showed a significantly higher feeling of safety during the SH trial (p< 0.05).

**CONCLUSION:** A safety harness system increases the safety of subjects without affecting the results of a maximal exercise test. Therefore, safety is not a limitation during a maximal exercise test for collegiate middle and long distance runners.



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1540 Board #321 MAY 30 9:30 AM - 11:00 AM

**An Examination of Stretching Practices and Perceptions within US Collegiate Cross Country and Distance Programs**

Lawrence Judge<sup>1</sup>, David Bellar<sup>2</sup>, Jeffrey Petersen<sup>3</sup>, Bruce Craig<sup>1</sup>, Kimberly Bodey<sup>4</sup>, Erin Gilreath<sup>4</sup>, Laura Simon<sup>1</sup>, Matt Benner<sup>1</sup>. <sup>1</sup>Ball State University, Muncie, IN. <sup>2</sup>University of Louisiana at Lafayette, Lafayette, LA. <sup>3</sup>Baylor University, Waco, TX. <sup>4</sup>Indiana State University, Terre Haute, IN.  
(No relationships reported)

Research pertaining to pre-activity and post-activity stretching continues to expand in varied sport settings along with related best practice recommendations.

**PURPOSE:** This study was designed to determine if the pre- and post-activity stretching practices and perceptions of college cross country and track and field distance programs are aligned with the current recommendations.

**METHODS:** A total of 770 questionnaires were distributed to NCAA Division I, Division II, and Division III coaches in the United States. The demographic characteristics for participants in the investigation were as follows: n = 111, 78.2% male, 21.8% female, and age 41.31±12.0 years. The questionnaire was designed to gather demographic, professional, and educational information, as well as specific pre- and post-activity stretching usage by the coaches. The responses were examined by computing frequency counts and means where applicable. Pearson's chi-square tests were utilized to determine differences in stretching modality usage.

**RESULTS:** Chi square analyses revealed a significantly greater usage of static stretching alone as a pre-activity modality ( $\chi^2 = 21.582$ ,  $p = 0.0174$ ) by non-certified coaches (18.9%, n = 9) versus their certified counterparts (1.8%, n = 1). In addition, certified coaches reported higher usage of dynamic flexibility only during the pre-activity period (47.4%, n = 27) versus non-certified peers (32.4%, n = 16). Coaches were also asked if they allowed for static stretching between interval work and competitive efforts, and similarly a significant difference ( $\chi^2 = 11.948$ ,  $p = 0.0177$ ) was noted with a higher percentage of non-certified coaches (45.5%, n = 23) allowing athletes to perform static stretches during these situations than certified peers (37.9%, n = 22).

**CONCLUSION:** When comparing coaching specific certification to pre-activity flexibility practices, it is clear not all coaches are in compliance with suggested pre-activity flexibility recommendations. These significant differences help demonstrate coaching certification courses as an effective tool for communicating current information about effective stretching modalities. However, the results also revealed that there are still many certified coaches who are not implementing best practices into athlete stretching routines.

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1541 Board #322 MAY 30 9:30 AM - 11:00 AM

**Effects Of 8-week Whole-body Vibration Training On Running Economy**

Ching-Feng Cheng, Kuo-Hui Cheng, Yu-Ming Lee, Hsin-Wei Huang, Yu-Hsuan Kuo, Heng-Ju Lee. National Taiwan Normal University, Taipei, Taiwan.  
(No relationships reported)

Running economy (RE), one of the critical physiological factors related to running performance, can be improved by explosive training. Whole-body vibration (WBV) has been used as an exercise modality to enhance explosive performance. However, there are no studies to demonstrate if the WBV training could be used to improve the RE.

**PURPOSE:** The purpose of this study is to investigate the effects of 8-week WBV training on power performance and RE.

**METHODS:** Twenty-four male collegiate athletes were recruited and randomly assigned to experimental (WBV, n=12) and placebo (PL, n=12) groups. The WBV participants performed semi-squat vibration training (30 Hz, ± 1–2 mm, 3 times per week), while PL participants performed identical training without vibration. The isometric maximum voluntary contraction test was used to evaluate the maximal isometric force ( $F_{max}$ ) and the rate of force development (RFD) of the lower extremities, and RE was measured on a level treadmill at 3 different velocities (2.68, 3.13, and 3.58 m·s<sup>-1</sup>), before and after the intervention.

**RESULTS:** There were no significant improvements on the  $F_{max}$  of the knee extensors and flexors in the both groups after training. The  $F_{max}$  of the lower leg (plantar flexion, from 80.8 ± 24.5 to 99.0 ± 33.9 N·m,  $p < 0.05$ ,  $\eta^2 = 0.567$ ; dorsiflexion, from 38.1 ± 6.5 to 43.0 ± 7.7 N·m,  $p < 0.05$ ,  $\eta^2 = 0.415$ ), and the RFD of 0–200 ms during plantar flexion (from 186.0 ± 69.2 to 264.6 ± 87.2 N·m·s<sup>-1</sup>,  $p < 0.05$ ,  $\eta^2 = 0.184$ ) were significantly increased in the WBV group after training. No significant differences were observed on the  $F_{max}$  of the dorsiflexors and the RFD of 0–200 ms during plantar flexion after PL intervention. The averaged RE values for the 3 running velocities were significantly improved after WBV training (pre- vs. post-training, 4.31 ± 0.33 vs. 4.65 ± 0.34 m·ml<sup>-1</sup>·kg<sup>-1</sup>,  $p = 0.001$ ,  $\eta^2 = 0.654$ ); however, no significant differences were found in the PL group (pre- vs. post-training, 4.18 ± 0.26 vs. 4.26 ± 0.44 m·ml<sup>-1</sup>·kg<sup>-1</sup>,  $p = 0.476$ ). The WBV training significantly improved RE at selected speeds (~5.0–6.2 % in caloric unit cost, and ~7.2–8.5 % in distance unit cost,  $p < 0.05$ ).

**CONCLUSION:** These results indicate that short-term WBV training may improve RE and power performance in competitive athletes.

Supported by grants from National Taiwan Normal University, Taipei, Taiwan.

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1542 Board #323 MAY 30 9:30 AM - 11:00 AM

**Manipulation of Training Regimen and Dietary Pattern Enhanced Submaximal Performance in Ramadan Fasting Distance Runners**

Ali M. Al Nawaiseh<sup>1</sup>, Mo'ath F. Bataineh<sup>1</sup>, Matt Green<sup>2</sup>. <sup>1</sup>The Hashemite University, Zarqa, Jordan. <sup>2</sup>University of North Alabama, Alabama, AL. (Sponsor: Matt Green, FACSM)  
(No relationships reported)

Muslim athletes are obligated to abstain from eating and drinking from dawn to dusk during the whole lunar month of Ramadan, this religious practice has been reported by many to interrupt regular training schedules and therefore influence performance.

**PURPOSE:** We investigated the effects of modified training protocols and altered dietary intake on the performance of Ramadan (daytime) fasting on distance running performance.

**METHODS:** Fourteen competitive distance male runners (23.9 ± 3.1 yrs) who observed Ramadan participated in this study after signing an IRB-approved Informed consent. Participants reported to the lab at 10:00 am and rested for 30 minutes. A graded treadmill exercise protocol (Conconi) was conducted to assess oxygen consumption (VO<sub>2</sub>), rating of perceived exertion (RPE), heart rate (HR), and time to exhaustion on 3 separate occasions (3 days before Ramadan, at day 14 and day 28 of Ramadan). Subjects maintained their free living style for the first two weeks of Ramadan. For the second half of Ramadan participants were randomly divided into two groups (control and treatment). Treatment included training (modified schedule & increased load) and dietary (increased caloric and fluid intake and modified timing of intake).

**RESULTS:** Ramadan decreased energy intake ( $p < 0.0001$ ), number of meals ( $p < 0.0001$ ), and training loads ( $p < 0.0001$ ). HR and VO<sub>2</sub> at sub maximal speeds tended to decrease while RPE increased ( $p = 0.046$ ) during Ramadan. Time to exhaustion tended to increase during Ramadan for both groups. However, the treatment group took longer to reach exhaustion ( $p = 0.021$ ) and tended to have lower HR and VO<sub>2</sub> compared to control group at the end of Ramadan. Body weight and body fluids were not affected by fasting.

**CONCLUSIONS:** Despite increasing RPE during exercise, Ramadan enhanced performance and this effect could be augmented by manipulating dietary behavior (mainly timing of intake) and training protocol.

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1543 Board #324 MAY 30 9:30 AM - 11:00 AM

**Case-Study: Individualized Training and Nutrition Periodizations in Three Elite Marathoners**

Trent Stellingwerff. Canadian Sport Centre - Pacific, Victoria, BC, Canada. (Sponsor: Lawrence L. Spriet, FACSM)  
(No relationships reported)

Recent studies have begun to examine how the implementation of individualized fueling (i.e. a periodic lack of carbohydrate (CHO) availability during training) and fluid strategies, can enhance training effectiveness and adaptations that ultimately translates into optimal race-day performance in endurance athletes.

**PURPOSE:** To characterize periodized training and nutrition interventions leading to individualized race-day fluid and fueling plans for three world-class marathoners.

**METHODS:** This case-study involved 16 wks of nutrition and training periodization in 3 elite male runners (28.3±2.3 yrs; 67.3±3.3 kg) with >9yrs of elite training (>125km/wk) prior to a target marathon. Athletes kept detailed training logs including information on training volume (min; km) and interval splits, body weight and subjective ratings of perceived exertion (RPE) for each training session. RPE based training impulse calculations (TRIMP; i.e. training volume x intensity = load) were undertaken as a measure of training "load". Two main nutritional interventions were implemented: periodic low-CHO availability training, and individualized targeted CHO and fluid intake interventions. Interventions were fully described to each athlete/coach and continuous interaction and individual feedback were provided with alterations implemented, where needed, throughout the 16 wk period.

**RESULTS:** Athletes averaged 12.6±2.1 training sessions/wk for a total of 202±22 sessions over 16 wks. Average weekly training volumes were 173.6±32.5, 213.3±41.2 and 159.6±27.0 km/week for marathoner 1, 2 and 3, respectively. There was a weekly high TRIMP of 4437 AU (wk 9) and low of 1887 AU (wk 16), and an average of 3082±646 AU. Of the 606 total training sessions, on average ~74, 11 and 15% were completed at an intensity in zone 1 (very easy to somewhat hard), zone 2 (at lactate threshold) and zone 3 (very hard to maximal). There was 2.5±2.3 low energy training bouts per week. On race day athletes consumed 61±15g CHO in 604±156 ml per hour (10.1±0.3% CHO solution). Athletes improved their marathon race times from 2:16:53 to 2:11:23, a debut at 2:16:17 and 2:15:15 to 2:12:39, respectively.

**CONCLUSIONS:** These unique periodized training and nutrition approaches in preparation for competition allowed for enhanced individual marathon performance.

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**1544 Board #325 MAY 30 9:30 AM - 11:00 AM**  
**Body Composition and Weight Changes Based on Sex During a 15-Week Marathon Training Program**

Scott R. Brown, Stacy J. Ingraham, Jane R. Yank, Jordan M. Langen. *University of Minnesota, Minneapolis, MN.*  
(No relationships reported)

Exercise and nutritional interventions have been at the forefront to produce positive health changes and reduce obesity. The general public often views the effectiveness of an exercise program solely on changes in weight, especially females. This research demonstrates weight loss may not occur with months of an endurance training intervention and weight loss may be a poor assessment to quantify immediate positive results. This study also gives evidence that the public needs a practical way to assess body composition changes through intervention programs designed to lower body weight. Finally, there appears to be a difference between males and females in regards to weight loss during the marathon training.

**PURPOSE:** To determine if a 15-week marathon training program is successful for lowering body weight and improving body composition without a subsequent diet intervention.

**METHODS:** Eighty-five students (30 males, 55 females) were recruited from a marathon- training course offered by the Physical Activity Program at the University of Minnesota. Testing included VO<sub>2</sub>max, body composition, and anthropometric measures. Testing was done prior to the marathon training and two weeks prior to the marathon. Percentage of body fat was assessed using a BodPod. Independent t-tests were used to compare males and females on two dependent variables: (a) change of weight (kg), and (b) change in percentage of body fat after 15 weeks of marathon training. Differences between pre- and post-test measurements of weight and percentage of body fat were assessed using dependent t-tests for paired samples.

**RESULTS:** There was a not a weight change for females (0.21 +/- 0.22 kg p=0.346), and men trended to lose weight (-0.74 +/- 0.39 kg, p=0.75). Percent body fat did decline for females (-1.04 +/- 0.35%, p=0.004) and males (-1.26 +/- 0.46%, p=0.10) trended toward a decline also. Men lost more weight (0.95 +/- 0.441 p=0.027) than females and men also trended towards lowering percent body fat (0.258 +/- 0.14, p=0.073) when compared to females.

**CONCLUSIONS:** There is a tendency for males to lose more weight and have larger changes in body fat percentages than females following a 15-week marathon-training program and changes in percent body fat may be the best way to monitor body compositional changes during an endurance training protocol.

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**1545 Board #326 MAY 30 9:30 AM - 11:00 AM**  
**Maintenance of Increased Step Frequency Training in Female Runners Following Period of No Training**

Timothy J. Quinn, FACSM, Sara E. Hourihan, Shauna L. Dempsey. *University of New Hampshire, Durham, NH.*  
(No relationships reported)

Running economy (RE) is the steady-state VO<sub>2</sub> for a given submaximal running velocity and accounts for up to 65% of the variability in performance time. Increased step frequency (SF) training has been previously shown to improve running economy (RE). Whether an increased SF can be maintained following this type of training is unknown.

**PURPOSE:** The purpose of the study was to determine if a runner could retain an increased step frequency and improved RE after 12 days of structured training followed by 14 days with no learning stimulus.

**METHODS:** Ten female runners were recruited from local races and track clubs that had 5K times between 17-22 mins within the past year and a SF <175 s/min. Day 1 involved subjects running for 5 mins on the treadmill at 3.4 and 3.8 m/sec at their preferred SF (PSF) and at an optimal SF (OSF) of 180 s/min. VO<sub>2</sub> was measured at the two speed and SF conditions. VO<sub>2</sub>max was measured after the submaximal runs. Days 2-11 involved training on the treadmill for 15 mins each day at the OSF of 180 s/min. A metronome was used to help subjects maintain the increased SF and SF was monitored using a footswitch and a BIOPAC MP100 Data Acquisition System. Days 12 and 26 involved post-training treadmill VO<sub>2</sub> testing with no step training between days. Subjects were encouraged to train at the recently learned, faster SF. A repeated-measures ANOVA was used to detect significant differences at the p<0.05 level.

**RESULTS:** Following the training and on average, submaximal VO<sub>2</sub> decreased by 3.0% (p=NS), HR dropped 4.0% (p<0.05), and SF was 4.0% (p<0.05) higher across both speeds and conditions. Following two weeks of no structured SF training, the VO<sub>2</sub> reduction was maintained (2.9%; p=NS) as were the reduced HR (4.0%; p<0.05) and increased SF (3.7%; p<0.05) compared to the pre-training measurements and these findings were not different from post-training measurements.

**CONCLUSIONS:** The results from this study suggest that an increased SF can be maintained following a short SF training program resulting in a lower VO<sub>2</sub> and HR and therefore, an improved RE in well-trained female runners.

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**1546 Board #327 MAY 30 9:30 AM - 11:00 AM**  
**The Effect of Stride Frequency on Running Economy**

Robert M. Otto, FACSM, Michele Aquino, John W. Wygand, Raymond Peralta, Mariel Wenzel, Cory Whitmer, Shannon Isom. *Adelphi University, Garden City, NY.*  
(No relationships reported)

Run economy is closely allied with both stride frequency and stride length, which are inversely proportional at a fixed speed. It is believed that veteran runners gravitate to a specific stride frequency, which may coincide with optimal efficiency. Often acute fatigue during a race attenuates both run performance and efficiency through changes in stride frequency and length. If an optimal stride frequency can be identified, then the seasoned athlete can strive to retain the optimal stride frequency during all efforts.

**PURPOSE:** To determine the effects of three different stride frequencies on energy cost at a fixed speed.

**METHODS:** 12 intercollegiate athletes (9 male, 3 females, ht. 173.3 ± 8.9 cm, body mass 66.9 ± 10 kg) volunteered to run at a steady state level which corresponded to their 10K race pace. A baseline trial was conducted at 214.4 (n=2), 241.2 (n=3) or 268 (n=7) m/min and 1% grade at the participants self-selected stride frequency (SS), while metabolic energy cost (oxygen consumption) and stride frequency were obtained. Subjects practiced running at the initial fixed speed with a stride frequency of 5 steps/min above (A) and 5 steps/min below (B) their self-selected stride frequency. After a minimum of four practice sessions, subjects performed trials A and B with open circuit spirometry in a randomized design.

**RESULTS:** Mean SS stride frequency was 89 ± 6.7 with a range of 81-102. The mean energy cost at a fixed speed and a stride frequency of SS, A, and B were 51.5 ± 5.7, 51.2 ± 5.6 and 51.4 ± 5.0 mL<sub>O</sub><sub>2</sub>/kg-min, and .204, .203, and .204 mL<sub>O</sub><sub>2</sub>/kg-meter, respectively, with a mean range of less than 39 mL<sub>O</sub><sub>2</sub>/min among all trials. Stride length and stride length/leg length ratio were 1.43, 1.35, and 1.51 meters/stride and 1.70, 1.62, and 1.81, for SS, A, and B trials, respectively. Statistical analysis by ANOVA at p<.05 revealed no significant difference among the three trials, even though eight subjects displayed the lowest energy cost at a stride frequency greater than their SS frequency.

**CONCLUSION:** The lack of statistical significance among various stride frequencies does not preclude the possibility of an improved run efficiency and/or performance of specific individuals with an alteration in stride frequency.

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**1547 Board #328 MAY 30 9:30 AM - 11:00 AM**  
**Running Economy Is Not Related To Jumping Performance**

James M. Smoliga<sup>1</sup>, Josh J. Fleming<sup>2</sup>, Michael S. Hux<sup>2</sup>, Andrea J. Fradkin<sup>2</sup>. <sup>1</sup>Marywood University, Scranton, PA. <sup>2</sup>Bloomsburg University, Bloomsburg, PA.  
(No relationships reported)

Previous research has shown that plyometric training is an effective way of improving running economy (RE). Yet it is unknown whether certain jump types have larger running-specific components associated with them.

**PURPOSE:** To determine the relationship between eight different jump types and RE.

**METHODS:** Ten recreationally active college students (six males, four females) participated in two days of testing separated by 48 hours. On Day 1, participants ran for five minutes on a treadmill at four submaximal speeds with three minutes rest between speeds. Metabolic data was collected continuously and RE for each speed was computed as  $\text{VO}_2$  required to run 1km. On Day 2, participants performed a series of eight randomized jumps including a single-legged vertical jump (VJ), broad jump (BJ), and contralateral jump (CJ) on both right (R) and left (L) legs, as well as a double-legged (2L) VJ and BJ. Participants performed three repetitions of each jump, with 45 seconds rest between repetitions and a three minute rest between jump types. A repeated measures ANOVA was performed to compute differences in metabolic data and RE between speeds. Pearson's product moment correlations were performed to determine the relationship between the best jump performance for each condition and RE.

**RESULTS:** There were significant differences in heart rate and  $\text{VO}_2$  between all speeds ( $p \leq 0.001$ ), yet there were no significant differences in RE between all speeds ( $p = 0.938$ ). Very poor, non-significant, negative relationships were found between mean RE ( $218.2 \pm 27.2 \text{ mL O}_2 \cdot \text{kg}^{-1} \cdot \text{km}^{-1}$ ) and both double-legged jumps ( $\text{VJ}_{2L}$ ,  $0.52 \pm 0.16\text{m}$ ,  $r = -0.015$ ,  $p = 0.967$ );  $\text{BJ}_{2L}$  ( $2.22 \pm 0.50\text{m}$ ,  $r = -0.055$ ,  $p = 0.880$ ), as well as  $\text{VJ}_L$  ( $0.39 \pm 0.14\text{m}$ ,  $r = -0.028$ ,  $p = 0.938$ ). Very poor, non-significant, positive relationships were found between RE and all right-legged jumps ( $\text{VJ}_R$  ( $0.37 \pm 0.13\text{m}$ ,  $r = 0.059$ ,  $p = 0.872$ );  $\text{BJ}_R$  ( $1.77 \pm 0.43\text{m}$ ,  $r = 0.248$ ,  $p = 0.489$ );  $\text{CJ}_R$  ( $2.02 \pm 0.33\text{m}$ ,  $r = 0.159$ ,  $p = 0.662$ ), as well as  $\text{BJ}_L$  ( $1.82 \pm 0.35\text{m}$ ,  $r = 0.218$ ,  $p = 0.546$ ) and  $\text{CJ}_L$  ( $2.01 \pm 0.34\text{m}$ ,  $r = 0.175$ ,  $p = 0.629$ ).

**CONCLUSION:** All jump types examined in this study had very poor relationships to RE, suggesting that there must be alternate explanations for the improved RE seen after plyometric training. Future research should explore other jump types, as well as other mechanisms that may account for this.

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**1548** Board #329 MAY 30 9:30 AM - 11:00 AM

**Effects of Unweighting on Heart Rate Response and Speed/Incline Adjustments Necessary in Elite Runners**

Robert G. LeFavi, Aubrey G. Morris, Jayme Eitner, Ernest Ledesma, Bryan L. Riemann. *Armstrong Atlantic State University, Savannah, GA.* (Sponsor: T. Jeff Chandler, FACSM)

(No relationships reported)

The AlterG Treadmill, which makes use of lower body positive pressure (LBPP), enables runners to train at race-pace speeds yet with variable body weights (BW) and resultant ground reaction forces. The AlterG is marketed as an "unweighting" tool useful during lower body injury. There is lack of research investigating the additional speed and/or incline necessary at lower BW to achieve the equivalent intensity possible at 100% BW.

**PURPOSE:** To quantify AlterG speed and incline adjustments necessary at two levels of unweighting in order to achieve intensities equivalent to those at 100% BW running.

**METHODS:** Following an initial  $\text{VO}_{2\text{max}}$  test, seven elite male runners (average age = 30.1 yrs; ht = 177.4 cm; wt = 77.1 kg;  $\text{VO}_{2\text{max}}$  = 64.1 ml/kg/min) underwent two unweighted running trials (75% BW and 50% BW). The trials ended when subjects reached their heart rate at 90%  $\text{VO}_{2\text{max}}$ . Heart rate, speed, and incline were recorded throughout each trial.

**RESULTS:** When subjects were unweighted to 75% BW and ran at their heart rate equivalent of 70%  $\text{VO}_{2\text{max}}$ , they required an average speed increase of 1.7 mph and an average incline increase of 4.3%; at 80%  $\text{VO}_{2\text{max}}$ , 2.8 mph and 3.1% incline, respectively; at 90%  $\text{VO}_{2\text{max}}$ , 3.4 mph and 2.0% incline, respectively. When subjects were unweighted to 50% BW and ran at their heart rate equivalent of 70%  $\text{VO}_{2\text{max}}$ , they required an average speed increase of 2.7 mph and an average incline increase of 5.1%; at 80%  $\text{VO}_{2\text{max}}$ , 4.1 mph and 4.7% incline, respectively; at 90%  $\text{VO}_{2\text{max}}$ , 3.9 mph and 4.1% incline, respectively. Further, the average speed increase at 75% BW across all target intensities to reach the equivalent heart rate at 100% BW was 3.1 mph, yet there was only a 0.8 mph additional increase necessary when BW dropped from 75% to 50%. Likewise, the average incline increase at 75% BW relative to 100% BW was 3.1%, while the decrease from 75% BW to 50% BW required only an additional 1.9% incline.

**CONCLUSION:** Unweighting due to LBPP requires an increase in running speed and incline in order to maintain training intensity levels in elite male runners. Since the increases in speed and incline necessary to achieve target intensities do not appear to be linearly related to the level of unweighting, further research is necessary to identify the variables at which maximum intensity can be achieved while ground reaction forces are minimal.

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**1549** Board #330 MAY 30 9:30 AM - 11:00 AM

**Physiological Characteristics of a Co-ed Cross Country Running Team Living and Training at Altitude**

Scott N. Drum, FACSM, Sarah Baysden, Meta Haley. *Western State College of Colorado, Gunnison, CO.*

(No relationships reported)

The literature is limited related to characterizing the traits of successful college cross country (XC) running programs, especially ones where athletes live and train at altitude (7,700 ft or 2,350 m) while competing frequently at or near sea level.

**PURPOSE:** To determine the physiological characteristics of a national caliber, college XC running team residing at altitude with an established tradition of winning men's and women's NCAA Division II (D-II) national championships.

**METHODS:** Maximal treadmill testing records in reference to 14 men ( $21 \pm 2.2$  yrs) and 10 women ( $20 \pm 1.1$  yrs) were retrospectively analyzed for maximal oxygen uptake ( $\text{VO}_{2\text{max}}$ ), heart rate max ( $\text{HR}_{\text{max}}$ ), pulmonary ventilation at max ( $\text{V}_E@_{\text{max}}$ ), ventilatory threshold (VT), and heart rate at VT ( $\text{HR}@_{\text{VT}}$ ). All subjects had been living and training consistently with their college-based XC program for at least one year and were tested at 7,700 ft in Gunnison, Colorado.

**RESULTS:** Men and women, respectively, exhibited an average (mean  $\pm$  SD)  $\text{VO}_{2\text{max}}$ ,  $\text{HR}_{\text{max}}$ ,  $\text{V}_E@_{\text{max}}$ , VT, and  $\text{HR}@_{\text{VT}}$  of  $63 \pm 2.8$  and  $50 \pm 3.4 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ ,  $191 \pm 6.1$  and  $186 \pm 10.1$  bpm,  $168 \pm 17.9$  and  $124 \pm 13.4 \text{ L} \cdot \text{min}^{-1}$ ,  $3.7 \pm .3$  and  $2.6 \pm .3 \text{ L} \cdot \text{min}^{-1}$ , and  $178 \pm 6.7$  and  $174 \pm 8.8$  bpm, respectively. Interestingly, with regard to  $\text{VO}_{2\text{max}}$ , the men and women were about 7.6% and 15.5%, respectively, decremented versus trained sea level, college runners found in the literature. Furthermore,  $\text{HR}_{\text{max}}$  was reduced by about 4% and 7% in men and women, respectively, in comparison to the standard sea level  $\text{HR}_{\text{max}}$  formula of 220-age (noting that this formula maintains a large SD).

**CONCLUSION:** Well-trained male and female college XC runners living and training at altitude may exhibit some decrements in physiological performance attributes when compared to sea level trained competitors. However, despite potential physiological decrements at altitude, upon return to sea level for racing, both genders in the current study seem to benefit from training and living high within the context of competing in the NCAA D-II ranks. Potentially, controlled studies should be conducted on this particular team and others that reside at altitude to fully discover the supposed sea level racing advantages of living and training at a moderate elevation (i.e., between about 7,000 and 8,000 ft) and competing in the NCAA D-II classification.

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**1550** Board #331 MAY 30 9:30 AM - 11:00 AM

**Age, Gender, and Mode Considerations in Elite Ultra-endurance Triathlete Performances**

Vincent Nethery, Travis Hudon, Tim Burnham, Robert Pritchett. *Central Washington University, Ellensburg, WA.*

(No relationships reported)

Participation in World Championship events through invitation via qualification represents the ultimate in competition for age group competitors. The ultra-endurance Ironman 70.3 World Championships, held over consecutive years in Clearwater Florida, represents one such venue.

**PURPOSE:** To compare overall as well as swimming (1.9 km), cycling (91 km), and running (21.2 km) performances across a 20-70yr age-span in males and females.

**METHODS:** Times for the top 20 male and female competitors each year (2006-2009) were extracted from WTC 70.3® World Championship race results and compared across age groups (ANOVA-Bonferroni post-hoc). Absolute and relative differences among age groups were calculated and compared.

**RESULTS:** Overall performance for males was maintained through age group 45-49 with progressively greater declines ( $P < 0.05$ ) noted for older age categories. Declines of 4.09%, 7.63%, and 10.57% were observed for the 50-54, 55-59, and 60-64 age groups relative to their immediate preceding group. Females followed a similar pattern, except that diminished overall performance was noted after the 40-44 age group with declines of 3.66%, 8.44%, and 13.88% for the 45-49, 50-54, and 55-59 age groups relative to the immediate preceding category. In males, swim and run performances diminished after age 50 whereas cycling performance was maintained until age 55. In contrast, all female sub-discipline performances declined beyond age 50.

**CONCLUSIONS:** The threshold for age related diminishments in high-level ultra-endurance triathlon performances are related to both gender and specific event sub-discipline. Such performance-based analyses of world-class age-group athletes, provides unique insight into the relationships between aging, functional ability, and task mode.

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1551 Board #332 MAY 30 9:30 AM - 11:00 AM

**Training, Nutrition, Injury and Lifestyle Characteristics of Shorter Distance Triathletes**

Loren E. Johnson<sup>1</sup>, Alexandra L. Braud<sup>1</sup>, Laura A. Forney<sup>1</sup>, Conrad P. Earnest, FACSM<sup>2</sup>, Laura K. Stewart<sup>1</sup>. <sup>1</sup>Louisiana State University, Baton Rouge, LA. <sup>2</sup>Pennington Biomedical Research Center, Baton Rouge, LA.  
(No relationships reported)

The triathlon is a popular sport which consists of swimming, biking and running; however, there is little descriptive data about individuals participating in this event.

**PURPOSE:** To provide information about the training, nutrition and overall health of triathletes.

**METHODS:** Athletes participating in shorter distance (Sprint or Olympic distance) triathlons in the Southern region of the US during the 2011 season completed a 30 question survey examining training habits, nutritional supplementation, lifestyle characteristics, injury occurrence and overall health status. Data are presented as mean  $\pm$  standard error.

**RESULTS:** Male and female triathletes (N = 277) ranged in age from 18 - 66 yrs (38.7  $\pm$  0.61 years). Average height was 175.9  $\pm$  0.81 cm and weight was 74.3  $\pm$  0.15 kg. Athletes had 4 years of previous race experience and typically finished in the upper 50% of their age group by gender. Training consisted of 3.2  $\pm$  .21 hours swimming, 6.2  $\pm$  .39 hours biking, 5.1  $\pm$  .41 hours running, 1.3  $\pm$  .10 hours weight lifting, and .97  $\pm$  .19 hours of cross training per week. Triathletes reported consuming 3.5  $\pm$  .09 servings of carbohydrates, 3.0  $\pm$  .06 servings of fruits, 3.1  $\pm$  .08 servings of vegetables, 2.3  $\pm$  .08 servings of dairy products, 2.3  $\pm$  .08 servings of fat rich foods and 3.1  $\pm$  .08 servings of protein rich foods on a daily basis. The most commonly used nutritional supplements were bars (92%) followed by liquids (91%). Triathletes (n = 71) reported average energy consumption 2322  $\pm$  51.5 kcal, with 2473.9  $\pm$  72.9 kcal and 2072  $\pm$  57.6 kcal in men and women respectively. Knee (34%), foot (31%), back (24%) and shoulder (18%) injuries were the most common, but the majority of athletes reported that their health (89%) and quality of life (86%) was very good or excellent. Lastly, most triathletes (88%) reported no problems with work or other daily activities as a result of emotional problems.

**CONCLUSION:** Overall, triathletes cycle more than run and spend the least time swimming. Triathletes reported eating more carbohydrates than other food groups and regularly use liquids and bars as supplements. While most triathletes experience a higher quality of life, a number of them tend to experience injuries to the lower extremity.

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1552 Board #333 MAY 30 9:30 AM - 11:00 AM

**Recovery Heart Rates in Trained Recreational Cyclists and Runners**

Silvie Grote<sup>1</sup>, Herman L. Falsetti<sup>2</sup>, William C. Beam, FACSM<sup>3</sup>, Kelia G. McDonald<sup>1</sup>, John F. Sanguedolce<sup>1</sup>. <sup>1</sup>Loyola Marymount University, Los Angeles, CA. <sup>2</sup>Health Corp., Laguna Niguel, CA. <sup>3</sup>California State University, Fullerton, Fullerton, CA.  
(No relationships reported)

Cardiovascular disease is the leading cause of death in the United States. Recovery heart rates have been studied in diseased populations in order to establish a marker for increased risk of mortality from cardiovascular disease. Abnormal 1-minute heart rate recovery (<13 bpm) is significantly associated with greater mortality. Recovery heart rates of highly trained recreational athletes have not been studied to the same degree.

**PURPOSE:** The purpose of this study was to investigate the effect of age and mode on heart rate recovery in trained recreational athletes.

**METHODS:** Forty-four recreational athletes were studied including 21 cyclists and 23 runners. The participants, who were considered trained (training at least 6 hours per week), had a mean maximal oxygen consumption of 50.5 $\pm$ 9.0 ml kg<sup>-1</sup> min<sup>-1</sup> and mean resting heart rate of 50 $\pm$ 7 bpm. The sample was divided into 3 different age groups - young (n=5, age=22 $\pm$  4), middle-age (n=14, age= 35 $\pm$  3), and masters (n=25, age=51 $\pm$  8) Following completion of maximal exercise, recovery heart rate at 1 minute (HRR1) and 2 minutes (HRR2) was determined by HR<sub>max</sub>-HR<sub>min</sub>. ANOVA was used to test for main effects due to age and mode with follow up using an independent t test to examine differences between the modes.

**RESULTS:** Heart rate recovery at 1 and 2 minutes, respectively, for young (31 $\pm$  13, 78 $\pm$ 11), middle age (36 $\pm$ 17, 84 $\pm$ 22), and masters (31 $\pm$ 11, 71 $\pm$ 19) were not significantly different. Training mode did have an impact on recovery heart rate. Heart rate recovery in runners was significantly faster (p<0.05) with HRR1 (39 $\pm$ 13) and HRR2 (87 $\pm$ 16) than recovery in cyclists with HRR1 (25 $\pm$ 10) and HRR2 (64 $\pm$ 16).

**CONCLUSION:** This study describes the effect of age and mode on heart rate recovery in trained recreational athletes. Runners exhibit faster recovery than cyclists regardless of age.

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1553 Board #334 MAY 30 9:30 AM - 11:00 AM

**Upper Body Training And Exercise According To ACSM Guidelines: Effects On Handcycling And Cycling Capacity.**

Florentina J. Hettinga, Mark Hoogwerf, Ben Sijtsma, Marloes van Ballegooijen, Faes Kerkhof, Lucas H.V. van der Woude. *Center for Human Movement Sciences, University Medical Center Groningen, University of Groningen, Groningen, Netherlands.* (Sponsor: Thomas Janssen, FACSM)  
(No relationships reported)

**PURPOSE:** Studies on optimal training are mostly aimed at training the large muscle groups of the lower body. 'How can we optimally train the upper body' is a particularly relevant question for those in a wheelchair. To develop a knowledge base on upper body training, it is important to use available knowledge on training in general, and adapt this to the rehabilitation context. The present study aims to study effects of training the upper body according to the ACSM guidelines and to determine if training adaptations are exercise specific.

**METHODS:** 22 Female able-bodied participants, non-experienced to upper body exercise, were randomly divided in a handcycling training (TG: 7-weeks, 3 times a week at 65% heart rate reserve for 30 minutes) and control group (CG). Peak physiological capacity was evaluated pre- and post-training with an incremental handcycling exercise test to determine local, exercise specific adaptations. A matched incremental test on a bicycle ergometer was performed, to determine non exercise specific central/cardiovascular adaptations. Oxygen uptake (VO<sub>2</sub>), heart rate (HR), ventilation (VE), power output (PO) and rate of perceived exertion (RPE) were compared between TG and CG before and after training on both handcycling and cycling performance.

**RESULTS:** TG improved significantly on peak VO<sub>2</sub> (+18.1%), peak PO (+31.9%), peak VE (+31.4%) and peak HR (+4.0%) during handcycling compared to CG. No improvements were found in the incremental cycling test, thus differences in peak capacity between cycling and handcycling decreased after training.

**CONCLUSIONS:** Handcycling is an effective training mode for upper body exercise capacity. A training schedule based on ACSM guidelines (though designed for exercising the large muscle masses of the lower body) leads to exercise specific improvements in handcycling performance on peak VO<sub>2</sub>, peak PO and peak HR. In this way, it seems that ACSM guidelines can be used as a general basis to determine training frequency, intensity and duration for upper body exercise in healthy able-bodied subjects. Future research must focus on transferability of these results to different patient groups and persons with different impairments and physiological capacities. In particular those with a low physical capacity must receive special attention.

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1554 Board #335 MAY 30 9:30 AM - 11:00 AM

**Effects Of Low Intensity Cycling With Blood Flow Restriction On Body Composition, Strength, And Vo2max**

Daeyeol Kim, Harshvardhan Singh, Kaelin Young, Christopher A. Fahs, Lindy M. Rossow, Jeremy P. Loenneke, Robert S. Thiebaut, Eonho Kim, Kyle Sherk, Xin Ye, Debra A. Bemben, FACSM, Michael G. Bemben, FACSM. *University of Oklahoma, Norman, OK.*  
(No relationships reported)

Traditional high-intensity cycle training (HI) has been shown to improve muscular responses and aerobic capacity, however, recent research indicates that low-intensity cycle training with blood flow restriction (LI) can have similar effects.

**PURPOSE:** To compare the effects of 6 weeks high-intensity cycle training to low-intensity cycle training with blood flow restriction on body composition, muscle hypertrophy, muscle strength, and aerobic capacity.

**METHODS:** Subjects (31 males, 18-30 yrs) were assigned to one of three groups: HI (n=10, 60-70% Heart Rate Reserve (HRR)), LI (n=11, 30% HRR with BFR at 160-180 mmHg), and CON (n=10, no exercise). Subjects in HI and LI exercised 3 sessions (5 min warm-up & 20 min cycling)/week for 6 weeks. Body composition (fat %, total fat mass, and total lean mass by DXA), muscle hypertrophy (leg fat and lean mass by DXA, and muscle CSA by pQCT), muscle strength (1-RM leg extension and flexion), and aerobic capacity (VO<sub>2max</sub>) were measured pre and post training. A two-way repeated measure ANOVA was utilized to compare groups and times with statistical significance set at p<0.05.

**RESULTS:** There were no significant differences between groups for any of the outcome variables but a number of trends were noted. Fat %, fat mass, and lean mass changed by -4.7%, -4.3%, and 2.1% in LI, -0.4%, -0.1%, and 0.7% in HI, and -1.1%, -1.1%, and 0.0%, respectively in CON. Additionally, leg fat mass decreased by 3.1% in LI, but only 1.3% in HI and 0.4% in

CON. Leg flexion strength was significantly different between HI and CON ( $P = 0.035$ ), however, % changes for leg extension and flexion strength were 5.2% and 7.2% in HI, 5.7% and 6.3% in LI, respectively. Finally, % change for  $VO_{2max}$  was 5.7% in HI, 2.1% in LI, and -1.4% in CON.  $VO_{2max}$  was significantly different between HI and CON ( $P = 0.029$ ).

**CONCLUSIONS:** Even though low-intensity cycle training with blood flow restriction did not statistically improve body composition, muscle hypertrophy, muscle strength, and  $VO_{2max}$ , decreases for fat in the LI group were greater than the HI, and the other changes for LI were similar to the changes for the HI group.

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**1555** Board #336 MAY 30 9:30 AM - 11:00 AM  
**The Effect Of Endurance Cycling Training On Cross-sectional Area And Strength Of Thigh Muscles In Human**  
Hidetoshi Hoshikawa, Saori Yoshida, Tsukasa Miyamura. *Hamamatsu University, Shizuoka, Japan.*  
(No relationships reported)

Although endurance training has been shown to markedly affect the oxidative capacity of the skeletal muscle, there is limited information about the effect of on the skeletal muscle morphological property and strength.

**PURPOSE:** To investigate the effect of endurance cycling training on cross-sectional area of and isokinetic strength of thigh muscles.

**METHODS:** Four male ( $20.8 \pm 0.5$  yr,  $171.9 \pm 1.5$  cm,  $63.5 \pm 2.2$  kg) and four female ( $20.5 \pm 0.5$  yr,  $164.5 \pm 4.5$  cm,  $52.9 \pm 7.6$  kg) university students were participated in this study. They trained for 7 weeks on a bicycle ergometer for 30 min/day, three times a week at a work load requiring 60 % of oxygen uptake reserve ( $VO_{2R}$ ) at 90 rpm. Before and after training, isokinetic knee extension and flexion moment (60, 150, and 240 deg/s) were measured and cross-sectional areas (CSAs) of quadriceps femoris and hamstrings at 30, 50, and 70 % of the femur bone length, and psoas major muscle at the center of the L4-L5 transverse level were determined by magnetic resonance imaging.

**RESULTS:**  $VO_{2max}$  was significantly increased by  $10.1 \pm 6.6$  % after training ( $p < 0.01$ ). By the end of the training period, peak knee extension moment at 60, 150 and 240 deg/s ( $10.3 \pm 7.2$ ,  $9.6 \pm 8.8$ , and  $18.2 \pm 14$  %, respectively,  $p < 0.05$ ) and flexion moment at 60deg/s ( $8.7 \pm 8.1$  %,  $p < 0.05$ ) were significantly increased. CSA of quadriceps femoris was significantly increased at 30, 50, and 70 % of the femur bone length after training ( $5.8 \pm 5.9$ ,  $4.5 \pm 3.9$ ,  $5.1 \pm 4.4$  %, respectively,  $p < 0.05$ ). Significant increase in CSA of hamstrings was observed at 70 % of the femur bone length after training ( $5.1 \pm 4.0$  %,  $p < 0.05$ ). Although CSA of psoas major was not statistically significance, the value tended to be higher after training ( $p = 0.06$ ).

**CONCLUSIONS:** These results suggest that moderate endurance cycling training induce muscle hypertrophy and increase muscle strength in the thigh.

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**1556** Board #337 MAY 30 9:30 AM - 11:00 AM  
**Comparison Of Different Exercise Tests For Predicting Endurance Performance In Moderately Trained Cyclists**  
Niklas Psilander<sup>1</sup>, Mikael Flockhart<sup>2</sup>, Kent Sahlin<sup>1</sup>. <sup>1</sup>Karolinska Institutet, Stockholm, Sweden. <sup>2</sup>Swedish School of Sport and Health Sciences (GIH), Stockholm, Sweden.  
(No relationships reported)

Laboratory exercise tests are important for evaluating training adaptations and to predict endurance performance. The most frequently used test parameters are  $VO_{2max}$  and power output at the 4 mmol L<sup>-1</sup> blood lactate threshold ( $W_{LT4}$ ). However, alternative test parameters might provide improved precision and/or reduce the need of expensive laboratory equipment.

**PURPOSE:** To investigate how different test parameters correlates with endurance performance in moderately trained cyclists.

**METHODS:** Eighteen cyclists ( $VO_{2max}$  (mean  $\pm$  SEM)  $56 \pm 1$  mL  $kg^{-1}$   $min^{-1}$ ) completed two tests on separate days; a 40 min time trial (TT40) on a SRM cycle ergometer for assessment of endurance performance and an incremental ergometer test for assessment of maximal oxygen consumption ( $VO_{2max}$ ; mL  $kg^{-1}$   $min^{-1}$ ) and maximal power output at exhaustion ( $W_{max}$ ; W  $kg^{-1}$ ). Lactate was measured in capillary blood taken during and after the incremental test and used for calculation of the power output at the 4 mmol L<sup>-1</sup> ( $W_{LT4}$ ; W  $kg^{-1}$ ) and modified  $D_{max}$  ( $W_{Dmax}$ ; W  $kg^{-1}$ ) lactate threshold.

**RESULTS:** Endurance performance, calculated as the average power output during the TT40 (W  $kg^{-1}$ ), was correlated with the conventionally used test parameters  $VO_{2max}$  ( $r = 0.81$ ,  $p < 0.01$ ) and  $W_{LT4}$  ( $r = 0.78$ ,  $p < 0.01$ ). However, higher correlation coefficients were observed between TT40 and the alternative test parameters  $W_{max}$  ( $r = 0.90$ ,  $p < 0.01$ ) and  $W_{Dmax}$  ( $r = 0.87$ ,  $p < 0.01$ ). Further, multiple regression analysis shows that  $W_{max} + W_{Dmax}$  can explain 80 % (adjusted  $r^2$ -value) of the variance in endurance performance whereas  $VO_{2max} + W_{LT4}$  can explain 73 %.

**CONCLUSION:** Compared to traditional test parameters, our results indicate that both  $W_{max}$  and  $W_{Dmax}$  are suitable test parameters to predict endurance performance in moderately trained cyclists. However,  $W_{max}$  is to be preferred due to high precision in combination with relatively low laboratory costs.

This study was supported by The Swedish National Centre for Research in Sports.

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**1557** Board #338 MAY 30 9:30 AM - 11:00 AM  
**Gender Differences In Training Load Guided Cycling Training**  
Andreas Bruch, Bjoern Stapelfeldt. *Albert-Ludwigs Universität Freiburg, Germany, Freiburg, Germany.*  
(No relationships reported)

A novel approach for guiding endurance training is the Training Load (TL) concept. TL aims to make different exercise sessions comparable in terms of adaptive or exhausting characteristics. Input information for TL include gender, weight,  $VO_{2max}$ , HR<sub>max</sub>, HR<sub>rest</sub>, lactate threshold (LT), anaerobic threshold (IAT), heart rate and training time. It has been shown that using TL results in significantly less intense training with equal performance improvements in cycling training (Bruch et al., ECSS 2011). The question remains whether gender has an impact on TL guided vs. non-guided training in cyclists.

**PURPOSE:** To document and analyze gender differences in TL guided and non-guided training in well-trained cyclists.

**METHODS:** 22 competitive level German cyclists and triathletes (11 males, 11 females) with 15 h/week cycling training and  $VO_{2peak}$  values between 50-60 ml/min/kg trained for 8 weeks, study group guided by TL, control group without guiding. At the beginning and end of the study a standardized incremental exercise test (IET) was completed starting with 100 W for males and 80 W for females with 20 W increase every 3rd minute. Lab-test measurements included weight related power at LT, IAT and maximum power. During study time the TL-values of all subjects were calculated before and after every training session. In addition the training starting and ending times, the minutes of training over 100 bpm and the average HR of each session were documented.

**RESULTS:** TL guided cycling training decreased intensity in training and led to equal performance increase in women and men. Women completed an average of 53,45 training session, men 50,36 training sessions ( $p = 0.41$ ). TL-values before training were on average 87,39 in women, 91,49 in men ( $p = 0.83$ ). TL-values after training range from 152,65 in women to 159,23 in men ( $p = 0.83$ ). Women and men achieved similar performance increase (no significant differences in any relevant marker).

**CONCLUSION:** TL guiding in cycling training seems to be effective in both genders. It leads to a less intense training while achieving the same performance increase. Positive implications include optimizing training intensity and recovery times. These may prevent overtraining and reducing the risk of illness and injury in women and men.

Supported by Polar Electro Oy, Kempele, Finland.

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**1558** Board #339 MAY 30 9:30 AM - 11:00 AM  
**VO<sub>2</sub> Kinetics in Uphill Cycling**  
Andrew Gai. *University of Central Missouri, Warrensburg, MO.*  
(No relationships reported)

**PURPOSE:** The objective of this study was to test for differences in oxygen consumption during a cycling hill climb based on whether the subject was seated or standing while pedaling.

**METHODS:** Eight male trained cyclists began by having DEXA scan to determine body comp and a preliminary  $VO_{2max}$  test on an electronic bike ergometer. The  $VO_{2}$  data was used to set the ergometer wattage levels and determine cardio-respiratory fitness. Subjects returned on a separate day to do a simulated climb portion of the research. The exercise began with cycling at a light pace to warm up. After warm-up, the intensity was increased to a wattage equal to 60% of  $VO_{2max}$  to simulate a moderate hill climb. The subject pedaled in a standing position for 3 minutes while  $VO_{2}$  data and heart rate were monitored and collected. After the 3 minute climb, the wattage was lowered to allow the subject to recover. After 3 min recovery, a second climb using seated

pedaling method for 3 minutes at 60% was completed. The subject was then allowed to recover and a second more difficult simulated climb was performed at 85% of  $\text{VO}_2\text{max}$  for 3 minutes seated and standing. Data was collected for  $\text{VO}_2$  consumption, wattage and heart rate for all 3-minute sessions. The  $\text{VO}_2$  data used for comparison was an average of the last minute of each 3 minute "climb" session.

**RESULTS:** The hypothesis was that the seated hill climb would require more oxygen consumption compared to the standing climb. Results for the 60% intensity were  $3.376 \pm 0.58$  L/min standing and  $2.967 \pm 0.31$  L/min seated ( $p < 0.05$ ). The values for the 85% intensity were  $3.993 \pm 0.52$  L/min standing and  $3.904 \pm .32$  L/min for seated ( $p > 0.05$ ).

**CONCLUSION:** Based on the current data at lower wattage levels seated cycling is more efficient, while higher wattage levels were equal seated or standing. [[Unsupported Character - &#8194;]] [[Unsupported Character - &#8194;]]

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**1559**    *Board #340*    **MAY 30**    **9:30 AM - 11:00 AM**  
**Range of Motion is Not Related to Cycling Performance**

Daryl L. Parker, Jamie L. Donkin, Rick T. Bradley, Raymond Martinez, Jr, Max Polin, Roberto Quintana. *Irvin Faria Exercise Physiology Research Laboratory, CSU Sacramento, Sacramento, CA.*  
(No relationships reported)

Over the past several year a number of research studies have evolved indicating that pre-exercise static stretching can reduce muscular performance. This has lead to the recommendation that static stretching should be completed during the post-exercise period. However, it is unclear whether improving range of motion in a joint provides a benefit or detriment to performance.

**PURPOSE:** This investigation was conducted to examine the range of motion (ROM) in the major muscle groups of cycling exercise and determine if there is a relationship between ROM and performance.

**METHODS:** Nine competitive cyclists [(female n=1) age:  $23.8 \pm 4.37$  yrs, mass:  $69.8 \pm 9.72$  kg,  $\text{VO}_2\text{max}$ :  $61.3 \pm 7.28$  ml/kg/min] served as subjects for this investigation. All had been competing for over a year and ranged in ability from category 5 to 2 (USA cycling). Upon arrival to the lab each subject completed a graded exercise test (GXT) on a cycle ergometer (male= $35 \text{ W min}^{-1}$ , or female= $25 \text{ W min}^{-1}$ ) to determine  $\text{Wmax}$  and  $\text{VO}_2\text{max}$ . Following the GXT, range of motion (ROM) was assessed using a Leighton flexometer. Hip flexion (HF), hip extension (HE), knee flexion (KF), knee extension (KE), and plantar flexion (PF) were all measured in triplicate. Following the ROM assessment, each subject completed a Wingate test for the determination of peak power (PP). The rest period between the GXT and the Wingate test was 30 minutes minimum. Thirty minutes was the minimum amount of time required for the GXT to not interfere with the outcome of the Wingate test during our pilot testing. Relationships between ROM and PP as well as ROM and  $\text{Wmax}$  were assessed using Pearson's r. An alpha level 0.05 was used to assess significance in this sample.

**RESULTS:** The average  $\text{Wmax}$  and PP for the sample was consistent with competitive cyclists ( $\text{Wmax}$   $5.41 \pm 0.58$  W/kg, PP  $13.6 \pm 1.31$ , respectively). None of the ROMs assessed had a significant relationship with  $\text{Wmax}$  (HF  $r=0.32$   $p=0.40$ , HE  $r=0.20$   $p=0.61$ , KF  $r=0.40$   $p=0.28$ , KE  $r=0.10$   $p=0.79$ , PF  $r=0.40$   $p=0.29$ ) or PP (HF  $r=0.37$   $p=0.33$ , HE  $r=0.36$   $p=0.33$ , KF  $r=0.004$   $p=0.99$ , KE  $r=0.04$   $p=0.91$ , PF  $r=0.34$   $p=0.38$ ).

**CONCLUSIONS:** The data from this investigation seem to suggest that poor ROM is not a detriment to the motion of cycling. The data also seem to suggest that good range of motion is not a benefit in the motion of cycling. A larger sample may elucidate a different relationship.

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**1560**    *Board #341*    **MAY 30**    **9:30 AM - 11:00 AM**  
**Comparison Of Vo2 For Three Cycling Modes**

Andrew I. Miller, Edward M. Heath, FACSM, Eadric Bressel, Gerald A. Smith, FACSM. *Utah State University, Logan, UT.* (Sponsor: Edward M. Heath, FACSM)  
(No relationships reported)

Bicycling research in a laboratory has an advantage of being more tightly controlled compared to field studies; however, consideration must be given to ecological validity for the study's results to be best applied to its target population and environment. A stationary cycle ergometer is often the default instrumentation for lab data collections, but results may not generalize well to target populations or environments for two key reasons: (1) a cycle ergometer is not what a cyclist is accustomed to riding and will usually have a geometry different from an individually-fitted cycle, and (2) there is no balance requirement on a cycle ergometer. Rollers or a stationary trainer can be used to partially address these concerns.

**PURPOSE:** To compare oxygen uptake ( $\text{VO}_2$ ) at a similar power level during cycling on an ergometer, a stationary trainer, and rollers.

**METHODS:** Highly-trained cyclists ( $n = 5$ , age =  $34.0 \pm 8.9$  yr,  $\text{VO}_2$  peak =  $63.7 \pm 4.8$  ml/kg/min) performed a ramped  $\text{VO}_2$  peak test with 50 W increase per min on a stationary trainer using their own bicycle. This was followed by 4 min sub-max tests at a power corresponding to 70% of  $\text{VO}_2$  peak on each of three modes in randomized order (modified Monark ergometer, CycleOps Supermagneto trainer, CycleOps aluminum rollers with magnetic resistance). Testing was performed at an altitude of 1382 m. Power on the bicycle (rollers and trainer) was measured via a Power Tap SL+ hub, and by way of resistance on the ergometer. Because power could not be exactly matched across the 3 modes, a regression based on the  $\text{VO}_2$  peak test was used to adjust  $\text{VO}_2$  values to corresponding values at a constant mechanical power.

**RESULTS:** Mean  $\text{VO}_2$  values at constant power levels were: rollers =  $48.2 \pm 5.2$ , trainer =  $46.9 \pm 5.1$ , and ergometer =  $46.9 \pm 4.1$  ml/kg/min.

**CONCLUSION:** Riding on rollers required a 2.8% increase in oxygen uptake (10.2 W) compared to riding a stationary trainer or ergometer at the same mechanical power level ( $p < 0.05$ ). This increased cost was likely due to the metabolic cost of balance associated with cycling on rollers, and suggests that rollers may better simulate the metabolic cost of natural cycling.

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**1561**    *Board #342*    **MAY 30**    **9:30 AM - 11:00 AM**  
**Effect Of An 11-week Strength Core-training Program On Lumbar Range Of Movement In Swimmers**

Monica Solana-Tramunt<sup>1</sup>, Josep Cabedo<sup>1</sup>, Ana M. Bofill-Rodenas<sup>2</sup>, Josep Morales<sup>1</sup>. <sup>1</sup>*FPCEE Blanquerna Ramon Llull University, Barcelona, Spain.* <sup>2</sup>*GISEAFE INEFC Barcelona, Barcelona, Spain.*  
(No relationships reported)

Lumbar range of movement (ROM) is essential to develop effective movements during underwater undulatory swimming technique. Core exercises are used to improve the strength of the muscles that participate on that technique but they are not designed to improve lumbar ROM.

**PURPOSE:** To examine the effects of an 11-week core training program on lumbar ROM after lumbar flexion and extension exercises on underwater gliding body position.

**METHODS:** A sample of 37 professional swimmers, 21 males and 16 females ( $20.7 \pm 3.3$  yrs), participated in the study. They were randomly divided in 21 swimmers for the experimental group (EG) and 16 swimmers for the control group (CG). EG fulfilled 3 core exercises, 6 days a week during 11-weeks. All subjects underwent the same type of training in parallel with the experimental group intervention and signed informed consent.

The exercises consisted of performing maximum lumbar extension and recover underwater gliding body position, repeated at slow pace of 10 breaths. ROM was measured by an electrogoniometer attached on the skin, its cranial arm over T12-L1 spinous process, line up to L3 level, and lower arm over S1-S3 surface. The evaluation consist of measuring lumbar ROM from maximal flexion to maximal extension degrees, in 3 consecutive trials separated by 20s, sitting over a Swiss ball keeping hips and knees between 80° and 90° of flexion, the back straight, the sight to the front and both hands over the knees on a relaxed position. The test position allowed easy lumbar movements on sagittal plane.

It has been measured the mean of each flexion and extension trial and calculated the total ROM from the maximal extension mean to maximum flexion mean degrees. ROM comparisons between pre-test and post-test were made using paired samples t -Test. The results are expressed by the mean, SD and significant differences ( $p < 0.05$ ) before and after the experimental period.

**RESULTS:** Lumbar ROM changed on EG from  $34.4 \pm 12.9^\circ$  to  $44.7 \pm 14.3^\circ$  ( $p=0.000$ ) and on CG from  $34.7 \pm 11.9^\circ$  to  $35.9 \pm 12.5^\circ$  ( $p=0.22$ ).

**CONCLUSIONS:** The results suggest that to repeat maximal lumbar extension positions at breathing pace without holding them, can increase lumbar range of movement in sagittal plane. It could be important to consider this on future ROM exercises programs.

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1562 Board #343 MAY 30 9:30 AM - 11:00 AM

**Effects of Altitude Training on Heart Rate Variability in Orthostatic Test in Elite Swimmers**

Ferran A. Rodriguez, FACSM<sup>1</sup>, Xavier Iglesias<sup>1</sup>, Belén Feriche<sup>2</sup>, Carmen Calderón<sup>3</sup>, Xavier Ábalos<sup>1</sup>, Jairo Vázquez<sup>1</sup>, Anna Barrero<sup>1</sup>, Lara Rodríguez<sup>1</sup>, Esa Hynnenen<sup>4</sup>, Benjamin D. Levine, FACSM<sup>5</sup>. <sup>1</sup>INEFC, University of Barcelona, Barcelona, Spain. <sup>2</sup>FCAFD, University of Granada, Granada, Spain. <sup>3</sup>Sierra Nevada High Altitude Training Center, Granada, Spain. <sup>4</sup>KIHU – Research Institute for Olympic Sports, Jyväskylä, Finland. <sup>5</sup>IEEM/UT Southwestern, Dallas, TX.  
(No relationships reported)

Different stressors, like athletic training, can change the autonomic modulation of the heart. This can be evaluated with heart rate variability (HRV) analysis. Acute hypoxia is also known to attenuate parasympathetic activity and accentuate the sympathetic activity. Whether these changes in autonomic modulation will disappear with altitude acclimatization remains unclear.

**PURPOSE:** This study was made to investigate the effects of 3-week moderate altitude training on HRV in elite swimmers.

**METHODS:** 9 elite swimmers (Hi) of international level (5 women and 4 men, age  $19.4 \pm 1.6$  years) lived and trained 3 weeks at Sierra Nevada, Spain (2,320 m). Control group (Lo) consisted of 11 swimmers of similar level (7 women and 4 men, age  $17.9 \pm 1.9$  years), who lived and trained at sea level. RR-intervals were recorded every morning in supine (8-min) and orthostatic (6-min) positions with beat-by-beat heart monitors. Breathing was paced to 12 breaths/min. Recordings were done during the 3-week intervention period and one week before and after. HRV was analyzed from the last 5-min period of both positions with FFT spectral power analysis. TRIMPs of every training session were calculated to estimate training load. HRV results are averaged over every week and presented as relative percentage changes.

**RESULTS:** The training load was similar in both groups during the 3-week intervention but was lower during the week after in Hi-group when compared to Lo-group ( $P=0.003$ ). An interaction of group, time and TRIMPs was found in change in spectral power of supine LF (-40% vs. +36%,  $P=0.02$ ) and HF (-46% vs. +55%,  $P=0.01$ ) during the intervention period showing increased HRV in Lo group and decreased HRV in Hi-group. Also LF (+93% vs. +12%,  $P=0.01$ ) and LF/HF ratio (+79% vs. -2%,  $P=0.01$ ) during standing increased more in Hi-group than in Lo-group in the end of the intervention.

**CONCLUSION:** The present findings of lower HRV in Hi-group than in Lo-group suggest that the physiological stress of training at moderate altitude leads to parasympathetic withdrawal and possibly increased sympathetic activity even after night rest. These changes in autonomic modulation seem to last longer than for the first week after altitude training camp.

Supported by CSD (35/UPB10/10, 05/UPB32/10) and MICINN (DEP2009-09181) grants.

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1563 Board #344 MAY 30 9:30 AM - 11:00 AM

**An Ultraendurance Swimming Event From Italy To Albany: A Case Study**

Giulia De Ioannon<sup>1</sup>, Giuseppe Cibelli<sup>2</sup>, Sergio Mignardi<sup>3</sup>, Agnese Antonelli<sup>1</sup>, Laura Capranica<sup>1</sup>, Maria Francesca Piacentini<sup>1</sup>. <sup>1</sup>University of Rome "Foro Italico", Rome, Italy. <sup>2</sup>University of Foggia, Foggia, Italy. <sup>3</sup>Scuola dello Sport CONI, Rome, Italy. (Sponsor: Carl Foster, FACSM)  
(No relationships reported)

**PURPOSE:** To investigate pacing strategy, average swimming speed (ASS), stroke rate (SR), and stroke length (SL) during a 42 nm (78.154 km) ultra-endurance swimming in open water.

**METHODS:** One male athlete (age: 48 yr, body mass: 68 kg, height: 172 cm) participated in the study. Anthropometric parameters were measured before and after the event. Water temperature (WT), ASS, SR, SL, rating of perceived exertion (RPE) were monitored every three hours during swimming. Hazard score (HS) was calculated as the product of the momentary RPE and the fraction of the event remaining at the same point. The profile of mood state (POMS) questionnaire was filled in at baseline (6 months before), immediately before swimming, and at 90 min post-event. The energy index (POMS vigour/fatigue) was calculated. Swimming velocity was expressed as % change every 3-hour period compared to the first split time.

**RESULTS:** The athlete completed the event in 23:44 hr:min. Body mass and skinfolds did not change after swimming, probably due to previous feeding (every 15 min). Despite WT remained constant ( $28 \pm 2^\circ\text{C}$ ), body temperature increased by 2.9%. ASS, average SR and SL were  $3.3 \text{ km} \cdot \text{hr}^{-1}$ ,  $58.6 \text{ strokes} \cdot \text{min}^{-1}$  and  $0.93 \text{ cm}$ , respectively. A positive relationship ( $r^2 = 0.84$ ,  $p < 0.05$ ) between SL and speed was found. Compared to the first 3 hours, between 18 hr and 21 hr the greatest decreases in speed (-36%) and in SL (-25%) were observed. Thereafter, the athlete increased speed (+26%) and in SL (+17%) between 21 hr and 23:44 hr:min compared to the previous three hours. RPE steadily increased from the beginning (5 pt) to the last 6-hour of swimming (10 pt). Pacing strategy varied, with a negative trend observed between 12 hr and 15 hr associated with high HS values (>3), and a positive trend was found from 21 hr to the end of the event (HS < 1.5). Compared to baseline, before the event the energy index showed a 33% increase, whereas after swimming a 65% decrease emerged.

**CONCLUSIONS:** For the first time an athlete crossed the Adriatic sea. Findings support SL as the most critical factor influencing speed in ultraendurance swimming. Despite the athlete perceived his effort at maximum during the last 6 hours, the decrease in HS and increases of swimming speed and SL might substantiate his determination to accomplish the challenging event. However, this aspect needs further investigation.

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1564 Board #345 MAY 30 9:30 AM - 11:00 AM

**The Role of High Volume Endurance Training in Competitive Swimming**

Masaru MATSUNAMI<sup>1</sup>, Akihiro TAIMURA<sup>2</sup>. <sup>1</sup>Beppu Mizobe Gakuen College, Beppu, OITA, Japan. <sup>2</sup>Nagasaki University, Nagasaki, Japan.  
(No relationships reported)

In competitive swimming, more than 80% of competitive swimming events are less than 2 minutes in duration. Therefore, it is shown that high volume training, which is aerobic training of low intensity, is not advantageous. However, the improvement of aerobic capacity is related to competitive performance, and in specificity principle, it is considered essential to perform endurance training in the early stages of an annual swimming training program.

**PURPOSE:** To examine the role of high volume endurance training which aimed at the improvement of aerobic capacity.

**METHODS:** Five competitive female swimmers (height,  $159.8 \pm 3.1 \text{ cm}$ ; body weight,  $52.3 \pm 3.9 \text{ kg}$ ) had taken a one-month break after the intercollege swimming championship in Japan, and then had trained in high volume endurance swimming for eight weeks. The swimming performance tests (200 m x 4t, 3t, 2t) were conducted before the training period (T1) and after the first (T2) and the second (T3) four weeks. Swimming velocity and heart rate (HR) after each trial were measured. Aerobic capacity was evaluated from the relation between swimming velocity (V) and HR. Moreover, subjects took part in swimming competitions in the 4th week (COMP1) and the 8th week (COMP2) of a training period.

**RESULTS:** V and HR of each set in T1 and T2 were 1.261 m/s, 144.0 bpm; 1.321 m/s, 163.2 bpm; 1.355 m/s, 180.0 bpm and 1.297 m/s, 141.6 bpm; 1.365 m/s, 162.0 bpm; 1.409 m/s, 177.6 bpm. After the training for the first four weeks (T2) the V-HR line was shifted to the right of T1, and the fall of HR in the same V was observed. However, change of the V-HR line was not observed after the training for the second four weeks (from T2 to T3). In COMP1, personal best times were improved at two out of ten races. In COMP2 of four weeks later, exceeding personal best times occurred at five out of ten races. A significant difference was observed in the %personal best between COMP1 (98.2%) and COMP2 (100.4%) ( $p < .05$ ).

**CONCLUSIONS:** It is suggested that high volume endurance training recovers the lowered cardiopulmonary function by detraining, and there is the possibility of a competitive performance improvement. Therefore, in view of progressive strengthening of swimming training, it seems that high volume endurance training has a role to play and should be arranged in the early stages of annual training.

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## A-45 Free Communication/Poster - Thermoregulation

MAY 30, 2012 7:30 AM - 12:30 PM  
ROOM: Exhibit Hall

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1565 Board #346 MAY 30 9:30 AM - 11:00 AM

### Heat Acclimation In Skin Graft Patients

Rebekah A. I. Lucas, Matthew S. Gano, James Pearson, Craig G. Crandall, FACSM. *Institute for Exercise and Environmental Medicine, Dallas, TX.*  
(No relationships reported)

**PURPOSE:** This project tested the hypothesis that skin graft patients have the capacity to heat acclimate.

**METHODS:** Twenty burn survivors (age range: 22-54 years) with well-healed split thickness grafts (16±14 years post-injury) were stratified into two groups: 20-40% body surface area (BSA) grafted (N=13) and 45-75% BSA grafted (N=7). Six similarly aged, non-injured subjects served as controls. Subjects exercised for 90 min (the first 45 min at 1 l/min oxygen uptake followed by 45 min at a workload equivalent to 45% maximal oxygen uptake) in an environmental chamber (40° C, 30% relative humidity) on the first and final day of a 7 day heat acclimation regimen. Local sweat rate (from non-grafted skin), whole body sweat rate (pre/post weight), and change in body core temperature (intestinal) and heart rate responses were measured.

**RESULTS:** See Table. Five grafted subjects (one 20-40%, four 45-75% BSA) were unable to complete the second 45 min bout of exercise on Day 1; therefore, Day 7 comparisons were time matched.

**CONCLUSIONS:** 7 days of heat acclimation attenuated the increase in body core temperature and heart rate in both the 20-40% and 45-75% BSA groups, indicating that these individuals are able to heat acclimate and thus improve heat tolerance. Local and whole body sweat rates were not improved by the heat acclimation regime; though this may be because the central drive for sweating (i.e., body core temperature) was reduced following the acclimation regime.

**Grant:** NIH GM068865.

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1566 Board #347 MAY 30 9:30 AM - 11:00 AM

### Heat Preconditioning Abolishes Eccentric Exercise-induced IL-6 Increase

San-Tsai Wang<sup>1</sup>, Hsueh-Yi Lin<sup>2</sup>, Li-Ching Chou<sup>3</sup>, Sun-Chin Yang<sup>4</sup>. <sup>1</sup>Ming Chuan University; Taipei Physical education college, Taipei, Taiwan. <sup>2</sup>National Ilan University; Taipei Physical education college, Ilan, Taiwan. <sup>3</sup>Ming Chuan University, Taipei, Taiwan. <sup>4</sup>Hsin Sheng University; Taipei Physical education college, Taipei, Taiwan. (Sponsor: Chia-Hua Kuo, FACSM)  
(No relationships reported)

It has been reported that exercise-trained animals have lower mortality rate against heat stress than sedentary animals, implicating a cross-adaptation in physiological components central to heat tolerance.

**PURPOSE:** This study was aimed to investigate that whether heat preconditioning can protect humans from exercise-induced muscle damage and inflammation.

**METHODS:** Using a balanced crossover design with one month separation, 16 active young male subjects voluntarily participated in a heat preconditioning program before exercise challenge, which includes 4 sessions of 30-min hot water immersions at 41 °C every 72 h.

**RESULTS:** Three days after last immersion, circulating muscle creatine kinase (CK) and thiobarbituric acid-reactive substances (TBARS) were slightly elevated by 27% and 21%, respectively (P< 0.05). This was concurrent with increased heart rate variability (HRV) (P< 0.05). After an acute bout of eccentric exercise challenge with 6 squats at 85% maximal voluntary effort for 6 sets, interleukin-6 (IL-6) and CK levels increased significantly by 120% and 34% (P< 0.05). However, this normal exercise response was completely eliminated following heat preconditioning. Post-exercise HRV and vagal power in the heat preconditioning trial were significantly greater than those in the control trial.

**CONCLUSIONS:** The results of the study suggest a hormetic effect of heat preconditioning, which can attenuate eccentric exercise-induced muscle damage and inflammatory response.

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1567 Board #348 MAY 30 9:30 AM - 11:00 AM

### Effects Of Heat Acclimatization On Work Tolerance And Thermoregulation In Trained Tropical Natives

Jason K W Lee, Amanda Q X Nio, David C Y Fun, Ya Shi Teo, Ee Von Chia, Chin Leong Lim. *Defence Medical and Environmental Research Institute, DSO National Laboratories, Singapore, Singapore.*  
(No relationships reported)

**PURPOSE:** This study aimed to investigate the effects of standard heat acclimatization in trained individuals residing in the tropics.

**METHODS:** Eighteen male trained soldiers, who are native to a warm and humid climate, performed a total of four heat stress tests donning the Skeletal Battle Order (SBO, 20.5 kg) and Full Battle Order (FBO, 24.7 kg) before (PRE) and after (POST) a 10-day heat acclimatization programme. Each heat stress test comprised three cycles of 60-min marches on a treadmill at 4 km/h, separated by 15-min seated rest. The trials were conducted in an environmental chamber (dry bulb temperature: 32°C, relative humidity: 70%, solar radiation: 400 W/m<sup>2</sup>). Work tolerance, body core (via ingestible temperature capsules) and skin (chest, triceps, thigh and calf) temperatures, heart rate, sweat rate and subjective responses were measured.

**RESULTS:** Excluding the data sets of which participants fully completed the heat stress tests (210 min) before and after heat acclimatization, work tolerance was improved from 173±30 to 201±18 min (~21%, p<0.05, n=9) following heat acclimatization. Heat acclimatization had no effects on baseline body core temperature across trials (37.1±0.3°C, p>0.05). After heat acclimatization, chest skin temperature during exercise was lowered in SBO (PRE=36.7±0.3 vs. POST=36.5±0.3°C, p<0.01) and FBO (PRE=36.8±0.4 vs. POST=36.6±0.3°C, p<0.01). Mean heart rate was similar with SBO (115±17 beats/min, p=0.44) and FBO (PRE=120±16 beats/min, p=0.70) following heat acclimatization. Heat acclimatization did not affect sweat rate in SBO (0.6±0.2 l/h, p=0.91) and FBO (0.6±0.2 l/h, p=0.54). After heat acclimatization, ratings of perceived exertion were decreased (PRE=11±2 vs. POST=10±2, p<0.05). Thermal sensation was reduced after heat acclimatization with SBO (PRE=1.2±0.7 vs. POST=0.9±0.7, p<0.05), but was similar with FBO (PRE=1.2±0.6 vs. POST=1.0±0.5, p=0.06).

**CONCLUSIONS:** A standard heat acclimatization programme improves work tolerance with negligible effects on thermoregulation in trained tropical natives. These findings are important for recommending appropriate heat acclimatization guidelines to tropical native athletes and military personnel undergoing physical training and competition/operation in a warm and humid environment.

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1568 Board #349 MAY 30 9:30 AM - 11:00 AM

### Core Temperature During Training In The Heat: Comparison Between Athletes In Continuous And Intermittent Sports

Jessica A. Frontanés, Raúl A. Rosario, Farah A. Ramírez-Marrero, FACSM, Osvaldo Hernández, Walter R. Frontera, FACSM, Anita M. Rivera-Brown, FACSM. *Center for Sports Health and Exercise Sciences, University of Puerto Rico School of Medicine, San Juan, Puerto Rico.*  
(No relationships reported)

Few field data are available on core temperature responses in elite athletes exercising in the heat in sports of intermittent nature in which the decreased exercise intensity is expected to facilitate heat dissipation.

**PURPOSE:** To compare the core body temperature responses between athletes in continuous (CON) and intermittent (INT) sports during a training session of prolonged duration in the heat.



**METHODS:** Sixty two elite athletes (runners, cyclists, and triathletes [CON]=23, mean age= 26.6 ± 6.9 yr; judo, soccer, tennis, basketball and handball players [INT]= 39, mean age=20.8 ± 3.3 yr) were tested during a typical training session for their sport. Heat exposure time in the last month was higher in CON (3,000.9 ± 1,738.2 min) compared to INT (796.9 ± 903.1 min), P < 0.05. Core temperature (T<sub>c</sub>) was measured pre, every 10 min and at the end of training using an ingestible temperature sensor. Acute changes in body weight were used to assess dehydration level (% of the pre-training BW). Exercise intensity was estimated using an accelerometer worn by the athletes during training. **RESULTS:** The duration of the training session was: CON= 75.8 ± 18.1 min; INT= 95.4 ± 16.9 min, P < 0.05. The WBGT was 30.3 ± 1.1 °C and 29.1 ± 1.3 °C for CON and INT, respectively (P < 0.05). Average exercise intensity was three times higher in CON (7,748.8 ± 1,307.3 activity counts/min) compared to INT (2,506.3 ± 504.6 activity counts/min), P < 0.05. Sweat rate and dehydration were higher for CON (1.6 ± 0.4 L/h and 2.0 ± 0.8%) compared to INT (1.0 ± 0.4 L/h and 1.0 ± 0.4%), both P < 0.05. Pre-exercise T<sub>c</sub> was higher in INT (37.4 ± 0.3 °C) compared to CON (37.2 ± 0.3 °C), P < 0.05. A steady increase in T<sub>c</sub> was observed throughout the exercise session for both CON and INT. The highest T<sub>c</sub> was similar for CON (38.8 ± 0.4 °C) compared to INT (38.7 ± 0.4 °C) and was not related to % dehydration in either group (P > 0.05). The change in T<sub>c</sub> (highest-pre exercise) was higher in CON (1.6 ± 0.6 °C) compared to INT (1.3 ± 0.4 °C), (P < 0.05).

**CONCLUSIONS:** In comparison to athletes in continuous sports, athletes in intermittent sports do not show the expected thermoregulatory response during training in a high heat stress environment possibly due to their lower level of heat acclimatization.

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**1569** Board #350 MAY 30 9:30 AM - 11:00 AM

**Heat Tolerance Testing: Physiologic Responses of Men and Women**

Josh B. Kazman<sup>1</sup>, Francis O'Connor<sup>1</sup>, Patricia Deuster<sup>1</sup>, Stacey Zeno<sup>1</sup>, Yuval Heled, FACSM<sup>2</sup>. <sup>1</sup>USUHS, Bethesda, MD. <sup>2</sup>Heller Institute, Tel Aviv, Israel.  
(No relationships reported)

**PURPOSE:** Heat tolerance testing (HTT) is used by the Israeli Defense Force for managing exertional heat stroke (EHS) and when heat intolerance (HI) is suspected. We compared physiologic responses to the HTT as a function of gender and aerobic capacity.

**METHODS:** Men (n=16) and women (n=7) underwent maximal aerobic power testing (VO<sub>2</sub>max) and a HTT (walking at 5kph on a 2% grade for 120 minutes in a chamber set at 40°C/40% relative humidity). Heart rate, blood pressure, core and skin temperatures (T<sub>core</sub>/T<sub>skin</sub>) were measured and sweat rate was determined by pre and post weight. The physiological strain index (PSI) was determined from heart rate and temperature. HI was determined by heart rate (>145 bpm) and T<sub>core</sub> (>38.5°C).

**RESULTS:** Maximal T<sub>core</sub> (Men: 38.2±0.3 vs. Women: 38.4±0.3°C), T<sub>skin</sub> (Men: 36.8±0.6 vs. Women: 37.2 ± 0.3°C), and PSI (Men: 5.0±1.3 vs. Women: 5.9±1.4) did not differ significantly by gender, whereas heart rate was lower (Men: 127±21 vs. Women: 146±18 bpm; p=0.055) and VO<sub>2</sub>max (Men: 51.9±7.5 vs. Women: 43.8±5.9 ml/kg/min; p=0.02) and sweat rate (Men: 1.09±0.29 vs. Women: 0.72±0.26 L/h; p=0.02) higher in men than women. Four men and 3 women were HI (30.4%). Persons with VO<sub>2</sub>max <50 ml/kg/min were 2.2 times more likely to be HI compared to ≥50 ml/kg/min.

**CONCLUSIONS:** The HTT does not appear to be biased against women, unless one considers VO<sub>2</sub>max, which is typically lower in women. Although different criteria could be set, it would not alter responses in a warm environment. Improving VO<sub>2</sub>max may be of primary importance.

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**1570** Board #351 MAY 30 9:30 AM - 11:00 AM

**Perceptual Responses of Obese and Lean Girls during Cycling under Thermoneutral and Heat Conditions**

Gabriela Tomedi Leites, Paulo Lague Sehl, Giovanni dos Santos Cunha, Adriano Detoni Filho, Flavia Meyer. Federal University of Rio Grande do Sul, Porto Alegre, Brazil.  
(No relationships reported)

Obese girls appear to subjectively perceive a greater discomfort during exercise in the heat compared to lean girls, indicating that ambient conditions could affect their adherence to an exercise program.

**PURPOSE:** To compare the perceptual responses of obese and lean pre-pubertal girls during exercise under thermoneutral and heat conditions.

**METHODS:** Twenty-seven girls (9.3±1.2 yrs old), 14 of whom were lean and 13 obese according to their % fat (<25 and >30%) measured by DXA, participated in the study. The girls completed two sessions (2-3 days apart) that, in a randomized order, differed only with respect to the thermal condition of the environmental chamber: neutral (23.9±0.9°C, 50.0±5.6% RH) and heat (35.2±0.9°C, 38.4±3.9% RH). Sessions consisted of 30-min of cycling at ~55% of their individual pre-determined VO<sub>2peak</sub>. Perceptual measurements consisted of four scales: 1) rate of perceived exertion (RPE Borg scale) 2) thermal sensation (9-point scale, from very cold to very hot); 3) thermal comfort (6-point scale, from very comfortable to very uncomfortable); 4) irritability (5-point scale, from nothing noticeable to very strong). RPE was recorded every five minutes of exercise, while the other responses were recorded at 0, 10, 20, and 30 minutes.

**RESULTS:** The RPE and thermal sensation were similar between groups and did not demonstrate a group × time interaction. Mean RPEs under the heat condition ranged from 8.0±2.0 to 12.0±6.0 and from 8.0±1.0 to 14.0±6.0, and under the thermoneutral condition from 8.0±1.7 to 11.0±4.0 and 8.0±0.7 to 12.0±4.0 in the lean and obese girls, respectively. Mean thermal sensation under the heat condition ranged from 6.0±1.3 to 7.5±2.2 in the lean and 6.0±1.2 to 7.0±1.5 in the obese, and under the thermoneutral condition, from 3.9±0.9 to 5.0±0.9 and from 3.8±1.5 to 5.0±2.0, respectively. In the lean girls, the thermal comfort decreased from 2.1±0.5 to 3.1±1.2 (p=0.009) and irritation increased from 1.3±0.4 to 2.0±1.0 (p=0.02) during the exercise in heat condition, while no change was observed in the obese girls.

**CONCLUSION:** Obese girls did not seem to experience a greater discomfort or heat sensation during cycling based on these exercise and environmental conditions.

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**1571** Board #352 MAY 30 9:30 AM - 11:00 AM

**Sweating Of Obese And Lean Prepubescent Boys During Cycling In The Heat**

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(No relationships reported)

Obese children are considered to be at a greater risk for exertional heat-illness during exercise in the heat, however, it is unclear whether their sweating characteristics or body water balance are different from those of lean children.

**PURPOSE:** To compare sweat volume (SV), water balance, and sweat electrolyte concentration and losses in obese and lean boys after cycling in the heat.

**METHODS:** Thirty physically active prepubescent boys (age 9.3±1.1 years) participated in the study. Fifteen were obese (OB) and 15 lean (LB) with respective body mass, height, IMC, %fat and VO<sub>2peak</sub> of: 48.1±8.3 and 30.3±4.7 kg, 141±6.2 and 135±7.1 cm, 24.9±3 and 16.1±1 kg.m<sup>-2</sup>, 46.4±14.3 and 15.7±3.6 %, and 34±5.8 and 43.1±6.2 ml.kg<sup>-1</sup>.min<sup>-1</sup>). After a preliminary session whereby a physical evaluation and a VO<sub>2peak</sub> assessment were conducted, the boys came to an experimental session which consisted of 30-min of cycling (50-60% of their predetermined VO<sub>2peak</sub>) in the heat (35°C, 40-45% RH). SV was calculated from change in body mass plus the voluntary fluid intake of a commercially available sports drink. Sweat was collected using adhesives for [Na<sup>+</sup>], [Cl<sup>-</sup>] and [K<sup>+</sup>] analysis in duplicates (AVL 9180, Roche). Independent T-test were used to compare groups.

**RESULTS:** The SV after the 30-min of cycling was similar between OB and LB, with respective means±SD of 280 ± 50 and 255 ± 110 ml. When corrected for body mass, SV was lower in OB than LB (5.9 ± 0.9 vs 8.6 ± 4.3 ml.kg<sup>-1</sup>, p=0.035) but when corrected for body surface area SV remained similar between groups (208 ± 33.8 vs 244 ± 116 ml.m<sup>-2</sup>, p=0.064). Sweat [Na<sup>+</sup>] and [Cl<sup>-</sup>] were higher (p=0.005) in OB, whereas [K<sup>+</sup>] was similar between groups. OB and LB showed no difference both in water balance in ml (-131 ± 170 and -189 ± 132, p=0.234) or in the resultant electrolyte losses in mmol (Na<sup>+</sup>= 12.0 ± 6.31 and 10.6 ± 4.24, p= 0.463; Cl<sup>-</sup>= 14.55 ± 5.23 and 10.9 ± 3.73, p= 0.054, and K<sup>+</sup>=2.84 ± 2.27 and 2.44 ± 1.98, p=0.638).

**CONCLUSION:** Prepubescent OB had similar SV both in absolute amount or when corrected for body surface area; however, they presented a higher sweat [Na<sup>+</sup>] and [Cl<sup>-</sup>]. Both groups ended the 30-min cycling in similar body water deficits and sweat electrolyte losses.

1572 Board #353 MAY 30 9:30 AM - 11:00 AM

### Differences In Self-generated Convection And Heat Balance Status In NCAA Linemen And Backs

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(No relationships reported)

Greater core temperature elevations in linemen compared to backs during summer training camps may be due to the stationary nature of linemen-specific activities resulting in a lower self-generated air velocity and a lower attendant convective and evaporative heat transfer.

**PURPOSE:** To compare the influence of self-generated convection on heat balance status between American football linemen (L) and backs (B) during preseason summer training camp.

**METHODS:** Ten NCAA D1 American football players 5 linemen (mass: 128±21 kg, BSA: 2.53±0.22 m<sup>2</sup>) and 5 backs (mass: 82±8 kg BSA: 2.02±0.12 m<sup>2</sup>) took part in on-field measurements at the start of summer training camp in southern Florida (T<sub>db</sub>:31.2±1.6°C, T<sub>wb</sub>:27.0±0.7°C, T<sub>re</sub>:38.4±2.8°C). Mean skin temperature (T<sub>sk</sub>) and self-generated air velocities (v<sub>self</sub>) were measured throughout practice. Self-generated convective (h<sub>c</sub>) and evaporative (h<sub>e</sub>) heat transfer coefficients and resultant sensible heat losses (C+R) and maximum rate of evaporative heat loss (E<sub>max</sub>) were calculated. Values were also combined to derive the maximum rate of metabolic heat production that is physiologically compensable (M<sub>max</sub>).

**RESULTS:** Values for T<sub>sk</sub> were similar between L (35.4±0.8°C) and B (35.4±0.4°C) (p>0.05). However, v<sub>self</sub> (L:0.23±0.06 m/s, B:0.37±0.10 m/s) and the resultant h<sub>c</sub> and h<sub>e</sub> values were greater in B compared to L (p<0.05). Nonetheless, no significant differences in C+R (L:-4±15 W/m<sup>2</sup>, B:+9±9 W/m<sup>2</sup>) or E<sub>max</sub> (L:70±8 W/m<sup>2</sup>, B:81±7 W/m<sup>2</sup>) were found between L and B over the course of practice (p>0.05). However since L had a lower BSA-to-mass ratio (L:199±16 cm<sup>2</sup>/kg, B:248±12 cm<sup>2</sup>/kg) M<sub>max</sub> per unit mass was lower in L (1.6±0.3 W/kg) compared to B (2.8±0.2 W/kg) (p<0.05).

**CONCLUSION:** The greater v<sub>self</sub>, h<sub>c</sub> and h<sub>e</sub> in B did not result in different C+R or E<sub>max</sub> values between positions. However, due to differences in body morphology a greater metabolic rate can be sustained in linemen before physiological compensability is reached in a summer training camp environment.

1573 Board #354 MAY 30 9:30 AM - 11:00 AM

### Effects of Heat Acclimation, With or Without Simulated Hypoxic Living, on Exercise Performance

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(No relationships reported)

**PURPOSE:** This project aimed to investigate the effect of 12 days of heat acclimation, with or without simulated hypoxic living, on physiological perturbations and performance during submaximal and maximal efforts.

**METHODS:** Well-trained men and women (age 35±2 yrs, VO<sub>2max</sub> 60.2±1.6 mL.kg<sup>-1</sup>.min<sup>-1</sup>) were allocated to either: heat exposure (H, N=7), heat + altitude exposure (H+A, N=7), or controls (CON, N=7). All participants completed a heat stress test (30°C, 80% humidity), which consisted of a 75 min submaximal effort at ~63% of the peak power output achieved in a pre trial VO<sub>2max</sub> test followed immediately by a 15 min maximal effort time trial. H and H+A then completed normoxic heat training sessions (1 h at 58% of peak power output at 30°C, 80% humidity) for 12 consecutive days. The H+A group was also exposed to 2500 m of altitude for an average of ~12 h per night. Blood and respiratory gas were collected during the experimental period and all tests were repeated post intervention. Differences between groups were determined using mixed model, repeated measures ANOVA.

**RESULTS:** There were no differences between groups at baseline. There were several group x trial interactions during the submaximal effort such that daily heat exposure tended to decrease heart rate in both H and H+A (P=0.08), but temperature decreased only in H (-1.1 ± 0.3°C, P=0.03) whilst respiratory exchange ratio was lower only in H+A (-0.08 ± 0.01, P<0.01). Heat exposure also produced lower lactate responses in the H and H+A compared with CON (2.07 ± 0.24 vs. 2.27 ± 0.19 vs. 3.10 ± 0.39 mmol/L, P=0.05). For the time trial, there was a trend for improved performance in both the H and H+A for total distance (P=0.06) and average wattage (P=0.07). As there was no difference between H and H+A, these groups were pooled. Compared to CON, daily heat exposure, with or without altitude exposure, produced greater improvements during the time trial (0.53 ± 0.13 vs. 0.01 ± 0.11 km, P=0.02; 35.1 ± 9.4, vs. -1.7 ± 8.5 watts, P=0.02).

**CONCLUSIONS:** Heat exposure improved time trial performance and tended to reduce physiological demands during submaximal workloads. However, concurrent exposure to altitude may impair or alter heat acclimation. Future studies should consider the timing of the altitude exposure in relationship to heat exposure to optimize performance.

1574 Board #355 MAY 30 9:30 AM - 11:00 AM

### Heat Induces An Overload During Complex Cognitive Performance

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(No relationships reported)

**PURPOSE:** To investigate the modifications in brain electrical activity (EEG) when performing a cognitive task in the heat.

**METHODS:** 10 subjects performed a planning task (OTS: One Touch Stockings of Cambridge) with two levels of complexity: simple (OTS-4) and complex (OTS-6) after 2 hours of rest in hot (HOT, WBGT =40.2 ±0.6°C.) and neutral (CON, WBGT =21.1 ± 0.4°C) environments. EEG was recorded over the frontal lobe and theta power (4-8 Hz) and total alpha power (8-12 Hz) were analyzed.

**RESULTS:** Central temperature, was significantly higher in HOT (39.0 ± 0.2) than in CON (37.0 ± 0.2) condition. Independent of conditions, total alpha power (p<0.005) decreased from baseline to task engagement and theta power increased linearly comparing baseline to OTS-4 and OTS-6, respectively (p<0.05), suggesting theta activity increases with memory load and is a good indicator of working memory task demand. Prior to task engagement, theta power was higher in HOT (2.08) than in CON (1.68). During OTS-4, theta power in HOT (2.19) remained higher than in CON (1.97), however during OTS-6 theta power in HOT (2.27) was similar in CON (2.24). Performance on OTS-4 was similar in HOT and CON, whereas performance on OTS-6 was significantly lower in HOT than in CON (P<0.005).

**CONCLUSIONS:** The present changes in theta and alpha power suggest the existence of a load on working memory capacity prior to task engagement in response to heat exposure. Despite the difference in theta power during OTS-4, performance remained the same. However, no difference in theta power was observed between conditions during OTS-6, suggesting that it had reached a critical threshold that explains the decrements in cognitive performance in the heat. Thus, the present study demonstrates that additional cognitive resources for complex cognitive task are unavailable given the allostatic load imposed by passive hyperthermia leading to decrements in performance.

1575 Board #356 MAY 30 9:30 AM - 11:00 AM

### Heat Stress Does Not Augment Ventilatory Responses To Pre-Syncopal Limited Lower-Body Negative Pressure

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(No relationships reported)

**INTRODUCTION:** Simulated hemorrhage reduces central blood volume and mean arterial pressure (MAP), while ventilation increases possibly to attenuate reductions in venous return via the respiratory pump. Whole-body heat stress can also cause hyperventilation.

**PURPOSE:** To test the hypothesis that ventilatory responses to reductions in central blood volume and arterial pressure during simulated hemorrhage are greater when individuals are exposed to a hyperthermic challenge comparable to that experienced by soldiers (Buller et al. 2008).

**METHODS:** 8 healthy males ( $34 \pm 9$  years,  $176 \pm 6$  cm,  $80.2 \pm 4.2$  kg) underwent a simulated hemorrhagic challenge, using lower body negative pressure (LBNP) until the development of pre-syncope symptoms, on two separate occasions: normothermic control and during whole body heat stress. Heat stress was induced using a water perfused suit sufficient to raise core body temperature  $\sim 1.2^\circ\text{C}$ . Core body temperature (CorTemp, intestinal pill), ventilation ( $V_E$ , Parvo Metabolic Cart) and MAP (Finometer) were measured throughout.

**RESULTS:** Prior to LBNP, MAP was reduced from baseline values in the heat stress trial ( $89 \pm 6$  vs.  $80 \pm 6$  mmHg;  $P = 0.001$ ) but was unchanged in the time control period in the normothermic trial ( $95 \pm 13$  vs.  $97 \pm 12$  mmHg;  $P = 0.51$ ). In the heat stress trial  $V_E$  increased from baseline values ( $8.3 \pm 3.6$  to  $11.7 \pm 4.6$  l/min;  $P < 0.001$ ). There was no change in  $V_E$  in the normothermic trial at similar time points ( $7.5 \pm 1.3$  to  $7.8 \pm 1.7$  l/min;  $P = 0.56$ ). At pre-syncope, neither absolute MAP (heat stress trial:  $59 \pm 14$ ; normothermic trial:  $69 \pm 14$  mmHg; mmHg;  $P = 0.20$ ) nor the reduction in MAP from pre-LBNP (heat stress trial:  $21 \pm 10$ ; normothermic trial:  $28 \pm 16$  mmHg;  $P = 0.28$ ) were different between heat stress and normothermic trials. At pre syncope,  $V_E$  increased to  $19.7 \pm 8.6$  l/min ( $P < 0.001$ ) and  $24.0 \pm 8.8$  l/min ( $P < 0.001$ ) in the normothermic and heat stress trials, respectively. However, the increases in  $V_E$  from pre-LBNP were not different between trials ( $P = 0.10$ ).

**CONCLUSION:** Despite similar reductions in MAP in response to simulated hemorrhage, the increase in  $V_E$  was not greater when individuals were hyperthermic. These data suggest that the central drive to increase  $V_E$  during simulated hemorrhage is not altered by hyperthermia.

NIH HL61388

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**1576** Board #357 MAY 30 9:30 AM - 11:00 AM

**Extracellular Hsp72 Is Both Duration- And Intensity-dependent During Moderate And Intense Exercise-heat Stress To Exhaustion**

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(No relationships reported)

The extracellular expression of heat shock protein 72 (eHsp72) during exercise-heat stress is suggested to increase as a function of the core temperature attained. However, whether this relationship is also influenced by exercise intensity remains unclear.

**PURPOSE:** This study investigated the relationship between eHsp72 expression and exercise to exhaustion in the heat at moderate and high intensities to determine the role of exercise intensity in mediating eHsp72 release.

**METHODS:** Sixteen male subjects cycled to exhaustion at 60% and 75% of maximal oxygen uptake in hot conditions ( $40^\circ\text{C}$ , 50% relative humidity). eHsp72 expression was measured prior to exercise, on reaching exhaustion, and 24 h following exercise cessation. Heart rate, core temperature, oxidative stress (malondialdehyde; MDA), and blood lactate and glucose concentration were measured to determine the predictor variables associated with eHsp72 expression.

**RESULTS:** The expression of eHsp72 increased similarly from pre-exercise baseline to exhaustion in the 60% and 75% trials ( $P < 0.001$ ). During the following 24 h, eHsp72 expression decreased to levels below baseline in both trials ( $P < 0.05$ ). Core temperature was significantly different at exhaustion, reaching  $39.7^\circ\text{C}$  in the 60% trial (58.9 min) and  $39.0^\circ\text{C}$  in the 75% trial (27.2 min) ( $P < 0.001$ ). The rate of rise in core temperature ( $2.1^\circ\text{C}\cdot\text{h}^{-1}$ ) was significantly greater in the 75% trial ( $P < 0.001$ ). Heart rate exceeded 96% of maximum on reaching exhaustion in both trials. A significant decline in MDA was observed 24 h after exercise compared with pre-exercise baseline and exhaustion ( $P < 0.001$ ). eHsp72 expression was highly correlated with the core temperature attained in the 60% trial and the rate of increase in core temperature in the 75% trial ( $P < 0.05$ ).

**CONCLUSION:** The similarity in expression of eHsp72 during moderate and high intensity exercise may relate to the duration (i.e. core temperature attained) and intensity (i.e. rate of increase in core temperature) of exercise. Therefore, the immuno-inflammatory release of eHsp72 in response to exercise in the heat appears to be duration- and intensity-dependent.

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**1577** Board #358 MAY 30 9:30 AM - 11:00 AM

**Platelet Inhibition Attenuates Skin Blood Flow During Exercise in the Heat Without Impairing Thermoregulation**

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(No relationships reported)

During passive heating (water-perfused suit), chronic low-dose aspirin and clopidogrel (Plavix®) treatment each result in a lower skin blood flow response and a greater rate of rise in core temperature in healthy, middle-aged individuals. If similar results occur during exercise in hot environments this would have widespread health implications, as these are the top anti-thrombotic agents used worldwide.

**PURPOSE:** The present double-blind, placebo control, crossover study examined the effects of seven days of systemic low-dose aspirin (81 mg/day) and clopidogrel (75 mg/day) treatment on physiological responses of healthy, middle-aged (50-65 years old) men and women during exercise in a hot environment ( $30^\circ\text{C}$ , 40% rh).

**METHODS:** Four men and three women exercised at 60%  $\text{VO}_{2\text{max}}$  on a cycle ergometer for up to 60 minutes. Esophageal temperature and skin temperatures at six sites were measured. Cutaneous vascular conductance was calculated as skin blood flow (laser Doppler Flowmetry) divided by mean arterial pressure (MAP) and normalized as a percentage of maximum vasodilation (elicited via local heating to  $43^\circ\text{C}$ ; %CVC<sub>max</sub>). Heart rate and blood pressure were also recorded.

**RESULTS:** Control of skin blood flow was altered by both low-dose aspirin and clopidogrel treatments. Both treatments increased the threshold for reflex vasodilation (aspirin  $37.29 \pm 0.03^\circ\text{C}$  and clopidogrel  $37.45 \pm 0.04^\circ\text{C}$  versus control  $37.07 \pm 0.02^\circ\text{C}$   $p < 0.001$ ). Aspirin treatment resulted in lower plateau skin blood flow versus control ( $45 \pm 3$  versus  $56 \pm 3$  %CVC<sub>max</sub> at 40 minutes of exercise;  $p = 0.03$ ). Despite altered thermoregulatory skin blood flow effector mechanisms; there was no difference in esophageal or body temperatures from control.

**CONCLUSION:** Platelet COX inhibition (low-dose aspirin) attenuates the plateau in skin blood flow during exercise, while both COX and platelet  $\text{P}_2\text{Y}_{12}$  ADP receptor inhibition (clopidogrel) increase the threshold for reflex vasodilation without impairing thermoregulation.

**FUNDING:** Supported by NIH grant R21 HL098645-01

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**1578** Board #359 MAY 30 9:30 AM - 11:00 AM

**Sex-differences In Whole-body Sudomotor Activity Are Only Evidenced At High Requirements For Heat Loss**

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(No relationships reported)

A lower whole-body sudomotor activity has recently been observed in females, paralleled by a lower thermosensitivity of the response. Although evidence suggests that these differences only occur at higher exercise intensities, no study has examined potential sex-differences in sudomotor activity at increasing requirements for heat loss.

**PURPOSE:** To examine sex-related differences in whole-body sudomotor activity during progressive increases in the requirement for heat loss.

**METHODS:** Eight males (M) and eight females (F, follicular phase) performed three successive 30 min exercise bouts at fixed rates of metabolic heat production equal to 200, 250, and 300  $\text{W}\cdot\text{m}^{-2}$ . Air temperature and humidity were set at  $40^\circ\text{C}$  and 20%. Whole-body sudomotor activity (evaporative heat loss, EHL) was measured by direct calorimetry. Mean body temperature ( $T_b$ ) was calculated from esophageal and mean skin temperatures.

**RESULTS:** By design, metabolic heat production did not differ between groups during the exercise bouts ( $p > 0.05$ ). Nonetheless, changes over time in EHL significantly differed between sex ( $p = 0.002$ ). Although EHL did not differ between groups during the first (M:  $228 \pm 5$  vs. F:  $220 \pm 7$   $\text{W}\cdot\text{m}^{-2}$ ,  $p = 0.418$ ) and second (M:  $284 \pm 9$  vs. F:  $273 \pm 7$   $\text{W}\cdot\text{m}^{-2}$ ,  $p = 0.394$ ) exercise bouts, it became significantly greater in males during the third exercise bout ( $348 \pm 13$  vs.  $305 \pm 8$   $\text{W}\cdot\text{m}^{-2}$ ,  $p = 0.015$ ). The greater EHL observed in males was paralleled by a greater thermosensitivity of the response compared to females ( $296 \pm 27$  vs.  $195 \pm 21$   $\text{W}\cdot\text{m}^{-2}\cdot^\circ\text{C}^{-1}$ ,  $p = 0.011$ ). In contrast, no differences in the mean  $T_b$  onset threshold for EHL were observed ( $p = 0.224$ ).

**CONCLUSION:** Sex-differences in whole-body sudomotor activity are only evidenced at high requirements for heat loss. These results suggest that the lower sudomotor thermosensitivity observed in females is due to sex-differences in the properties of the thermoeffector organ (sweat gland). Supported by NSERC grant RGPIN-298159-2009.

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1579 Board #360 MAY 30 9:30 AM - 11:00 AM

**Aspirin Prevents Hyperthermic Platelet Activation in Firefighters During Exertion in Thermal Protective Clothing**

David Hostler, Serina J. McEntire, Steven E. Reis, Diane Comer, Charity G. Moore, Riana R. Pryor, Jennifer Erin, Priya Khorana, Francis X. Guyette, Joe Suyama. *University of Pittsburgh, Pittsburgh, PA.* (Sponsor: Robert Robertson, FACS) (No relationships reported)

Platelet aggregation is enhanced in firefighters following relatively short bouts of work in thermal protective clothing (TPC). Additionally, platelets may be directly activated by heat resulting in faster clot formation. It is important to understand if heat mediated platelet activation can be blunted or prevented given the high proportion of line of duty heart attacks in the fire service.

**PURPOSE:** Determine if aspirin therapy before and/or immediately following exertion in TPC prevents platelet activation.

**METHODS:** In this double-blind, placebo controlled study, 102 firefighters were randomized to receive daily therapy (81 mg aspirin or placebo) for 14d before and a single dose (325 mg aspirin or placebo) immediately following 50 minutes of treadmill exercise in TPC. The design used random assignment of aspirin before and after exercise (AA), placebo before and after exercise (PP), daily aspirin before and placebo following exercise (AP), and placebo before and aspirin following exercise (PA) conditions. Heart rate and core temperature were monitored during and for 90 minutes following exercise. Platelet closure time (PCT) was measured with a platelet function analyzer with an upper limit of detection of 300 sec before initial drug treatment, before exercise, immediately post exercise and 30, 60, and 90 minutes later. A random effects tobit model was used to test the effects of drug prior to exercise and during recovery controlling for the baseline platelet closure time.

**RESULTS:** Maximum heart rate and core temperature during exercise did not differ between groups with means exceeding 170 bpm and 38.6°C. Baseline median PCT did not differ between groups ranging from 112-124 sec and did not change after two weeks of placebo. PCT differed over time for the four groups ( $p < 0.001$ ) rising to a median of 300 sec [IQR 99, 300] in AA and 300 [92, 300] in AP prior to exercise. Following exercise, median PCT decreased to 275.5 [62, 300] (AA), 207 [55, 300] (AP), 95 [71, 182] (PA), and 90 [58, 201] (PP) sec. Median PCT returned to 300 sec 30 min after exercise in AA and AP and rose to 300 sec in PA 60 min after exercise.

**CONCLUSIONS:** Daily aspirin therapy blunts platelet activation during exertional heat stress. Furthermore, single dose aspirin therapy following exertional heat stress reverses platelet activation within 60 minutes.

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1580 Board #361 MAY 30 9:30 AM - 11:00 AM

**Interindividual Variability in Orthostatic Tolerance during Heat Stress: Role of Reductions in Cerebral Perfusion**

R. Matthew Brothers, Joshua F. Lee, Michelle L. Harrison, Skyler Brown. *University of Texas at Austin, Austin, TX.* (No relationships reported)

**PURPOSE:** Heat stress compromises orthostatic tolerance relative to normothermic conditions. However, the extent to which heat stress compromises orthostatic tolerance differs amongst individuals with some being more affected than others. While the exact mechanism(s) responsible for this interindividual variability in orthostatic tolerance during heat stress remain unknown, syncope will always occur when cerebral perfusion is not adequately maintained. This study tested the hypothesis that the individuals with the greatest heat-stress induced reduction in orthostatic tolerance would have the largest reduction in cerebral perfusion in this thermal condition.

**METHODS:** 15 individuals performed a maximal simulated hemorrhage challenge (lower body negative pressure; LBNP) during normothermia and following a whole-body heat stress on separate days. Tolerance during each condition was quantified as cumulative stress index (CSI) and the difference in CSI between thermal conditions was used to categorize individuals as HighDif (most affected by heat) and LowDif (least affected by heat). The effect of heat stress (prior to LBNP) on internal temperature (telemetry pill), cerebral perfusion ( $MCAV_{mean}$ : indexed by middle cerebral artery blood velocity), cerebral vascular conductance (CVC;  $MCAV_{mean} / \text{mean arterial pressure}$ ), and end-tidal carbon dioxide tension ( $PETCO_2$ ) was assessed in each group.

**RESULTS:** The difference in CSI was larger in the HighDif group relative to the LowDif group (HighDif:  $1243 \pm 135$  mmHg  $\times$  min; LowDif:  $605 \pm 311$  mmHg  $\times$  min,  $P < 0.01$ ). The increase in internal temperature was similar between groups (HighDif:  $1.47 \pm 0.15$  °C; LowDif:  $1.50 \pm 0.13$  °C,  $P = 0.70$ ). Heat stress reduced  $PETCO_2$ ,  $MCAV_{mean}$ , and CVC relative to normothermia in both groups ( $P < 0.05$  for each variable), however, the magnitude of the reduction in  $PETCO_2$  (HighDif:  $7.2 \pm 5.7$  Torr; LowDif:  $5.5 \pm 2.7$  Torr,  $P = 0.56$ ),  $MCAV_{mean}$  (HighDif:  $21.9 \pm 14.7$  cm $\cdot$ s $^{-1}$ ; LowDif:  $10.7 \pm 10.9$  cm $\cdot$ s $^{-1}$ ,  $P = 0.23$ ), and CVC (HighDif:  $31.3 \pm 24.9$  cm $\cdot$ s $^{-1}$ ·mmHg $^{-1}$ ; LowDif:  $11.4 \pm 19.2$  cm $\cdot$ s $^{-1}$ ·mmHg $^{-1}$ ,  $P = 0.18$ ) was similar between groups.

**CONCLUSION:** These results indicate the large interindividual variability in heat-stress induced reductions in orthostatic tolerance is not related to the degree to which cerebral perfusion is reduced in this thermal condition.

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1581 Board #362 MAY 30 9:30 AM - 11:00 AM

**Reduced Cardiac Baroreceptor Responsiveness is Associated with Reductions in Orthostatic Tolerance in Hyperthermic Individuals**

Joshua F. Lee, Michelle L. Harrison, Skyler Brown, R. Matthew Brothers. *University of Texas at Austin, Austin, TX.* (No relationships reported)

Orthostatic tolerance is reduced in hyperthermic humans; however, there is a large degree of variability in this response with tolerance being reduced more in some individuals than others. The factors underlying the variability in orthostatic tolerance during hyperthermic conditions remain largely unknown.

**PURPOSE:** To test the hypothesis that individuals with the largest difference in orthostatic tolerance during heat stress relative to normothermia would have a reduced heart rate response to spontaneous reductions in systolic blood pressure (lower cardiac baroreflex sensitivity) during heat stress compared to individuals with the least difference in tolerance between the thermal conditions.

**METHODS:** On 2 different days, one during normothermia and another during heat stress, 15 individuals were exposed to a simulated hemorrhage via lower body negative pressure (LBNP) to pre-syncope. Tolerance to LBNP was quantified using a cumulative stress index (CSI). The difference in CSI between thermal conditions was calculated for each subject. The 6 individuals with the largest CSI difference (LargeDif) and the 6 with the least CSI difference (SmallDif) between conditions were grouped together. The effect of heat stress on spontaneous cardiac baroreflex sensitivity during reductions in systolic blood pressure (prior to LBNP) was assessed using the sequence technique. Cardiac baroreflex sensitivity was assessed during reductions in systolic blood pressure since this is the relevant analysis for orthostatic tolerance.

**RESULTS:** The difference in CSI between thermal conditions was greater in the LargeDif relative to the SmallDif group ( $1243 \pm 135$  mmHg  $\times$  min vs.  $605 \pm 311$  mmHg  $\times$  min;  $P < 0.01$ ) despite a similar rise in core temperature (LargeDif:  $1.47 \pm 0.15$  °C vs. SmallDif:  $1.50 \pm 0.13$  °C;  $P = 0.70$ ). The increase in heart rate during spontaneous reductions in systolic blood pressure (i.e. cardiac baroreflex sensitivity) was lower in the LargeDif group relative to the SmallDif group during hyperthermia (LargeDif:  $-0.50 \pm 0.47$  beats  $\cdot$  min $^{-1}$   $\cdot$  mmHg $^{-1}$  vs. SmallDif:  $-1.81 \pm 1.13$  beats  $\cdot$  min $^{-1}$   $\cdot$  mmHg $^{-1}$ ,  $P = 0.03$ ).

**CONCLUSION:** These data support the hypothesis that individuals with lower spontaneous cardiac baroreflex sensitivity during heat stress are less able to tolerate orthostatic challenges in this thermal condition.

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1582 Board #363 MAY 30 9:30 AM - 11:00 AM

**Thermoregulatory Adaptations Following Sprint Interval Training**

Charles P. Katicka<sup>1</sup>, Andrew T. Del Pozzi<sup>1</sup>, Elisha Williams<sup>1</sup>, Svetlana Nepocaty<sup>2</sup>, Greg A. Ryan<sup>1</sup>, Jonathan E. Wingo<sup>1</sup>. <sup>1</sup>*University of Alabama, Tuscaloosa, AL.* <sup>2</sup>*Elon University, Elon, NC.* (No relationships reported)

Traditional endurance training (TET) typically involves weeks of long duration (60-90 min) exercise performed at a moderate to vigorous intensity. Recently, attention has focused on sprint interval training (SIT), a paradigm characterized by multiple bouts of short-duration, high-intensity exercise. Similar fitness benefits from TET and SIT have been demonstrated, but whether SIT, like TET, promotes heat acclimation, remains unclear.

**PURPOSE:** Was to test the hypothesis that SIT performed over 6 sessions results in measureable thermoregulatory and cardiovascular adaptations consistent with heat acclimation.

**METHODS:** Seven active men [mean  $\pm$  SD, 12.9  $\pm$  4.6% body fat, 22  $\pm$  3 yrs, 3.1  $\pm$  0.3 L/min peak oxygen uptake ( $VO_{2peak}$ )] performed 6 SIT sessions over 12 days with 48-72 h between

sessions. Each session consisted of 4-6 30-s Wingate Anaerobic Tests separated by ~4 min. Four individuals performed SIT in ~40 °C while 3 performed SIT in ~25 °C. Before and after the 2-week SIT protocol, participants cycled for 30 min at 65% VO<sub>2peak</sub> in 25 °C to assess the effects of SIT on heat acclimation.

**RESULTS:** Group outcomes were not different, so data were combined for simplification. There were no differences from pre- to post-training for any of the main outcome variables tested (onset of sweating, sweat sensitivity, heart rate at end of exercise, and rectal temperature change from pre- to post-exercise; all P > 0.05).

**CONCLUSIONS:** These results indicate that 2 weeks of SIT performed under the conditions specified does not result in heat acclimation.

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**1583** Board #364 MAY 30 9:30 AM - 11:00 AM

**Variability in Simulated Hemorrhagic Challenge Tolerance is not Explained by Differences in Body Temperature**

Matthew S. Gano<sup>1</sup>, Kimberly Hubing<sup>2</sup>, James Pearson<sup>2</sup>, Rebekah A.I. Lucas<sup>3</sup>, Robert Matthew Brothers<sup>4</sup>, Craig G. Crandall, FACSM<sup>3</sup>. <sup>1</sup>University of Arkansas, Fayetteville, AR. <sup>2</sup>Texas Health Presbyterian Hospital, Dallas, TX. <sup>3</sup>Texas Health Presbyterian Hospital, Dallas, TX. <sup>4</sup>University of Texas Austin, Austin, TX.  
(No relationships reported)

**PURPOSE:** To examine if body temperature variations in normothermic and heat stressed conditions explain the variability in tolerance to simulated hemorrhage within each thermal condition.

**METHODS:** Data were retrospectively examined in individuals who underwent a simulated hemorrhagic challenge to pre-syncope (onset of syncopal symptoms) via lower body negative pressure (LBNP). The correlation between mean body temperature (T<sub>body</sub>, calculated from core and skin temperatures) and LBNP tolerance time while normothermic (n=45) and passively heat stressed (n=90) was examined. Second, LBNP time while normothermic and heat stressed in the 15 lowest T<sub>body</sub> was compared to the 15 highest T<sub>body</sub> within each thermal condition. Third, for subjects tested in both thermal conditions (n=33), the correlation between the increase in T<sub>body</sub> and the decrease in LBNP time was examined, as was LBNP times of the 10 smallest T<sub>body</sub> increases relative to the 10 largest T<sub>body</sub> increases.

**RESULTS:** LBNP time while normothermic (1237 ± 240 sec) and heat stressed (635 ± 275 sec) was not correlated to T<sub>body</sub> within each condition (normothermic range = 36.21-37.24°C, r=-0.15, p=0.33; heat stress range = 37.69-39.46°C, r=-0.12, p=0.28). Normothermic LBNP times of those with the lowest (36.35 ± 0.07°C) and highest (36.87 ± 0.15°C) T<sub>body</sub> were not different (1241 ± 256 and 1233 ± 294 sec, respectively; p=0.94). Similarly, heat stressed LBNP times of those with the lowest (37.86 ± 0.09°C) and highest (38.82 ± 0.20°C) T<sub>body</sub> were not different (690 ± 266 and 559 ± 282 sec; p=0.20). For subjects tested in both thermal conditions, decreases in heat stressed LBNP time (606 ± 218 sec) were not correlated to the magnitude of T<sub>body</sub> elevation (1.64 ± 0.23°C; r=0.04; p=0.83); moreover LBNP time of those with the smallest T<sub>body</sub> increase (664 ± 231 sec, 1.38 ± 0.14°C) was not different than those with the largest T<sub>body</sub> increase (611 ± 212 sec, 1.91 ± 0.07°C; p=0.60).

**CONCLUSIONS:** Between subject variations in T<sub>body</sub> while normothermic and heat stressed do not explain the within-condition variability in tolerance to a simulated hemorrhagic challenge. Although heat stress compromises blood pressure control, differences (1.1-2.0°C) in the magnitude of body temperature increase during a heat stress do not explain the variability in tolerance.

Support NIH GM068865

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**1584** Board #365 MAY 30 9:30 AM - 11:00 AM

**Caffeine's Effect on Hydration and Body Temperature During Exercise in ≥26.6°C Environments: A Systematic Review**

Kelly D. Pagnotta<sup>1</sup>, Douglas J. Casa, FACSM<sup>1</sup>, Kerri E. Gavin<sup>2</sup>, Lindsay M. McDowell<sup>3</sup>. <sup>1</sup>Korey Stringer Institute, University of Connecticut, Storrs, CT. <sup>2</sup>Villanova University, Philadelphia, PA. <sup>3</sup>The Pomfret School, Pomfret, CT.  
(No relationships reported)

Caffeine (CAF) has become the most widely used behaviorally active substances in the world today and has recently been removed from the list of banned substance by the International Olympic Committee. Previous studies related to CAF and performance indicate that CAF prior to exercising clearly enhances endurance performance. Recent studies have been completed to assess how CAF effects heat tolerance in warm or hot environments, but few, if any, have systematically consolidated the findings.

**PURPOSE:** To analyze how CAF directly effects hydration and core temperature (T<sub>c</sub>) while exercising in a warm or hot environment.

**METHODS:** Two independent searches were completed in various databases for CAF, T<sub>c</sub> and exercise and CAF hydration status and exercise, using a variety of search terms. Inclusion criteria included original research with human subjects, controlled, counter balanced hydration strategies, valid measurements of hydration status and T<sub>c</sub>, CAF dosages of 3-9 mg.kg body mass administered less than 3 hours prior to exercise, exercise lasting greater than 30 minutes, environmental conditions greater than or equal to 26.6°C. Quality control was obtained by a PEDro score of greater than or equal to 7 and 2 independent reviews of each article. Studies were excluded if they included time to exhaustion as the exercise component, the effects of CAF could not be isolated, or they had no control group (CON). The initial search revealed 342 studies and 49 were further analyzed. 41 studies were excluded for not meeting the inclusionary criteria, leaving a total of 8 studies for inclusion. Studies with multiple trials examining various doses of caffeine were counted as separate studies, resulting in a total of 12 possible data sources.

**RESULTS:** Studies included in the analysis of change in T<sub>c</sub>. (n=10) mean difference (CAF-CON =0.08°C ). Independent of the mode used to assess, CAF had no effect on hydration status (CAF-CON) (%body mass Δ [n=7] = 0.033%, Uosmo [n=4] = 48.5, Usg [n=3]= 0.003).

**CONCLUSIONS:** Because CAF can have an ergogenic effect on performance, and, as our results suggest, little physiological effect on heat tolerance and hydration status, it seems to not have detrimental thermoregulatory effects when athletes who are exercising in the heat and utilizing doses between 3-9 mg.kg body mass.

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**A-46** Free Communication/Poster - Upper Extremity

MAY 30, 2012 7:30 AM - 12:30 PM

ROOM: Exhibit Hall

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**1585** Board #366 MAY 30 9:30 AM - 11:00 AM

**Biomechanical Simulation Of The Passive Mechanical Coupling In The Hand And Wrist**

Benjamin I. Binder-Macleod, Jules P.A. Dewald, Wendy M. Murray. Northwestern University, Evanston, IL.  
(No relationships reported)

The muscles that control the hand cross multiple joints, particularly the extrinsic finger muscles which cross the wrist and extend to the fingers. This complex musculoskeletal anatomy creates passive mechanical linkages between joints, coupling the movement of multiple joints. In healthy individuals the passive coupling between the wrist and hand facilitates opening and closing of the fingers. Impairments, due to stroke, OA, or other injuries, may disrupt this coupling and cause a loss of hand control.

**PURPOSE:** To use a multi-joint biomechanical model of the upper limb to evaluate how the musculoskeletal structures couple the motion of the index finger and wrist.

**METHODS:** A biomechanical model of the upper extremity was utilized to calculate the rest posture of the MCP joint at different wrist postures via static equilibrium analysis. Rest postures were calculated to be the MCP joint angle at which the sum of the total passive torques (ligaments, joint capsule, and intrinsic and extrinsic finger muscles) and the torque produced by the mass of the phalanges of the finger equal 0 Nm. Work done passively to resist motion of the MCP joint from the rest position by the musculoskeletal structures was calculated. A sensitivity analysis of the effects the muscle properties have on the rest posture and work was conducted at 0° wrist posture by varying the extrinsic flexor muscles' optimal fiber lengths (L<sub>fo</sub>) and tendon slack lengths (L<sub>ts</sub>).

**RESULTS:** The rest posture of the first MCP joint at wrist flexion angles of -60°, 0°, and 60° were 75°, 51°, and -20° respectively. At wrist angles -60° and 0° the extrinsic finger flexors contributed the largest percentage of work (91% and 59%) to resist MCP motion, and at 60° the extrinsic finger extensors primarily (74%) resisted MCP motion. The sensitive analysis of L<sub>fo</sub> and L<sub>ts</sub> to 99%, 95% and 90% of nominal length showed changes in rest postures (L<sub>fo</sub>: 51°, 51°, & -63°; L<sub>ts</sub>: 51°, 80°, & 90°) and increases in the passive resistive work (L<sub>fo</sub>: 125%, 268%, & 579% ; L<sub>ts</sub> 187%, 1000% & 3779%).

**CONCLUSIONS:** When passive properties of the musculoskeletal structures of the hand are incorporated into a multiarticular biomechanical model of the upper limb, simulations of the mechanical coupling of the hand and wrist can be analyzed, along with how alterations to muscle properties, due to disorders, may affect this coupling.

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**1586** Board #367 **MAY 30** **9:30 AM - 11:00 AM**  
**The Influence of Patient's Body Size on Dental Hygienist Shoulder Kinematics**

Tal Amasay<sup>1</sup>, Andrew Karduna<sup>2</sup>. <sup>1</sup>Barry University, Miami Shores, FL. <sup>2</sup>University of Oregon, Eugene, OR.  
(No relationships reported)

Dental Hygienists have been identified, as an occupational group that is at risk for musculoskeletal disorders of the upper extremities, and that the prevalence of these disorders increases with years of occupational exposure. Additionally, in the United States, the prevalence of overweight and obese people has increased sharply for both adults and children. This increase may introduce more exposure of dental hygienists to obese patients which may result in an increased prevalence of shoulder musculoskeletal disorders.

**PURPOSE:** The aim of this study was to evaluate the influence of patient girth on dental hygienists shoulder kinematics and exposure during teeth instrumentation in a simulated occupational environment.

**METHODS:** Sixteen female dental hygienists, mean age of 49.6 years (28 - 64 years) and current work experience ranging from 1.5 - 32 years participated in the study. Three dimensional kinematics of the scapula and humerus were collected at a sampling rate of 120 Hz using the Polhemus Liberty magnetic tracking system. During data collection, the participants instrumented three different teeth on two different manikin representing the 50<sup>th</sup> and 99<sup>th</sup> percentiles of body size. To quantify differences in humeral and scapular kinematics and humeral exposure parameters, two independent variables with two levels were chosen, Hand Dominance and Body Type size. Separate two-way ANOVAs with repeated measures were conducted.

**RESULTS:** Significant higher mean humeral elevation angles were observed while instrumenting the big manikin for the dominant (33 vs. 45 deg) and non-dominant (31 vs. 36 deg) hands. Significant higher mean scapular upward rotation angles were observed while instrumenting the big manikin for the dominant (2 vs. 6 deg) and non-dominant (-1 vs. 2 deg) hands. Furthermore, dental hygienist spent significantly more time above 30 deg (dominant 42% vs. 68%, non dominant 47% vs. 60%) and 60 deg (dominant 13% vs. 28%, non dominant 4% vs. 11%) of humeral elevation while instrumenting the big manikin.

**CONCLUSION:** This study provided evidence that dental hygienists alter their shoulder kinematics while instrumenting big girth patients. Consequently, patients of greater girth may increase dental hygienists' risk of developing shoulder musculoskeletal disorders.

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**1587** Board #368 **MAY 30** **9:30 AM - 11:00 AM**  
**Kinematics Of The Shoulder Complex During Ergonomic Hand Drive Wheelchair Propulsion: Shoulder Impingement Implications**

Mark D. Tillman, FACSM, Zukowski A. Lisa, Patty W. Hovis, Otzel M. Dana, Roper A. Jaimie, Orit Shechtman. *Univ. of Florida, Gainesville, FL*  
(No relationships reported)

The shoulder is the most mobile joint in the body and vitally important to the manual wheelchair user for propulsion and transfers. Shoulder impingement (SI) syndrome is the most frequently reported upper extremity pathology for wheelers. SI pain is exacerbated by various combinations of four particular movements of the shoulder complex: scapular protraction and arm flexion (FLX), abduction (ABD) and internal rotation (IR). Alternative drive mechanisms may provide relief.

**PURPOSE:** To test an ergonomic hand drive mechanism (EHDM) for a conventional manual wheelchair (CMW) that may lead to improved wheeling mechanics as related to SI.

**METHODS:** Thirteen adult full-time wheelchair users (43.0±15.0 yrs, 74.5±16.8 kg, 173.1±13.2 cm) completed five trials in a CMW and five trials in the same chair equipped with an EHDM. All participants were medically and functionally stable and at least six months post injury. Digital video data were captured by 11 cameras as each participant wheeled at their preferred pace across a flat, smooth 8m long surface. Angular kinematics of the shoulder (flexion/extension, abduction/adduction, internal and external rotation) and one measure of scapular motion (protraction/retraction) were computed for right and left sides. At least one push cycle was analyzed per trial with average values calculated for all five trials. Paired sample t-tests were used to compare maximum values between the two conditions ( $\alpha=0.05$ ).

**RESULTS:** The following changes were noted with EHDM use compared to CMW: FLX increased ( $p<.001$ ), ABD decreased ( $p=.002$ ), IR decreased ( $p<.001$ ), and scapular protraction decreased ( $p=.025$ ).

**CONCLUSION:** The kinematic alterations while using the EHDM may have clinical implications regarding SI. ABD was reduced by 14.6%, IR was reduced by 48.2%, and scapular protraction decreased by 57.5%. Alternatively, FLX increased over three fold to 31.5°, but presumably not to a level of impingement. EHDM use may lessen SI risk by reducing three of the four injurious movements. The influence of these movements in combination was not considered and should be addressed in future research.

This work supported in part by NIH/NCRRTSA award to the University of Florida UL1 RR029890. The hand drive mechanism used in this study is the intellectual property of Shands Healthcare.

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**1588** Board #369 **MAY 30** **9:30 AM - 11:00 AM**  
**Quantitative Examination of Pelvic and Scapular Stabilizing Muscle Activation during Shoulder Rehabilitation**

Michael Sola, Gretchen D. Oliver, Sean Huddleston. *University of Arkansas, Fayetteville, AR*. (Sponsor: Heidi Kluess, FACSM)  
(No relationships reported)

The kinetic chain approach to shoulder rehabilitation has become the standard. Incorporating proximal stability for distal mobility requires a stable base of not only the hips and pelvis but also the scapula. Thus shoulder rehabilitation should encompass the musculature about the shoulder as well as stabilizing musculature of the pelvis and hips.

**PURPOSE:** To quantify muscle activation of the gluteus maximus and upper trapezius muscle groups during shoulder rehabilitation exercises.

**METHODS:** Bipolar surface electrodes were applied to the 30 participants' (23.5 ± 1.34yr; 174.4 ± 11.0 cm; 76.6 ± 16.9 kg) dominate upper trapezius and gluteus maximus muscle groups. sEMG data were collected and expressed as percent of maximum voluntary isometric contraction (% MVIC). Data were interpreted as minimal activation 0-20% MVIC, moderate activation 20-35% MVIC, moderately strong activation 35-50% MVIC, and significantly high activation >50% MVIC. Participants performed shoulder dump, dynamic physioball (DPB), standing dynamic abduction, and standing dynamic flexion exercises.

**RESULTS:** Moderate activation was seen in the shoulder dump and standing dynamic abduction exercise for the gluteus maximus. Standing dynamic abduction and DPB showed high upper trapezius activation, while standing dynamic flexion and the shoulder dump showed moderately strong activation (Figure 1).

**CONCLUSION:** The exercises performed allowed for moderate to moderately strong activation in both upper and lower extremity musculature. When trying to incorporate total kinetic chain during shoulder rehabilitation, it is important that the shoulder exercises are focused not only on the shoulder but also on the stabilizing base of the lower extremity.

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**1589** Board #370 **MAY 30** **9:30 AM - 11:00 AM**  
**Wheelchair Propulsion Using an Ergonomic Hand Drive Mechanism Reduces Wrist Jerk Throughout Range of Motion**

Lisa A. Zukowski, Jaimie A. Roper, Dana Otzel, Patty Hovis, Orit Shechtman, Mark D. Tillman, FACSM. *University of Florida, Gainesville, FL*  
(No relationships reported)

Forty-nine to 63% of conventional manual wheelchair (CMW) users suffer from carpal tunnel syndrome (CTS), which is likely induced by a combination of potentially large forces transmitted through the wrist and an extreme wrist range of motion (ROM). The ergonomic hand drive mechanism (EHDM) tested in this study utilizes a more neutral wrist orientation. Further, because the EHDM uses continuous contact between the lever and hand, more constant force application and therefore reduced jerk ( $\Delta a/\Delta t$ ) should result.

**PURPOSE:** To evaluate wrist jerk in relation to angular orientation while using the EHDM.

**METHODS:** Thirteen adult full-time CMW users who were medically and functionally stable and at least six months post injury were recruited (43.0±15.0 yrs, 74.5±16.8 kg, 173.1±13.2 cm). Motion data were captured by 11 cameras as participants propelled across a length of 8m completing 5 trials in a CMW and 5 trials in the same CMW fitted with the EHDM. Angular

kinematics of the wrist (flexion/extension, radial/ulnar deviation) were computed and third derivatives (jerk) were calculated. At least one push phase was analyzed per trial and all trials were combined to calculate an average push per participant that was divided into ten consecutive time intervals. Maximum jerk values (MJV) from each interval were compared between conditions using paired samples t-tests ( $\alpha=0.05$ ). Wrist orientation at statistically different MJV were then compared between conditions using the Wilcoxon signed-rank test ( $\alpha=0.05$ ).

**RESULTS:** Use of the EHDM resulted in reduced MJV within both planes of motion throughout the majority (60%) of the intervals ( $p<0.05$ ). Wrist orientation however did not vary ( $p>0.05$ ) at significantly different MJV except for a reduction in radial deviation with use of the EHDM ( $p<0.033$ ).

**CONCLUSION:** EHDM use reduces jerk throughout the push phase of propulsion. These results evince more constant force application with EHDM use and infer a reduction in wrist joint reaction forces, which may lessen both the symptoms as well as the likelihood of developing CTS.

Supported by the Clinical and Translational Science Institute Pilot & Collaborative Research Projects (NIH). The hand drive mechanism used in this study is the intellectual property of Shands Healthcare.

**1590** Board #371 MAY 30 9:30 AM - 11:00 AM

**Reliability of Motion Capture Shoulder Kinematics in Wheelchair Propulsion Utilizing an Ergonomic Hand Drive**

Patty W. Hovis, Lisa A. Zukowski, Jaimie A. Roper, Otzel M. Dana, Kaitlin Murphy, Orit Shechtman, Mark D. Tillman, FACSM. *Univ. of Florida, Gainesville, FL*  
(No relationships reported)

Obtaining motion capture data from wheelchair users during propulsion requires multiple reliable trials. Data reliability (repeatability/consistency) implies precision of both measurements and the detection of differences between trials. Researchers commonly collect 5 trials; however, loss of trial data can occur due to intrinsic or extrinsic error leaving fewer trials for analysis. Reliability of results may be affected when only 3 to 4 successful trials are obtained. Thus, it is important to determine the minimum number of trials necessary to achieve data reliability.

**PURPOSE:** To determine the reliability of analyzing 3, 4, and 5 trials with a conventional manual wheelchair (CMW) and the same CMW with an attached ergonomic hand drive (EHD).

**METHODS:** Ten full-time wheelchair users ( $39.6 \pm 9.8$  yrs,  $172.0 \pm 13.3$  cm,  $72.5 \pm 15.0$  kg), at least six months post injury, completed 5 trials in a CMW and 5 trials in the same chair equipped with an EHD. Digital video data were captured as each participant wheeled at their preferred pace across a flat, smooth 8m long surface. Shoulder angular kinematics (max flexion [FL], max extension [EXT], and range of motion [ROM]) for the right side were computed for all 5 propulsion trials. Intra class correlation coefficients (ICC) were calculated and compared between the conditions.

**RESULTS:** The ICC for FL, EXT, and ROM for 3 trials (0.89, 0.88, 0.79 respectively), 4 trials (0.87, 0.89, 0.79 respectively), and 5 trials (0.89, 0.90, 0.84 respectively) varied. The ICC for FL angles obtained from 3, 4 and 5 trials with the EHD were greater than CMW trials ( $>0.90$  vs.  $0.80-0.84$ , respectively). The ICC for EXT angles were greater for CMW trials than EHD trials ( $>0.90$  vs.  $0.77-0.81$ , respectively). The ICC for ROM were greater for EHD than CMW trials ( $0.80-0.84$  vs.  $0.76-0.80$ , respectively).

**CONCLUSION:** High ICC values for the EHD FL and CMW EXT indicate high reliability for 3, 4, and 5 trials. However, higher variability was found between trials with ROM, EHD EXT, and CMW FL. Therefore, a minimum of 5 trials is recommended for manual wheeling motion capture with additional trials being performed based on participant capabilities.

This work supported in part by NIH/NCRRTS award to the University of Florida ULI RR029890. The hand drive mechanism used in this study is the intellectual property of Shands Healthcare.

**1591** Board #372 MAY 30 9:30 AM - 11:00 AM

**Changes in Shoulder Range of Motion and Humeral Torsion in High School Baseball Players**

Sakiko Oyama, Elizabeth E. Hibberd, Joseph B. Myers. *University of North Carolina at Chapel Hill, Chapel Hill, NC*  
(No relationships reported)

Baseball participation involves repetitive throwing and/or pitching, and has been theorized to lead to musculoskeletal adaptations at the shoulder that are associated with injuries. However, no study has evaluated changes in both shoulder range of motion (ROM) and humeral retrotorsion (HT) in high school baseball players over a year.

**PURPOSE:** To describe changes in shoulder ROM and HT over a year in high school baseball players ( $16.1 \pm 0.8$  years, range=14-17 years) using a longitudinal study design.

**METHODS:** In spring of 2010, shoulder internal/external rotation ROM (digital inclinometer) and HT (ultrasonographic method) was measured in 339 participants. Measurements were repeated on the 108 returners in spring of 2011. Dominant-limb shoulder internal/external rotation ROM, total rotation ROM, and HT were compared pre-post the follow-up period using paired t-tests.

**RESULTS:** Shoulder internal rotation (mean difference=  $-4.0 \pm 9.5^\circ$ ,  $p<.001$ ), external rotation (mean difference=  $-5.1 \pm 14.3^\circ$ ,  $p<.001$ ), and total rotation (mean difference=  $-9.4 \pm 18.7^\circ$ ,  $p<.001$ ) ROM decreased over a year. HT (mean difference=  $1.2^\circ \pm 5.7^\circ$ ,  $p=.04$ ) increased slightly, yet the change was clinically insignificant.

**CONCLUSIONS:** Alterations in shoulder ROM without concomitant changes in HT indicates that the changes in shoulder ROM in high school baseball players are mainly attributed to changes in soft tissue property rather than osseous adaptation. This may be due to the fact that participants were approaching the end of skeletal maturity. Decreased internal rotation and total rotation ROM have been linked to upper extremity injuries in overhead athletes. Therefore, observations from this study supports the benefit of implementing stretching programs in high school baseball players to help maintain shoulder ROM and possibly prevent upper extremity injuries. Supported by NIH-NIAMS R03AR055262.

**1592** Board #373 MAY 30 9:30 AM - 11:00 AM

**Comparison Of Sleeper’S, Cross Body And Manual Stretching For Posterior Shoulder Tightness: Randomized Controlled Trial**

Hande Guney, Gul Baltaci, Nihan O. Pekyavas, Gul Oznur Karabicak, Buket Teker, Pinar Balci, Ece Nohutlu Gunaydin. *Hacettepe University Faculty of Health Sciences Physiotherapy and Rehabilitation, Ankara, Turkey*  
(No relationships reported)

**BACKGROUND:** Glenohumeral internal rotation deficit (GIRD) and posterior shoulder tightness (PST) have been link to each other and associated with the shoulder pain. Lately, many researchers have focused on efficiency of different stretching methods on PST and GIRD.

**PURPOSE:** To determine if the acute effects of manual stretching method is superior to cross-body stretching and sleeper stretch to resolve the PST and GIRD.

**METHODS:** Fifty-six asymptomatic female (mean age:  $24.95 \pm 3.03$  years) who have more than  $20^\circ$  of GIRD, randomly assigned to 1 of 3 intervention groups. The manual stretching group ( $n=20$ ), the cross-body stretch group ( $n=18$ ), the sleeper stretch group ( $n=18$ ) (Table 1). Shoulder internal rotation ROM, with the arm abducted  $90^\circ$  was measured before and after 1-week intervention period. Subjects were asked to perform twice daily for 5 repetitions, holding each stretch for 30 seconds. One-way analysis of variance (ANOVA) was used for determination of equivalence among groups and evaluation of subject characteristics.

**RESULTS:** The increase in internal rotation ROM for the subjects in the manual stretching group (mean  $\pm$  SD:  $19.0^\circ \pm 4.6^\circ$ ) were significantly greater than the cross-body stretch group ( $11.0^\circ \pm 2.6^\circ$ ,  $p=0.001$ ) and sleeper stretch group ( $9.3^\circ \pm 2.8^\circ$ ,  $p=0.001$ ). The improvements in the sleeper stretch group were not different from the cross-body stretch ( $p=0.385$ )

**CONCLUSION:** Based on our results, the manual stretching appears to be more effective when comparing to both cross-body stretch and sleeper stretch group to gain internal rotation ROM. While the improvement in internal rotation from the cross-body stretch was greater than the sleeper stretch, this difference could not be statistically significant.

| Descriptives          |                            |                             |                                 |
|-----------------------|----------------------------|-----------------------------|---------------------------------|
| Table 1.              | Age years<br>Mean $\pm$ SD | BMI kg/cm2<br>Mean $\pm$ SD | ROM difference<br>Mean $\pm$ SD |
| Manual Stretching     | 23,9 $\pm$ 1,7             | 21,6 $\pm$ 2,6              | 19,0 $\pm$ 4,6 $^\circ$         |
| Cross Body Stretching | 27,1 $\pm$ 4,0             | 23,3 $\pm$ 3,2              | 11,0 $\pm$ 2,6                  |
| Sleeper’s Stretch     | 23,8 $\pm$ 1,7             | 21,4 $\pm$ 2,0              | 9,3 $\pm$ 2,8 $^\circ$          |

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**B-23 Free Communication/Poster - Cancer**

MAY 30, 2012 1:00 PM - 6:00 PM

ROOM: Exhibit Hall

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**1593 Board #1 MAY 30 2:00 PM - 3:30 PM****Quercetin Supplementation Reduces Chemotherapy-induced Fatigue In Mice: Possible Role Of MCP-1**Sara E. Mahoney<sup>1</sup>, E. Angela Murphy<sup>2</sup>, Jamie L. McClellan<sup>2</sup>, Benjamin Gordon<sup>2</sup>, M. Marjory Pena<sup>2</sup>, J. Mark Davis, FACSM<sup>2</sup>. <sup>1</sup>Texas A&M University, Kingsville, Kingsville, TX. <sup>2</sup>University of South Carolina, Columbia, SC.*(No relationships reported)*

Chemotherapy induces a range of severe side effects in cancer patients including nausea, vomiting, and fatigue. Although chemotherapy-induced fatigue is reported in up to 99% of cancer patients, little has been done to elucidate the mechanisms and possible treatments; however we have preliminary evidence that MCP-1 induced inflammation may play a role in the development of fatigue and that the dietary flavonoid quercetin can blunt this effect.

**PURPOSE:** To determine the efficacy of quercetin in reducing MCP-1 and subsequent fatigue after the administration of 5-fluorouracil (5-FU) chemotherapy.

**METHODS:** First, the effect of quercetin on voluntary wheel cage running was assessed using C57BL/6 mice assigned to one of four groups; normal diet-placebo (ND-PLA), normal diet-5-FU (ND-60), quercetin-placebo (Q-PLA), and quercetin-5-FU (Q-60). Mice were given a daily injection of either 60 mg/kg of 5-FU or phosphate buffered saline for five days and their activity was monitored 24 hours per day until 14 days post the initial injection. A second group of mice was used to assess blood following 5-FU. Mice were sacrificed at 5 or 14 d post initial injection.

**RESULTS:** Voluntary wheel running was reduced in both ND-60 and Q-60 as compared to the placebo groups ( $p < 0.05$ ), however, this response was blunted in Q-60 ( $p < 0.05$ ). Quercetin also blocked the 5-FU induced increase in plasma MCP-1 ( $146.5 \pm 22.08$  ng/mL for ND-14d vs.  $59.7 \pm 7.04$  for Q-14d,  $p < 0.001$ ). Both ND-60 and Q-60 had reduced hematocrit and hemoglobin at 5 and 14 days, but the reduction was less severe at 14 days in Q-60 ( $18.11 \pm 1.77$  % Hct for ND-60 vs.  $29.87 \pm 1.12$  for Q-60, and  $6.21 \pm 0.61$  g/dL Hb for ND-14d vs.  $9.68 \pm 0.26$  for Q-14d,  $p < 0.001$ ).

**CONCLUSION:** These results suggest a beneficial role of quercetin not only in reducing MCP-1 and presumably inflammation, but in blunting the severity of common side effects of chemotherapy such as anemia and fatigue.

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**1594 Board #2 MAY 30 2:00 PM - 3:30 PM****The Effect of a Breast Cancer Diagnosis on Physical Activity Attitude and Barriers**Stacy E. Cutrono<sup>1</sup>, Mark Stoutenberg<sup>2</sup>, Arlette Perry, FACSM<sup>1</sup>. <sup>1</sup>University of Miami, Coral Gables, FL. <sup>2</sup>University of Miami, Miller School of Medicine, Miami, FL.*(No relationships reported)*

Breast cancer (BCa) survivorship issues have become more prevalent as improvements in diagnostic measures and treatment have increased. A cancer diagnosis may serve as a teachable moment for the adoption of a healthy lifestyle. Evidence suggests that engagement in regular physical activity has numerous benefits for BCa survivors; yet physical activity levels still remain low.

**PURPOSE:** To assess the change in self-reported attitude toward physical activity and barriers to exercise pre- and post-diagnosis among BCa survivors.

**METHODS:** A web-based survey was developed and distributed to BCa survivors through community-based cancer organizations in South Florida. Respondents were asked to complete the survey pertaining to their physical activity attitudes and behaviors prior to diagnosis, their current physical activity levels, the importance of physical activity in their lives, and limitations to engaging in regular physical activity.

**RESULTS:** A total of forty-three BCa survivors completed the survey. The majority of respondents were between the ages of 50-69 years (61.0%), Caucasian (70.7%), employed (61.0%), and within three years since treatment completion (51.2%). Prior to diagnosis, 58.6% of respondents ranked the importance of physical activity as important or very important compared to 92.5% post-diagnosis. There was a significant improvement in the proportion of survivors who changed their self-reported importance of physical activity from pre- to post-diagnosis ( $p < 0.001$ ). The majority of respondents reported being at least somewhat active pre- and post-diagnosis. The most commonly reported type of activity was aerobic training. Time was the greatest limitation to engaging in regular physical activity both pre- and post-diagnosis.

**CONCLUSIONS:** As indicated by the survey, the majority of BCa survivors in this sample were engaging in regular physical activity pre- and post-diagnosis. There was an increase in the self-reported importance of physical activity post-diagnosis among the BCa survivors, possibly indicating a greater importance of lifestyle factors. Time was reported as the most common activity barrier and future efforts may focus on cognitive and social behavioral training focusing on ways to overcome this and other similar barriers.

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**1595 Board #3 MAY 30 2:00 PM - 3:30 PM****Relationships Between Physical Activity, Social Participation, And Health-related Quality Of Life In Colorectal Cancer Survivors**

Keith M. Thraen-Borowski, Amy Trentham-Dietz, Dorothy Farrar Edwards, Kelli F. Koltyn, Lisa H. Colbert, FACSM. University of Wisconsin-Madison, Madison, WI.

*(No relationships reported)*

**PURPOSE:** To examine the relationships between physical activity (PA), social participation (SP) and health-related quality of life (HQOL) in older, long-term colorectal cancer survivors (CRCS).

**METHODS:** Surveys were mailed to 1,768 male and female CRCS, aged  $\geq 65$  years and at least 5 years post cancer diagnosis, as identified by the WI state cancer registry. Surveys provided information on PA, SP, HQOL, health history and relevant covariates. Analysis of covariance was used to evaluate the cross-sectional relationship between PA and SP with each of the SF-36 subscales, as well as both summary scores (physical component summary score (PCS) and mental health component summary score (MCS)).

**RESULTS:** The final analytic sample consisted of 871 cases, the mean age was  $81.5 \pm 5.8$  yrs (mean $\pm$ SD) and mean time since diagnosis was  $8.2 \pm 1.7$  yrs. After adjustment for relevant covariates, PA, when classified as meeting or not meeting the current recommendation of 150 min/wk of moderate-vigorous activity, was associated with a 5-point higher PCS score ( $p < 0.001$ ), as well as higher physical function, role-physical, pain, general health, vitality, and social function subscale scores, but not MCS scores ( $p = 0.30$ ). SP, classified as "some" vs. "none," was not associated with higher PCS scores ( $p = 0.13$ ), but was associated with a 3-point higher MCS score ( $p = 0.003$ ), as well as higher physical function, role-physical, general health, social function, role-emotional, and mental health subscale scores. Subjects reporting greater amounts of moderate-vigorous intensity PA had significantly higher scores on PCS ( $p < 0.001$ ) than those reporting lower amounts. Participation in greater amounts of light intensity was not significantly associated with higher PCS or MCS scores after adjustment for moderate-vigorous PA ( $p = 0.21$ ;  $p = 0.43$ , respectively). Individuals participating in greater weekly hours of SP had higher PCS and MCS scores ( $p = 0.01$ ;  $p < 0.001$ , respectively) than those participating less.

**CONCLUSIONS:** Results suggest that both PA and SP are associated with greater HQOL in older, long-term colorectal cancer survivors. While PA is related to the physical health of these survivors, SP is related to both physical and mental health.

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1596 Board #4 MAY 30 2:00 PM - 3:30 PM

**Cancer-Related Fatigue Interferes with Walking and Recreational Activities among 287 Older Cancer Patients Receiving Chemotherapy**

Lisa Sprod, Supriya G. Mohile, Luke J. Peppone, Michelle C. Janelins, Gary R. Morrow, Karen M. Mustian. *University of Rochester, Rochester, NY.*  
(No relationships reported)

Cancer-related fatigue (CRF) is hypothesized to impair quality of life by interfering with patients' abilities to perform activities of daily living (ADL).

**PURPOSE:** The purpose of this study is to describe the interference of CRF with ADL in older cancer patients.

**METHODS:** 287 patients (all >65 yrs; M=72 yrs; N=171 female) with mixed cancer diagnoses were assessed on CRF and its interference with ADL 7 days after their first 2 chemotherapy infusions as part of a large nationwide clinical trial conducted by the URCC CCOP Research Base. CRF and interference with ADL were assessed using questions from the Multidimensional Assessment of Fatigue instrument (10-point Likert Scale; 1=Not at all to 10=A great deal). Results are presented as means and standard errors (M+SE).

**RESULTS:** Nearly half (145 of 287) of patients reported CRF at cycle 1 (5.67+0.16) and cycle 2 (5.20+0.17). During cycle 1, 59% of patients reported that CRF interfered with socializing (5.39+0.18), participating in recreational or leisure activities (5.34+0.28), household chores (5.32+0.18), and running errands (5.16+0.20). CRF interfered with walking in 56% (.04+0.20), cooking in 51% (5.17+0.20), bathing in 46% (6.11+0.25), dressing in 45% (6.04+0.26), working in 33% (6.51+1.02) and engaging in sexual activity in 28% (5.35+0.32) of patients. During cycle 2, CRF interfered with household chores in 54% (4.94+0.18), running errands in 53% (5.07+0.20), socializing in 52% (5.11+0.20), walking in 49% (4.73+0.20), participating in recreational or leisure activities in 47% (5.05+0.22), cooking in 44% (4.91+0.21), dressing in 43% (5.91+0.28), bathing in 42% (5.76+0.27), working in 26% (4.94+0.27), and engaging in sexual activity in 27% (4.54+0.28) of patients. CRF was significantly correlated with interference for all ADL at cycles 1 and 2 (all  $p < 0.01$ ).

**CONCLUSION:** CRF interferes with older cancer patients' abilities to perform ADL, such as walking, dressing, bathing, performing household chores, working, running errands, participating in recreational activities and leisure activities, socializing, and engaging in sexual activity while receiving chemotherapy.

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1597 Board #5 MAY 30 2:00 PM - 3:30 PM

**Physical Activity Patterns in Breast Cancer Patients and Survivors - Results from a German Patient Cohort Study**

Karen Steindorf, Christina Huy, Martina E. Schmidt, Alina Vrieling, Jenny Chang-Claude. *German Cancer Research Center (DKFZ), Heidelberg, Germany.*  
(No relationships reported)

Breast cancer is the most frequent type of cancer in women with rising numbers of patients and survivors. The benefits of physical activity (PA) for breast cancer patients are well known, including both physical and psychological effects. Thus, PA is increasingly discussed as concomitant therapy after breast cancer diagnosis and can add to the alleviation of therapy- and disease-related symptoms. However, little is known about PA behaviour in breast cancer patients during the course of the disease.

**PURPOSE:** To describe PA patterns including sports and active transportation in the course of breast cancer and to identify factors associated with these activities.

**METHODS:** The cohort study included 1,067 postmenopausal breast cancer patients from Southwest Germany. We collected quantitative information about walking and bicycling for transportation as well as sports before diagnosis, during therapy and one year after surgery and calculated MET-hours per week (MET=metabolic equivalent). Associations between these activities and clinical, behavioral and social characteristics were analyzed using logistic regression.

**RESULTS:** Median PA decreased significantly during therapy compared to PA before diagnosis from 36 to 14 MET<sup>2</sup>h/week and proportions decreased for walking (89.7% vs. 75.1%), bicycling (56.5% vs. 19.3%) and sports (64.6% vs. 14.8%, all  $p < 0.001$ ). The most frequent PA pattern during therapy was walking without any bicycling and sports (48.7%), followed by a pattern with none of the investigated activities (21.7%). Chemo-/radiotherapy was negatively associated with sports (OR: 0.35 [0.17-0.73]), but positively associated with walking during therapy (OR: 2.08 [1.04-4.15]). Participation in rehabilitation increased the likelihood for bicycling (OR: 1.48 [1.06-2.09]) and sports one year after surgery (OR: 1.88 [1.38-2.58]).

**CONCLUSION:** The results highlight the need for interventions to increase PA after breast cancer diagnosis, in particular for moderate to vigorous activities. Increasing participation in rehabilitation might help to increase the proportion of patients who bicycle and engage in sports.

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1598 Board #6 MAY 30 2:00 PM - 3:30 PM

**Move On: Feasibility Of A Walking Intervention In Colon Cancer Survivors**

Kathleen Y. Wolin, FACS, Casey Fagin, Matthew Mutch. *Washington University School of Medicine St Louis, St Louis, MO.*  
(No relationships reported)

In observational studies of colon cancer survivors, physical activity has been associated with prolonged survival and lower rates of recurrence. Exercise interventions in cancer survivors are often supervised and require regular travel by participants. There is little data on the feasibility of interventions with stepped contact.

**PURPOSE:** To evaluate the feasibility of recruiting colon cancer survivors and effectively delivering an intervention to increase walking delivered through an existing evidence based physical activity intervention paradigm.

**METHODS:** Colon cancer survivors >age 18 with resected new primary stage II or III colon cancer who were at least one month post-adjuvant therapy were recruited to a 12 week phased walking intervention. Participants met with a coach weekly for 4 weeks and walked on their own outside of meetings. In the second phase, lasting 8 weeks, survivors received brief weekly phone calls. Intervention messaging and content was based on an existing evidence-based walking intervention for diabetics. Participants self-reported physical activity and wore accelerometers at baseline and follow-up. The Freedson equation was used to calculate estimated energy expenditure.

**RESULTS:** Surgeons referred 95 potentially eligible patients to the study. 23 were found ineligible, 62 declined and 11 enrolled. Between completion of the baseline assessment and their first intervention visit, three participants dropped-out of the study. Two of whom developed health problems that precluded their participation. Mean estimated energy expenditure at baseline was 1040 and at follow-up was 1552 kcal. 7 participants recorded valid step count data on their accelerometer. Mean step counts increased from 4365 at baseline to 6114 at follow-up. There were no statistically significant changes.

**CONCLUSIONS:** A stepped contact walking intervention can feasibly recruit colon cancer survivors after active treatment and engage them in significant behavior change.

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1599 Board #7 MAY 30 2:00 PM - 3:30 PM

**Exercise Effects on Cancer-Related Symptoms in Breast Cancer Survivors**

Lynette L. Craft<sup>1</sup>, Erik H. Vanlterson<sup>1</sup>, Maura P. Waldron<sup>1</sup>, Mark D. Huffman<sup>1</sup>, Seema A. Khan<sup>1</sup>, Kerry S. Courneya<sup>2</sup>. <sup>1</sup>*Feinberg School of Medicine, Northwestern University, Chicago, IL.* <sup>2</sup>*University of Alberta, Edmonton, AB, Canada.*  
(No relationships reported)

**PURPOSE:** There are over two million breast cancer survivors in the United States. Cancer-related symptoms such as depression, fatigue, and pain can last for years, negatively affecting the survivor's quality of life. Exercise programs provide relief for some cancer-related symptoms. However, researchers have not examined the ability of exercise to "overlap" symptoms and provide simultaneous relief for the commonly occurring symptom cluster of depression, fatigue, and pain in breast cancer survivors.

**METHODS:** Women with early stage breast cancer, who were 6 months-5 years post treatment, non-exercising, and self-reporting moderate symptoms for at least two symptoms of the cluster were enrolled in a pilot randomized controlled trial (RCT). Women were randomized to a standard exercise intervention, an intermittent exercise intervention, or a usual care control group. The exercise interventions consisted of 4-weeks of supervised exercise, followed by 8-weeks of unsupervised, home-based exercise. Assessments were conducted at Baseline, 4, 8, and 12-weeks post entry and included questionnaires, measurements of height, weight, cardiovascular fitness, and cancer-related symptoms.

**RESULTS:** Currently, 25 women have enrolled and most are Caucasian (63%) with Stage II disease (54%). At baseline, women were 52±9 years old, were overweight (Body Mass Index:  $M = 31.5$ ,  $SD = 7.5$ ), and had low fitness ( $VO_{2peak}$ :  $M = 24.6$ ,  $SD = 4.5$ ). They also endorsed relatively high levels of depression (Center for Epidemiologic Studies Depression Scale:  $M = 23.4$ ,  $SD = 8.9$ ), fatigue (Functional Assessment of Cancer Therapy-Fatigue:  $M = 24.3$ ,  $SD = 6.8$ ), and pain (Brief Pain Inventory:  $M = 3.0$ ,  $SD = 2.2$ ). At the completion of the supervised exercise (4 week follow-up), effect sizes [ES] for depression were large in the exercise groups [Standard Exercise Intervention:  $ES = 1.7$ , Intermittent Exercise Intervention:  $ES = 1.4$ ] and medium for the control group [ $ES = 0.5$ ]. Similarly large ES were found among the exercise groups for fatigue, but not for pain.

**CONCLUSION:** Initial data from this pilot RCT suggest that exercise is effective in alleviating cancer-related depression and fatigue among breast cancer survivors experiencing a symptom cluster. However, results are less clear for the effect of exercise on cancer-related pain among these survivors.

**1600** Board #8 MAY 30 2:00 PM - 3:30 PM

**Age-Based Predictions Of HRpeak Overestimate Achieved HRpeak In Cancer Survivors**

G. Stephen Morris, FACSM, Webb A. Smith, Melissa M. Hudson, James G. Gurney, Leslie L. Robison, Kiri K. Ness. *St. Jude Children's Research Hospital, Memphis, TN.*

*(No relationships reported)*

**PURPOSE:** Current guidelines for cancer survivors define exercise training intensity relative to age predicted peak heart rate (HRpeak). Because chemotherapy and radiation are cardiotoxic, we hypothesized that HRpeak predicted by published, age-based equations would not accurately reflect achieved HRpeak in cancer survivors. To test this hypothesis, achieved HRpeaks were compared to HRpeaks estimated by the prediction equations of Inbar (1994); Tanaka (2001), Gellish (2007) and 220-age.

**METHODS:** Adult survivors of childhood cancer enrolled in the St. Jude Children's Research Hospital Lifetime Cohort Study (SJLIFE) completed a cardiopulmonary stress test (CPT). Heart rate (HR), oxygen consumption and respiratory exchange ratio (RER) were measured continuously during a modified Bruce treadmill protocol. Participants who achieved a RER  $\geq$  1.10 during CPT (n = 93) were considered to have achieved maximal exercise exertion. Their achieved HRpeak was compared to the HRpeak predicted by each equation using a Bland-Altman analysis with an acceptable agreement between actual and predicted HR peak defined as a mean bias of  $\pm$  2 SD.

**RESULTS:** Table 1 presents the mean differences between the HRpeak predicted by each equation and the achieved HRpeak ( $\sum$  (HRpeak - achieved HRpeak)/93) and the 95% confidence intervals. In all cases, predicted HRpeak exceeded achieved HRpeak. The Bland-Altman analysis indicates that the 95% limit of agreement between the observed HRpeak exceeded the acceptable level of bias ( $\pm$  2 SD) for all tested prediction equations.

**CONCLUSIONS:** Because the tested equations overestimated achievable HRpeak, their use would underestimate exercise intensity defined relative to estimates of HRpeak.

TABLE 1. Mean difference between predicted HRpeak and achieved HRpeak.

| Method                    | Mean HR difference (BPM) | 95% CI    |
|---------------------------|--------------------------|-----------|
| Tanaka (208-0.7*age)      | 29.4 + 6.2               | 17.0-41.8 |
| Inbar (205.8-0.685 * age) | 27.6 + 6.2               | 15.2-40.0 |
| Gellish (207-0.7*age)     | 28.4 + 6.1               | 16.2-40.6 |
| Age Prediction (220-age)  | 32.9 + 6.2               | 20.5-45.3 |

**1601** Board #9 MAY 30 2:00 PM - 3:30 PM

**Fundamental Measurements Of Body Composition And Heart Rate To Advise Women On Healthy Lifestyle Choices.**

David H. Jones<sup>1</sup>, Melisa Nestore<sup>2</sup>, Sara Henophy<sup>2</sup>, Helen Hu<sup>2</sup>, Jean Boucher, FACSM<sup>3</sup>, Alain S. Comtois<sup>3</sup>, John Keyserlingk<sup>4</sup>. <sup>1</sup>Concordia University, Montreal, QC, Canada. <sup>2</sup>Ville Marie Fitness Wellness Center, Montreal, QC, Canada. <sup>3</sup>Université du Québec à Montréal, Montreal, QC, Canada. <sup>4</sup>Ville Marie Breast and Oncology Center, Montreal, QC, Canada. (Sponsor: Jean Boucher, FACSM)

*(No relationships reported)*

The Ville Marie Breast Centre has established a prevention and early detection program for women at risk of developing breast cancer. A component of this program is to encourage the women to work towards and continue to maintain their ideal body composition. This includes reducing the total amount of body fat and in particular, the total amount of visceral fat which accumulates on the body. Previous work has shown that as a woman's BMI increases, her risk for developing breast cancer also increases. Women that have been diagnosed and had treatment for breast cancer also have a greater risk of recurrence, as their BMI increases. Previous work at the centre has shown that women who have undergone adjuvant therapy tend to have a significantly higher BMI than women who have not undergone treatment for breast cancer.

**PURPOSE:** The goal behind this study was to determine body composition and basic cardiovascular measurements of the women who utilize the wellness services at the Ville Marie women's health centre.

**METHODS:** As part of the standard medical evaluation, a team of kinesiologists performed base line measurements on 4096 patient at The Ville Marie Breast Center. Measurements were obtained on 3400 non oncology female patients and 696 oncology female patients. The data obtained included age, height, weight, BMI, resting heart rate and blood pressure. Additional data was also obtained on lean muscle mass, body fat and waist-to- hip ratio on just over 1000 of the women.

**RESULTS:** The mean age of the oncology patients was 60.1 years (SD  $\pm$  9.2). The mean age of all subjects was 56.3 years (28- 88 years). The mean blood diastole pressure 75 mmHg (SD  $\pm$  9.8) and mean systole pressure was 127 mmHg (SD  $\pm$  17.4). The mean resting heart rate was 73 beats/ min (SD  $\pm$  11.95). The mean height and weight was 161 cm (SD 7.7) and 67 kg (SD  $\pm$  13.5) respectively. The mean Body mass index, BMI was 25.95(SD  $\pm$  5.37).

**CONCLUSION:** The information obtained from these measurements is utilized by the medical team to help direct the women on healthy lifestyle choices which include diet and exercise, as part of the prevention program. The physicians and medical team are able to incorporate the morphological measurements and heart rate and blood pressure values into the patients chart to determine the patient's level of risk.

**B-24 Free Communication/Poster - Cardiovascular I**

MAY 30, 2012 1:00 PM - 6:00 PM

ROOM: Exhibit Hall

**1602** Board #10 MAY 30 3:30 PM - 5:00 PM

**Test-retest-reliability Of Metabolic And Cardiovascular Load During Isokinetic Strength Testing.**

Josefine Weber<sup>1</sup>, Juliane Müller<sup>1</sup>, Christoph Otto<sup>1</sup>, Friederike Scharhag-Rosenberger<sup>2</sup>, Anja Carlssohn<sup>1</sup>, Frank Mayer<sup>1</sup>. <sup>1</sup>Outpatient Clinic University of Potsdam, Potsdam, Germany. <sup>2</sup>University of Applied Science for Prevention and Health Management, Saarbrücken, Germany.

*(No relationships reported)*

Isokinetic strength tests are evident to quantify strength deficits in healthy subjects or patients in physio- or sports therapy. However, the metabolic and cardiovascular load as well as the reliability of these measures during isokinetic strength testing is unknown.

**PURPOSE:** The aim of this study was to analyze the reproducibility of metabolic and cardiovascular measures during isokinetic strength testing of the lower limb.

**METHODS:** 15 healthy subjects (7 f/8 m; 28  $\pm$  5 yrs; 1.75  $\pm$  0.08 m; 72  $\pm$  9 kg; maximum oxygen uptake VO<sub>2max</sub> = 49  $\pm$  10 ml/min/kg) were included. Metabolic (VO<sub>2</sub> [ml/min/kg]) and cardiovascular variables (heart-rate [beats/min]) were measured at the end of an isokinetic test for local muscular endurance (LME; 60sec., leg-extension concentric, 0.3 m/s alternate; Legpress). Reproducibility was evaluated in a test-retest study-design over a period of 14 days (M1, M2). Intraclass correlation coefficient (ICC), Bland and Altman analysis (Bias  $\pm$  LoA) and Test-Retest-Variability (TRV) were calculated. VO<sub>2</sub> and heart-rate was analyzed descriptively (mean  $\pm$  SD).

**RESULTS:** The mean value of pretest for VO<sub>2</sub> was 37.4  $\pm$  3.57 ml/min/kg and for retest 35.4  $\pm$  3.43 ml/min/kg. Heart-rate was 172  $\pm$  10 beats/min in M1 and 170  $\pm$  9 beats/min in M2. ICC was

calculated .86 ( $p < .001$ ) for  $\text{VO}_2$  and .72 ( $p < .008$ ) for heart-rate. Bias for  $\text{VO}_2$  was  $-1.2 \text{ ml/min/kg}$  ( $\pm 5.23 \text{ ml/min/kg}$ ) and for heart-rate  $-0.5 \text{ beats/min}$  ( $\pm 14.3 \text{ beats/min}$ ). TRV was  $6.0 \pm 4.55\%$  for  $\text{VO}_2$  and  $3.29 \pm 2.51\%$  for heart rate.

**CONCLUSIONS:** It can be concluded that a one-minute strength test of the lower extremity elicits reasonable metabolic and cardiovascular reactions in healthy subjects. Both  $\text{VO}_2$  and heart-rate can be measured reliably during isokinetic strength tests for local muscular endurance.

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**1603** Board #11 MAY 30 3:30 PM - 5:00 PM

**Effects of a Single Resistance Training on Cardiovascular Health Indicators**

Huan-Chieh Chen, Shui-Yu Liu, Yi-Ting Su, Sandy S. Hsieh, FACSM. *National Taiwan Normal University, Taipei, Taiwan.*

(No relationships reported)

**PURPOSE:** To investigate the effects of a single resistance training on cardiovascular health indicators.

**METHODS:** Twenty four (24) males who have engaged in resistance exercise up to 6 months or more were recruited in this study. Subjects were divided into three groups with a circular-randomly order according to their maximum leg press strength: 1) high intensity with low repetition group (HL; 90%1RM $\times$ 4) (age:  $22.0 \pm 2.7$  yr, height:  $179.0 \pm 5.8$  cm, weight:  $73.6 \pm 8.3$  kg, BMI:  $22.9 \pm 1.9$ , maximum strength:  $282.0 \pm 97.2$  kg); 2) middle intensity with middle repetition group (MM; 75%1RM $\times$ 10) (age:  $23.3 \pm 2.5$  yr, height:  $175.4 \pm 6.4$  cm, weight:  $69.7 \pm 9.2$  kg, BMI:  $22.6 \pm 2.2$ , maximum strength:  $267.1 \pm 109.0$  kg); and 3) low intensity with high repetition group (LH; 60%1RM $\times$ 15) (age:  $22.6 \pm 2.5$  yr, height:  $174.0 \pm 2.6$  cm, weight:  $69.3 \pm 6.4$  kg, BMI:  $22.9 \pm 1.9$ , maximum strength:  $252.2 \pm 93.1$  kg). The single resistance training protocol included 2 sets (40%1RM) of warm up and 4 sets of the main exercise (leg press) with 2 minutes rest between sets. Blood samples were collected at rest, after warm up and immediately after each main exercise set (1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, and 4<sup>th</sup>). The values of C-reactive protein (CRP), triglycerides (TG), and high density lipoprotein (HDL) were analyzed with a mixed design two-way ANOVA.

**RESULTS:** There were no significant differences among groups for CRP and HDL. However, for TG, the 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> values of LH exercise were significantly higher ( $p < .05$ ) than that of HL exercise ( $137.5 \pm 68.7$  vs.  $77.0 \pm 18.4$ ,  $135.9 \pm 64.6$  vs.  $75.8 \pm 18.8$ ,  $134.1 \pm 59.5$  vs.  $76.8 \pm 21.5$  mg/dL). The consistent trend for within group comparison is that the HDL levels were significantly higher ( $p < .05$ ) for all 3 groups after the 4<sup>th</sup> set as compared to the baseline (HL:  $56.3 \pm 7.3$  vs.  $53.4 \pm 8.4$  mg/dL; MM:  $55.9 \pm 11.9$  vs.  $52.0 \pm 10.2$  mg/dL; LH:  $56.9 \pm 14.7$  vs.  $51.2 \pm 13.1$  mg/dL).

**CONCLUSION:** A single resistance training for those who have been accustomed with regular resistance exercise have acute benefits on cardiovascular health indicators. The rise in blood HDL values has a protective effect on cardiovascular system. Also, different intensities and repetitions of a single resistance training only affect TG in the LH group, but not the values of HDL and CRP.

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**1604** Board #12 MAY 30 3:30 PM - 5:00 PM

**Influence of Temperature on Vascular Adaptation to Muscle Endurance Exercise**

Leland Nielsen<sup>1</sup>, K. K. McCully, FACSM<sup>2</sup>. <sup>1</sup>Lander University, Greenwood, SC. <sup>2</sup>University of Georgia, Athens, GA.

(No relationships reported)

**PURPOSE:** The aim of this study was to determine whether temperature is a factor that influences the magnitude of vascular adaptation to training.

**METHODS:** Using a pretest-posttest design, twenty-two healthy, able-bodied subjects performed endurance-type training of the forearm with one arm in a warm condition and one arm in a cool condition. Subjects trained 4 times per week for 5 weeks. Both arms were submerged in water for 5 minutes with one arm exposed to warm water ( $42\text{-}44^\circ\text{C}$ ) and the other exposed to cool water ( $18\text{-}20^\circ\text{C}$ ). Once the 5-minute bathing period was completed, the corresponding arm was wrapped with either a heating pad or a cold pack. Once wrapped, the 20-minute training session began consisting of full range wrist curls using free-weight dumbbells. The subject was instructed to perform 10 repetitions in one arm over the period of 15 seconds then repeat with the opposite arm. Following this pattern, the subject performed exercise with one arm at a time over the 20-minute session with each arm performing 20 repetitions per minute (400 repetitions per session). The resistance was set to equal 15% of their 1-RM for each arm and progressed as tolerated. The outcome variables measured in each arm included arterial range in the radial artery, peak blood flow, lean tissue mass of the forearm assessed via dual energy x-ray absorptometry (DXA), and forearm strength assessed by a test of one-repetition maximum (1RM).

**RESULTS:** 1-RM strength significantly increased in both the warm ( $13.3 \pm 11.9\%$ , mean  $\pm$  SD) and cool ( $14.8 \pm 12.2\%$ ) conditioned arms ( $p < 0.0001$ ), although no temperature effect was observed ( $p = 0.44$ ). Despite a significant increase in forearm lean tissue mass ( $598 \pm 218.1$  vs.  $609 \pm 219.4$  grams), no difference was seen between temperature conditions ( $p = 0.39$ ). Arterial range in the radial artery did not change from pre to post in either arm ( $p = 0.68$ ). Peak blood flow in the radial artery did not change in either arm with training ( $p = 0.09$ ).

**CONCLUSION:** Increasing muscle temperature did not enhance arterial range or muscular adaptations following endurance training in able-bodied subjects. While people with SCI often have cool limb temperatures, our study suggests that temperature is not an important factor in determining muscle adaptations with training.

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**1605** Board #13 MAY 30 3:30 PM - 5:00 PM

**Handgrip Exercise Training Following Transradial Catheterization Ameliorates Arterial Dysfunction**

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(No relationships reported)

**PURPOSE:** The aim of the present study was to assess radial artery vasodilator function prior to transradial catheterization and again following randomisation to 6 weeks of rehabilitative localized handgrip training or a similar inactive control period.

**METHODS:** Twenty-five subjects undergoing transradial catheterization were recruited and assessed before (Pre) and 6 weeks following (Post) catheterization. Subjects were randomized to either 6 weeks of handgrip exercise training (Exercise,  $n=14$ ) or a similar non-exercise group (Control,  $n=11$ ). Radial artery flow-mediated dilatation (FMD; endothelium- and NO-dependent) and dilation in response to a sublingual dose of glyceryl trinitrate (GTN; endothelium-independent and NO-mediated) were assessed using high-resolution ultrasonography. In a subgroup of subjects ( $n=12$ , 8 Exercise, 4 Control), radial artery blood flow responses to graded upstream brachial artery infusion of acetylcholine (ACh; an endothelial-dependent nitric oxide-dependent vasodilator) and sodium nitroprusside (SNP; an endothelial-independent, nitric oxide-dependent vasodilator) were assessed. Procedures were undertaken 4 weeks prior to, and 6 weeks following catheterization and blood flow assessed as above.

**RESULTS:** FMD was significantly impaired following catheterisation in the Control group ( $7.9 \pm 1.4$  to  $4.5 \pm 0.6\%$ ), but was maintained in the Exercise group ( $6.0 \pm 0.9$  to  $6.6 \pm 0.9\%$ ; pre versus post) ( $P < 0.05$ ). There were no significant differences between the groups or across time for either the ACh or the SNP protocols ( $P > 0.05$ ). Post-hoc t-tests in the Exercise group showed a significant increase from baseline blood flows with all SNP infusions ( $P < 0.05$ ).

**CONCLUSIONS:** Six weeks of localized handgrip exercise training preserved radial artery endothelium-dependent vasodilator function following transradial catheterization. We suggest that exercise training should be considered to enhance radial artery function, prevent possible clinical consequences of catheterization and preserve the viability of the artery for subsequent catheterization or use as a bypass graft.

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**1606** Board #14 MAY 30 3:30 PM - 5:00 PM

**QT Interval Shortening in Long Term Androgenic Anabolic Steroid Users**

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(No relationships reported)

Androgenic anabolic steroid (AAS) abuse is associated with a growing number of cardiac consequences and has been implicated in cardiac electrophysiological changes. However conflicting reports have been published regarding the effect of AAS on rate corrected QT interval (QTc) at rest.

**PURPOSE:** this study aimed to further investigate the effect of AAS on QTc in a cohort of long-term AAS users in whom the effects may be more pronounced.

**METHODS:** A cross sectional independent groups design was used with AAS using resistance athletes ((AS) n=15) compared with a group of non-AAS using, resistance trained, age matched controls ((C) n=15). AS had a significant history of AAS use (18±2 yrs) and both AS and C had >19 year history of resistance training. Participants underwent a resting 12 lead ECG, from which QT interval was calculated and corrected to QTc using the Bazett formula. The main outcome measure was determined as evidence for differences in mean corrected QTc between groups. As previous research had reported both increases and decreases in response to AAS use, a 2-tailed analyses was performed. A secondary outcome was to calculate QTc interval that best differentiated between C and AAS users.

**RESULTS:** QTc was shorter in AS than in C (382.0 ± 21.01 ms versus 409 ± 18.77 ms for AS and C respectively p<0.001). Chi squared analyses revealed a greater incidence of QTc< 380ms in AS versus C p<0.01, specificity 93% sensitivity 60%.

**CONCLUSION:** The results support previous findings that AAS use causes a reduction in QTc which may be due to the effect of AAS on cardiac ion channels. Additionally the specificity and sensitivity of QTc in differentiating between AS and C in our sample is lower than that reported previously. This may be due to a number of factors e.g. increasing age countering the QTc shortening effects of long term AAS abuse.

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**1607** Board #15 MAY 30 3:30 PM - 5:00 PM

**The Post Exercise Blood Pressure Response of Two Popular Kettlebell Routines**

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(No relationships reported)

Hypertension (HTN) is a primary risk factor for cardiovascular disease (CVD). Exercise provides a highly beneficial post exercise hypotensive response (PEH) for healthy and hypertensive adults. Currently, ACSM recommends exercise that uses "large muscle groups, can be maintained continuously, and is rhythmical and aerobic in nature" to obtain the benefits of PEH (Pescatello, 2004). Kettlebell exercise meets these recommendations. A kettlebell is a cannonball shaped weight with a handle that is lifted using ballistic, Olympic lifting style, full-body movements.

**PURPOSE:** To determine if kettlebell exercise produces a PEH response that is statistically and clinically significant in a pre-hypertensive and hypertensive resistance trained male population.

**METHODS:** Eight resistance trained pre-hypertensive and hypertensive males (SBP = 133 ± 7 mmHg; DBP = 82 ± 6 mmHg; 29 ± 6 yrs) performed a randomized cross-over designed study which included 3 sets of a 6 exercise circuit (CIR), 12 minutes of continuous two-handed swings (THS), and a resting control (CON). Resting blood pressure (BP) and heart rate (HR) measurements were recorded before each trial. Participants recovered for 20 minutes after exercise before post-exercise BP and HR were recorded. Measurements occurred every 30 minutes for 120 minutes. Statistical significance was determined by two-way ANOVA with repeated measures and Tukey post-hoc analysis. Post-exercise BP responses were classified as clinical significance based on SBP <130 mmHg or DBP < 80 mm Hg.

**RESULTS:** Both CIR and THS averaged statistically significant decreases in SBP post-exercise compared to pre-exercise values (-7.2 ± 1.2 and -7.1 ± 1.5 mmHg respectively, p<0.05). All post-exercise SBP measurements were clinically significant for CIR and for THS at minute 0, 60, 90, & 120. A clinically significant decrease in DBP post-exercise compared to rest occurred at minute 30 and 60 for CIR. Heart rate was significantly elevated above CON during minute 0 for CIR and THS (23 ± 4.7 and 21 ± 4.7 bpm respectively, p<0.001).

**CONCLUSIONS:** The results indicate that kettlebell exercise is effective at producing an acute decrease in post-exercise BP in pre-hypertensive or hypertensive resistance trained males. The magnitude of the decrease in post-exercise blood pressure is clinically significant.

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**1608** Board #16 MAY 30 3:30 PM - 5:00 PM

**Cardiorespiratory Responses and Excess Postexercise Oxygen Consumption from Kettlebell Exercise**

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(No relationships reported)

Kettlebell exercises appear to produce considerable cardiovascular stress, however, only one peer-review article exists examining effects of acute kettlebell exercise on cardiovascular and metabolic stress without standardized number of repetitions.

**PURPOSE:** To determine the cardiovascular responses and oxygen costs during kettlebell circuit training as well as recovery (excess post-exercise oxygen consumption, EPOC) using a standardized protocol. It was hypothesized that kettlebells would elicit substantial increases in heart rate and blood pressure responses as well as a moderate oxygen cost during kettlebell circuit training and caloric expenditure during and following exercise.

**METHODS:** Five males (24.6±5.59 y) and 5 females (21.6±2.51 y) completed a preliminary session to determine VO<sub>2</sub> max, body composition, and kettlebell loading (based upon ability to complete presses) and to become familiarized with the kettlebell exercises. Subject completed a subsequent kettlebell session at least one week following the preliminary session, and consumed a liquid meal (Ensure™) two hours prior to the onset of exercise. The kettlebell session included 2 circuits of 4 exercises: two-arm swing, one-arm pull, around the world, and overhead press. All movements were timed such that each subject completed a standardized number of movements across the session with 1:1 exercise/rest intervals of 45s and 2 min rest between circuits for a total session time of 17 minutes and 30 seconds.

**RESULTS:** From rest to peak exercise, there was a significant increase in heart rate (69.6±3.43 to 148.3±21.99 b/min), systolic blood pressure (117.7±2.62 to 141.4±16.96 mmHg), mean arterial pressure (90.15±1.48 to 114.25±14.52 mmHg), and VO<sub>2</sub> (0.22±0.01 to 1.29±0.63 L/min). Rating of perceived exertion (RPE, 15 pt. scale) increased significantly during exercise to peak at 9.8±1.68. Total caloric expenditure during exercise was 93.65±35 kcal. EPOC was 3.74±2.16 L. Total caloric expenditure for exercise and recovery was 112.36±43.1 kcal.

**CONCLUSIONS:** Using the loadig protocol from the present study, data suggest that kettlebell exercise produces significant cardiovascular stress with a low to moderate metabolic cost.

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**1609** Board #17 MAY 30 3:30 PM - 5:00 PM

**Impact of Cold Exposure With Concurrent Isometric Handgrip Exercise on Wave Reflection and Heart Rate Variability**

Marcos A. Sanchez-Gonzalez, Alexei Wong, Andrew P. Koutnik, Katherine J. Ramirez, Song Y. Park, Arturo Figueroa. *The Florida State University, Tallahassee, FL.* (Sponsor: Bo Fernhall, FACSM)

(No relationships reported)

The incidence of adverse cardiovascular events such as myocardial infarction and arrhythmias peaks during winter. Cold may exacerbate adverse cardiovascular events in susceptible individuals performing physical activity.

**PURPOSE:** To examine the effect of cold and concurrent isometric handgrip exercise (IHG) on aortic mean pressure (aMAP), wave reflection, and cardiac autonomic function. We hypothesized that cold with IHG would evoke a greater increase in aMAP, augmentation index (AIx), and decrease heart rate variability (HRV) than IHG in room temperature.

**METHODS:** Twenty healthy men (23 ± 3 y) were randomized to assume the supine position for 30 min in an environmental chamber at cold (4°C) or temperate (24°C, temp) trials. Radial waveforms and HRV were obtained by applanation tonometry and HR monitor respectively. After resting measurements (RES), subjects performed a 3 min IHG (30% MVC) followed by a 3 min recovery period (REC).

**RESULTS:** At RES, aMAP and AIx were higher (P<.01) in the cold vs. the temp trial while normalized low frequency (nLF) and high frequency (nHF) were not different between trials. During IHG, AIx, aMAP, and nLF were increased (P<.01), while nHF was decreased (P<.01) in both trials; but aAIx was higher in the cold vs. temp. During REC, aMAP and aAIx remained elevated (P<.05) in the cold vs. temp. The nLF was lower (~.08 ms) and nHF was higher (~.10 ms, vagal rebound) than RES in the temp trial compared to a full REC of nLF and nHF in the cold.

**CONCLUSIONS:** cold evokes an additional increase in aortic wave reflection during and after acute exercise. Cold may attenuate cardiac vagal reactivation after acute exercise. Research is warranted to evaluate the effects of cold and exercise in populations at cardiovascular risk.

| ab vs COLD<br>cd vs RES | COLD      |            |           | TEMP      |            |             |
|-------------------------|-----------|------------|-----------|-----------|------------|-------------|
|                         | RES       | IHG        | REC       | RES       | IHG        | REC         |
| AMAP (mmHg)             | 90 ± 2    | 110 ± 3d   | 98 ± 2c   | 75 ± 3b   | 107 ± 4d   | 81 ± 2ac    |
| Alx (%)                 | 11 ± 3    | 24 ± 2d    | 17 ± 3c   | 0 ± 3b    | 15 ± 3bd   | 6 ± 3ac     |
| nHF                     | .44 ± .06 | .35 ± .03d | .43 ± .03 | .45 ± .33 | .38 ± .04d | .55 ± .03ac |
| nLF                     | .54 ± .03 | .64 ± .03d | .55 ± .03 | .53 ± .03 | .61 ± .04d | .45 ± .03ac |

**1610 Board #18 MAY 30 3:30 PM - 5:00 PM**  
**The Effect of Bikram Yoga on Vascular Function**

Stacy D. Hunter. *Pure Action, Inc., Austin, TX.*  
*(No relationships reported)*

Stacy D. Hunter, Mandeep Dhindsa, Emily Cunningham, Takashi Tarumi, Mohammed Alkatan, Nantinee Nualnim, and Hirofumi Tanaka, FACSM. The University of Texas at Austin. Austin, TX

Bikram yoga is a trademarked form of hatha yoga in which a series of 26 yoga postures are performed in a heated, humidified environment over a 90-minute period. The 90-minute session consists of pranayama (breathing), and standing, balancing, strengthening, and stretching asanas (postures) all performed in a sauna-like environment. Although this highly controlled style of Bikram yoga provides an optimal choice for interventional research studies, few studies have attempted to elucidate the health benefits associated with Bikram yoga.

**PURPOSE:** To determine the effects of Bikram yoga on key vascular functions and metabolic risk factors.

**METHODS:** 25 obese (42±12 yrs) and 27 lean (34±12 yrs) sedentary adults were studied before and after an 8-week Bikram yoga intervention. Subjects attended 3 90-minute Bikram yoga classes per week (24 sessions). During each class, a series of 26 postures were performed to scripted instruction in a room heated to 105° F with 60% relative humidity.

**RESULTS:** Body mass, body fat (via DEXA), systolic blood pressure, and total cholesterol were greater (p<0.05) in obese than in lean subjects. After the intervention period, there were no changes in body mass, body fat, or blood pressure, but trunk flexibility (via sit-and-reach test) increased in both groups (p<0.05). Serum concentrations of glucose, insulin, lipids, and lipoprotein did not change. Quality of life as assessed by SF-36 questionnaire improved after 8 weeks (p<0.05). No changes in measures of central arterial stiffness (aortic pulse wave velocity and carotid artery compliance) were observed after the yoga intervention. An index of endothelium-dependent vasodilation (brachial artery flow-mediated dilation) and glucose area under the curve (in oral glucose tolerance test) tended to decrease (p=0.08 and 0.07, respectively) in obese but not in lean adults.

**CONCLUSIONS:** Even though Bikram yoga was efficacious in improving quality of life and flexibility, it does not appear to improve arterial stiffness, endothelial function, or glucose tolerance in either lean or obese subjects.

**1611 Board #19 MAY 30 3:30 PM - 5:00 PM**  
**Cardiac Autonomic Control During Alternate Nostril Breathing at a Slow Breathing Rate**

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*(No relationships reported)*

Alternate nostril breathing (ANB) has been shown to enhance autonomic control of the heart by increasing vagal modulation, but there is little information on autonomic control during ANB at slow breathing rates.

**PURPOSE:** To examine cardiac autonomic modulation during ANB at a slow rate and to compare the effects of ANB to that of paced breathing (PB) at the same respiratory rate.

**METHODS:** Twenty healthy individuals (22.3 ± 2.9 yr) with no prior experience with ANB engaged in 30 min of both ANB and PB at a breathing rate of 5 breaths/min which were preceded by 5 minutes of normal breathing (PRE). Mean arterial pressure (MAP) and an electrocardiogram (EKG) were collected during all conditions and the EKG was evaluated for mean RR interval and heart rate variability (HRV) indices. HRV was reported as spectral power in the total (TP), low- (LF), and high-frequency (HF) ranges and were natural log (ln) transformed. Analysis of covariance (ANCOVA) using sex as a covariate was used to examine differences in the variables between conditions.

**RESULTS:** ANCOVA revealed differences in all HRV indices between the conditions (Table 1). Post-hoc analysis found that lnTP, lnLF/lnHF, and normalized LF (LFNU) were greater during PB and ANB compared to PRE. Conversely, normalized HF (HFNU) was lower during PB and ANB compared to PRE. There were no differences in MAP or mean RR interval between conditions.

**CONCLUSION:** Both ANB and PB at 5 breaths/min resulted in decreased parasympathetic and/or increased sympathetic control of the heart.

Table 1. Data are mean ± SEM.

|              | PRE          | PB           | ANB           | P-value |
|--------------|--------------|--------------|---------------|---------|
| lnTP (ms2)   | 8.51 ± 0.12  | 9.32 ± 0.15* | 9.10 ± 0.13*  | 0.026   |
| lnLF (ms2)   | 7.51 ± 0.13  | 9.10 ± 0.16* | 8.78 ± 0.16*† | <0.001  |
| lnHF (ms2)   | 6.78 ± 0.17  | 6.32 ± 0.21  | 6.39 ± 0.15   | 0.015   |
| lnLF/lnHF    | 1.12 ± 0.02  | 1.46 ± 0.04* | 1.39 ± 0.03*  | <0.001  |
| LFNU (%)     | 66.5 ± 2.8   | 93.0 ± 1.0*  | 89.3 ± 2.2*   | <0.001  |
| HFNU (%)     | 33.5 ± 2.8   | 7.0 ± 1.0*   | 10.7 ± 2.2*   | <0.001  |
| Mean RR (ms) | 819.3 ± 17.5 | 858.1 ± 20.5 | 815.4 ± 18.7  | 0.064   |
| MAP (mmHg)   | 85.8 ± 1.7   | 85.6 ± 1.7   | 88.5 ± 2.0    | 0.127   |

\* p<0.05 vs. PRE; † p<0.05 vs. PB

**1612 Board #20 MAY 30 3:30 PM - 5:00 PM**  
**Influence of Alternate Nostril and Paced Breathing on Cardiac Autonomic Balance**

Dante Andres, Shreya Ghiya, Matthew Lee, FACSM, M. Dot Fullwood. *San Francisco State University, San Francisco, CA.* (Sponsor: Marialice Kern, FACSM)  
*(No relationships reported)*

Alternate nostril breathing (ANB) has been shown to alter autonomic control of the heart, but it is unclear if these changes are due to ANB itself or due solely to the change in breathing rate.

**PURPOSE:** To examine cardiac autonomic modulation during ANB and to compare the effects of ANB on autonomic balance to that of paced breathing (PB) at the same respiratory rate.

**METHODS:** Ten healthy individuals (23.4 ± 1.9 yr) with no prior experience with ANB engaged in 10 min of both ANB and PB at a breathing rate of 12 breaths/min which were preceded by 5 minutes of normal breathing (PRE). An electrocardiogram (EKG) was collected during all conditions and the EKG was evaluated for mean RR interval and heart rate variability (HRV)

indices. HRV was reported as spectral power in the low- (LF; 0.04-0.15 Hz), and high-frequency (HF; 0.15-0.40 Hz) ranges and were natural log (ln) transformed. Analysis of variance (ANOVA) was used to examine differences in the variables between conditions.

**RESULTS:** Data are presented in Table 1. ANOVA revealed that lnLF, lnLF/lnHF, and normalized LF (LFNU) were lower during ANB and PB compared to PRE. Additionally, normalized HF (HFNU) was greater during ANB and PB compared to PRE. Lastly, lnLF and mean RR interval were lowest during PB.

**CONCLUSION:** Both ANB and PB at 12 breaths/min resulted in increased vagal modulation of the heart compared to normal breathing. These data suggests that PB has a similar effect on cardiac autonomic balance as ANB when breathing rate is the same.

Table 1. Data are mean ± SEM.

|              | PRE        | ANB         | PB          | P-value |
|--------------|------------|-------------|-------------|---------|
| lnLF (ms2)   | 7.58±0.48  | 6.49±0.27*† | 6.04±0.26*  | 0.016   |
| lnHF (ms2)   | 6.70 ±0.46 | 7.10±0.33   | 6.77±0.37   | 0.400   |
| lnLF/lnHF    | 1.12±0.07  | 0.92±0.03*  | 0.91±0.05*  | 0.006   |
| LFNU (%)     | 63.0±7.3   | 36.7±5.4*   | 35.1±7.2*   | 0.004   |
| HFNU (%)     | 37.0±7.3   | 63.3±5.4*   | 65.0±7.2*   | 0.004   |
| Mean RR (ms) | 872.6±75.3 | 835.3±55.6† | 761.3±49.6* | 0.043   |

\* p<0.05 vs. PRE; † p<0.05 vs. PB

**1613 Board #21 MAY 30 3:30 PM - 5:00 PM**

**Influence of Alternate Nostril Breathing on Heart Rate Variability in Non-Practitioners of Yogic Breathing**

Clarence M. Lee, Shreya Ghiya. *San Francisco State University, San Francisco, CA.* (Sponsor: Marialice Kern, FACSM)

(No relationships reported)

Although chronic alternate nostril breathing (ANB) has been shown to increase vagal modulation, there is no information on the immediate effects of ANB on autonomic control compared to paced breathing (PB) at the same rate.

**PURPOSE:** To examine cardiac autonomic modulation, as assessed by heart rate variability (HRV), following ANB in comparison to that following PB.

**METHODS:** Twenty individuals (age: 22.3 ± 2.9 yr) with no prior experience with ANB engaged in 30 min of both ANB and PB in a randomly assigned order. ANB and PB were preceded and followed by 5 min of normal breathing (PRE, Post-ANB, and Post-PB, respectively). An electrocardiogram was recorded during all conditions for HRV analysis, along with mean arterial pressure (MAP). HRV was reported as spectral power in the total (TP), low- (LF), and high-frequency (HF) ranges and were natural log (ln) transformed. Analysis of covariance (ANCOVA) using sex as a covariate was used to examine differences in variables between conditions and a significance level of 0.05 was used for all tests.

**RESULTS:** Data are presented in Table 1. The ANCOVA revealed lnTP, lnLF and lnHF were greater during both Post-ANB and Post-PB compared to PRE. The ANCOVA also revealed that there were differences in the mean RR interval between conditions (p < 0.05), although post-hoc tests were not significant. lnLF/lnHF and MAP did not significantly differ between conditions.

**CONCLUSION:** These data suggest that there was an increase in cardiac autonomic modulation following ANB and PB without a shift in autonomic balance. To our knowledge, this is the first study to investigate the autonomic effects of ANB in this population and to compare the effects of ANB and PB at the same breathing rate.

Table 1. Data are mean ± SEM.

|              | PRE         | Post-ANB     | Post-PB      |
|--------------|-------------|--------------|--------------|
| Mean RR (ms) | 821.1±22.2  | 843.3±28.3   | 852.9±38.4   |
| lnTP (ms2)   | 8.51 ± 0.14 | 9.51 ± 0.20* | 9.75 ± 0.22* |
| lnLF (ms2)   | 7.57 ± 0.18 | 8.46 ± 0.14* | 8.69 ± 0.22* |
| lnHF (ms2)   | 6.62 ± 0.21 | 7.96 ± 0.28* | 8.38 ± 0.30* |
| lnLF/lnHF    | 1.15 ± 0.03 | 1.07 ± 0.03  | 1.05 ± 0.03  |
| MAP (mmHg)   | 85.8 ± 1.7  | 87.5 ± 1.8   | 85.3 ± 2.3   |

\* p < 0.05 vs. PRE

**1614 Board #22 MAY 30 3:30 PM - 5:00 PM**

**The Effect Of Mild Exercise On Circulatory Responses During Simulated Aircraft Cabin Hypoxia And Dehydration**

Steve P. Hunter<sup>1</sup>, Gary Kitchen<sup>1</sup>, David P. Summers<sup>2</sup>. <sup>1</sup>*London South Bank University, London, United Kingdom.* <sup>2</sup>*Kings College London, London, United Kingdom.*

(No relationships reported)

**INTRODUCTION:** The incidence of a deep vein thrombosis or pulmonary embolism is increased with flight time over 6 hours (Lapostolle et al 2001). Immobilization PiO2 and lower ambient humidity encountered in the aircraft cabin are associated with hypohydration, hypovolaemia, increased blood viscosity, and reduced venous blood flow in the legs. (Greenleaf et al 2004). Schiffer et al (2005) stated mild exercise performed for 3 mins every 15 mins did not protect against DVT.

**PURPOSE:** To evaluate the effect of intermittent mild dorsi-plantar flexion exercise on circulatory responses during protracted sitting in a simulated aircraft cabin environment

**METHODS:** Six healthy male subjects participated in this study (age:21.2±2.2y); Trials were allocated by systematic rotation. Prior to each trial subjects were hypohydrated until they lost 0.3-0.5kg of body mass. Each trial required the subjects to breath 15% inspired oxygen whilst sitting and for 40 minutes. Blood velocity was measured at the femoral artery for a 1- minute period every 5 minutes. In the exercise trial 1-minute of ankle plantar flexion was carried out every 10 minutes.

**RESULTS:** Normalised peak femoral artery blood velocity (BV) was significantly higher immediately post ankle plantar flexion in the exercise trial (1.09±0.06 vs 0.83±0.13 p=0.04). This tendency was maintained across the 4 exercise bouts but had disappeared 5 minutes post exercise. Evidence of a cumulative effect of exercise on blood velocity was not seen. Heart rate (HR, bpm) was significantly elevated following exercise compared to rest trial (84.3±8.2 vs 74.3± 7.4bpm. p=0.002) and this difference was maintained 5 minutes post exercise (75.6±9.5 vs 71.9±8.0 bpm. p=0.043). Systolic blood pressure showed no significant differences immediately following exercise (137.9±14.5 vs 117.6±13.5 p=0.07).

**CONCLUSION:** Intermittent plantar flexion exercise elevated HR, SBP and peak BV significantly immediately post exercise. Elevation in HR but not in BV 5-minutes post exercise was seen. BV measured at the femoral artery may not be sensitive enough to determine peripheral short-term BV responses. Future studies should include measures of microcirculation and tissue swelling to determine the potential protective circulatory benefits of this form of exercise, or use more intense/frequent exercise.

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1615 Board #23 MAY 30 3:30 PM - 5:00 PM

**Impact of Air Travel and Marathon Running on Markers of Thrombotic and Vascular Risk in Endurance Athletes**

Beth A. Parker<sup>1</sup>, Amanda L. Augeri<sup>1</sup>, Jeffrey A. Capizzi<sup>1</sup>, Kevin D. Ballard<sup>2</sup>, Brian R. Kupchak<sup>2</sup>, Peter Kriz<sup>3</sup>, Christopher Troyanos<sup>4</sup>, Pierre A. D'Hemecourt, FACSM<sup>4</sup>, Paul D. Thompson, FACSM<sup>1</sup>. <sup>1</sup>Hartford Hospital, Hartford, CT. <sup>2</sup>University of Connecticut, Storrs, CT. <sup>3</sup>Center for Sports Medicine, East Providence, RI. <sup>4</sup>Children's Hospital, Boston, MA.

(No relationships reported)

**PURPOSE:** D-dimer and p-selectin are markers of venous thrombotic risk and elevated p-selectin has been associated with increased cardiovascular events. We examined the effects of exercise and air travel on markers of vascular risk in marathon runners.

**METHODS:** Forty-one adults participating in the 114th Boston Marathon (April 19, 2010) were divided into travel (n=23) and non-travel "control" (n=18) groups based on whether they lived > 4 hr plane flight or < 2 hr car trip from Boston. Subjects provided venous blood samples the day before (PRE), immediately after (FINISH), and after returning home the day after the marathon (POST). Blood was analyzed for soluble D-dimer and p-selectin.

**RESULTS:** D-dimer increased more PRE to FINISH (142±83 to 387±196 ng/mL) in travel than in control subjects (85±26 to 233±95 ng/mL; p=0.02 for comparison). Moreover, 6 travel vs. 0 control subjects had d-dimer values >500 ng/mL, the clinical threshold for excluding venous thrombosis (p = 0.03 for Fisher's exact test). P-selectin increased with exercise (p < 0.01) regardless of travel (p = 0.09), but age was related to p-selectin (p = 0.01) such that older subjects exhibited higher p-selectin values PRE (r<sup>2</sup> = 0.14; p = 0.02), and FINISH (r<sup>2</sup> = 0.16, p=0.01).

**CONCLUSIONS:** These results demonstrate that the combination of exercise and travel increases venous and arterial thrombotic risk. Moreover, resting and post-exercise p-selectin levels are higher with age. These results may explain reports of venous thrombosis with air travel after athletic events as well as reports of cardiac events in older individuals running marathons.

Research supported by ACSM Foundation Research Endowment Grant (Parker).

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1616 Board #24 MAY 30 3:30 PM - 5:00 PM

**One Week of Swimming Training Influences Resting Heart Rate Variability in Young Swimmers**

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(No relationships reported)

Researches have been insufficient to generate a sustained relationship between Heart Rate Variability (HRV) changes, an indirect measure of autonomic control, and the training process.

**PURPOSE:** to investigate the effect of 1-wk of swim training on young swimmers HRV parameters at rest.

**METHODS:** 12 swimmers (7 female: 13±.3 yrs, 47±6.1 kg; 5 male: 14±.6 yrs, 48± 6.4 kg) swam an incremental maximal step test (2x200 m front crawl) and undertook HRV recordings at the 1st (M1) and 6th (M3) days of a training week and at the 3rd day (M2) for HRV also. A 5-min R-R interval (RR) data was collected, in supine position under controlled breathing, using Polar RS800™ and processed by HRV Analysis software. Time and frequency domain analysis gave: heart rate, std. deviation (dv.) of normal RR intervals (SDRR), square root of the mean of the sum of the squares of differences between adjacent NN interval (RMSSD), number of interval differences of successive NN intervals greater than 50 ms (NN50), percent of NN50 (pNN50), std. dv. of the instantaneous beat-to-beat variability of data (SD1), and std. dv. of the continuous long-term variability (SD2). Very low (VLF; .003 - .04 Hz), low (LF; .04 - .15 Hz), and high (HF; .15 - .4 Hz) frequency bands, were analyzed in absolute (ms<sup>2</sup>), percentage (%) and normalized units (nu) power. LF/HF ratio was calculated. T test and Wilcoxon tests were used (p<.05).

**RESULTS:** In females, RR rose from M1 to M3 (.8±.1 / .9±.1) and from M2 (.8±.1) to M3. pNN50 augmented from M2 to M3 (22±16 / 38±17). HF% increased from M1 to M2 (33±13 / 25±12) and HFnu from M1 to M3 (42±15 / 59±11). LFnu (59±15 / 41±11) and LF/HF ratio (1.7±.1 / .7±.3) declined from M1 to M3. The lower time performed on the 2nd 200 m rep from M1 to M3 (171±18 / 167±16 s) came with elevated swimming speed (1.18±.1 / 1.2±.1 m.s<sup>-1</sup>) and percent of 200 m race swimming speed (94±2 / 96±3 %). In males, pNN50 declined from M2 to M3 (33±13 / 30±11).

**CONCLUSION:** Training seems to be the main determinant of increases on HRV time domain indexes. Frequency domain variations, suggesting an increased parasympathetic and suppressed sympathetic modulations, occurred only in females. The predominance of vagal influence may be associated with the higher performance observed after 1-wk of swim training. Further studies are needed to determine how can these disturbances be useful in training methodology.

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1617 Board #25 MAY 30 3:30 PM - 5:00 PM

**The Link Between Physical Activity, Heart Rate Variability and Bone Mineral Content in Women**

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(No relationships reported)

Studies have demonstrated that cardiovascular disease (CVD) and mortality are associated with reduced bone mineral content (BMC) and bone fractures. Heart rate variability (HRV) has been considered a strong predictor of increased cardiac mortality. However, little is known about the link between HRV and BMC in woman.

**METHODS:** HRV parameters were investigated in the supine and standing positions in 48 healthy females (20,6 years ± 1.25). Several anthropometric measurements were taken, including: height (158,98 cm ± 5,92), body mass (59,6 ± 8,5 kg), and BMI (23,68 kg/m<sup>2</sup> ± 3,1). HRV was analysed using the time domain, frequency domain and Poincaré plot analysis. Dual-energy x-ray absorptiometry (DEXA) was used to obtain the participants body bone mineral content (BMC). Statistical analysis included the determination of the Pearson correlation coefficient for the normal distributed data and Spearman correlation coefficient for non-normal distributed data sets. The strength of the correlations coefficients were defined as weak (0.1 to 0.2), moderate (0.3 to 0.4) and strong (>0.5). A p-value of <0.05 was considered statistically significant.

**RESULTS:** Associations were found between BMC and HRV. A statistically significant moderate positive correlation was found between standing heart rate (HR) and leg BMC (p=0.025) as well as standing HR and total BMC (p=0.033). Significant moderate negative correlations were found between: (a) Mean RR (standing) and BMC of the leg (p=0.019), trunk (p=0.028) and total BMC (p=0.018); (b) HFms<sup>2</sup> (standing) and leg BMC (p=0.021). A weak negative correlation was observed between HFms<sup>2</sup> (standing) and trunk BMC (p=0.045).

**CONCLUSION:** Several associations were found between BMC and the standing HRV measurements. Supine heart rate is regulated primarily by the parasympathetic branch of the ANS, while the response to standing is regulated by the withdrawal of the parasympathetic and increase of the sympathetic tone. These results support the fact that increased BMC and responsiveness to an orthostatic challenge may be found in the more active and fit individuals. However, further studies are necessary to define the relationship between CVD risk factors, bone mineral content and osteoporosis, more specifically and to understand the complex interaction between these risk factors.

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1618 Board #26 MAY 30 3:30 PM - 5:00 PM

**Sex Differences in Blood Pressure Variability and Baroreflex Sensitivity Following 8 Weeks of Endurance Training**

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(No relationships reported)

**INTRODUCTION:** Blood pressure variability (BPV) is associated with poor cardiovascular outcome. The low frequency component of the BPV measurement (LF-BPV) is used as an index of sympathetic modulation and baroreceptor sensitivity (BRS) is an indicator of parasympathetic control. Since both parasympathetic and sympathetic modulation is also affected by intense physical exertion, the response to physical exertion may provide further insight.

**PURPOSE:** To determine if there are sex specific responses in BPV and BRS before and after a maximal exercise bout and the effect of an 8 week endurance exercise intervention on these responses.

**METHODS:** Baseline and post training measurements were obtained in 58 previously sedentary subjects (30 females and 28 males). BPV measurements were assessed using finger plethysmography, during paced breathing in a supine position. The 8 week endurance training program consisted of 30-60 min of endurance exercise at 60-90% of HR<sub>max</sub> 3 times per week. Pre-

and post-intervention values were compared between sexes using a repeated measures (2x2) ANOVA. If data were not normally distributed, they were log transformed before statistical analyses.

**RESULTS:** Acute exercise increased LF-BPV significantly both pre and post training ( $p=0.025$  and  $0.039$ , respectively) in women ( $5.31\pm 0.71$  to  $8.23\pm 1.34$  pre training and from  $4.83\pm 0.75$  to  $7.73\pm 0.91$  post training) but not in men. Men had significantly higher baseline values of LF-BPV compared to women ( $p=0.013$  and  $0.020$ , pre and post training, respectively) but LF-BPV did not significantly change with an acute bout of exercise either pre ( $10.16\pm 1.90$  to  $8.02\pm 1.40$ ) or post ( $8.96\pm 1.64$  to  $9.11\pm 1.36$ ) training in men. Exercise training also did not significantly change resting or post exercise levels of LF-BPV. However, exercise training increased ( $p=.038$ ) the reduction in BRS in response to the acute exercise bout in men ( $-9.40\pm 3.30$  to  $-12.86\pm 1.69$ ) but not in women.

**CONCLUSION:** Acute maximal exercise increases sympathetic modulation in females to values closer to those of males, but this effect is not changed with training. With training, men, but not women, increased vagal withdrawal in response to acute exercise. The impact of these sex differences in autonomic control on cardiovascular risk needs further investigation.

**1619 Board #27 MAY 30 3:30 PM - 5:00 PM**

**Effects Of Sprint Interval And Traditional Endurance Training On Heart Rate Recovery In Obese Children**

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(No relationships reported)

Heart-rate recovery after maximal graded exercise test (HRR) has been identified as a strong predictor of cardiovascular mortality in adults. Previous studies have found a positive association between adiposity and reduced HRR, which suggests cardiovascular autonomic dysfunction. However, the differential effects of sprint interval training (ST) and endurance training (ET) on HRR have been overlooked in obese children.

**PURPOSE:** The main aim of this study was to compare the effects of ST and ET on HRR in obese children.

**METHODS:** Thirty obese children aged  $10 \pm 0.8$  years were randomly assigned into either ST or ET group. The training program was comprised of two exercise sessions per week for 12 weeks. The ST group performed 3-6 sets of 1-minute running exercise at the VO<sub>2</sub> peak velocity (vVO<sub>2</sub>) interspersed by 3-minute rest intervals. The ET group performed 30 to 60-minute running sessions at 80% of the VO<sub>2</sub> peak. At baseline and after the intervention, a maximal graded exercise test was performed to determine VO<sub>2</sub> peak. Furthermore, HRR at the first minute ( $\Delta$ HRR1) and second minute ( $\Delta$ HRR2) were assessed following the exercise test.

**RESULTS:** Both groups equally and significantly improved HHR (Table 1). Additionally, VO<sub>2</sub> peak and time-to-exhaustion were improved in both ST (delta changes:  $4.8 \pm 1.7\%$ ,  $1.8 \pm 0.5\%$ , respectively;  $p<0.05$ ) and ET groups (delta changes:  $4.6 \pm 0.9\%$ ,  $1.8 \pm 0.2\%$ , respectively;  $p<0.05$ ).

**CONCLUSIONS:** ET and ST equally improved HHR after exercise in obese children, suggesting that the both types of exercise training are able to improve autonomic function in obese children. Furthermore, classical cardiovascular adaptations to exercise training were improved at a similar extent following ST and ET training programs.

Table 1. Effect of a 12-week sprint (ST) vs endurance training (ET) program on HRR in obese children

|               | ST              |                   | ET              |                   |
|---------------|-----------------|-------------------|-----------------|-------------------|
|               | Pre             | Post              | Pre             | Post              |
| $\Delta$ HRR1 | $33.1 \pm 12.6$ | $45.8 \pm 14.1^*$ | $30.7 \pm 10.3$ | $44.4 \pm 7.3^*$  |
| $\Delta$ HRR2 | $45.1 \pm 13.4$ | $59.3 \pm 8.3^*$  | $46.8 \pm 9.5$  | $59.6 \pm 12.7^*$ |

**1620 Board #28 MAY 30 3:30 PM - 5:00 PM**

**Acute Exercise Training Enhances Resting Microvascular Nutritive Exchange; Nitric Oxide and  $\alpha$ -Adrenergic Mediated Mechanisms**

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(No relationships reported)

Acute exercise training has been shown to improve vascular function and nitric oxide (NO) bioavailability.

**PURPOSE:** To determine if muscular nutritive exchange is enhanced by seven days of exercise training, and if changes are mediated by a NO mechanism.

**METHODS:** 16 men and 16 women performed seven consecutive days of exercise on a cycle ergometer for one hour at 70% VO<sub>2</sub>peak. One day prior to and one day following training, a muscle biopsy was taken and six microdialysis probes were inserted into the vastus lateralis and perfused with a control solution (0.9% saline containing 5 mM ethanol) at 2  $\mu$ l/min and the outflowing dialysate was collected under resting, non-stimulated conditions. Perfusion media was changed on five probes to contain the control solution and one of the following: 1) 10 mg/ml L-NMMA (NOS inhibitor), 2) 30 mg/ml sodium nitroprusside (SNP), 3) 30 mg/ml acetylcholine (ACh), 4) 1  $\mu$ M phentolamine (Phen), an  $\alpha$ -adrenoceptor blocker, 5) 1  $\mu$ M norepinephrine (NE), an  $\alpha$ -adrenoceptor agonist. Nutritive exchange was assessed via the ethanol outflow/inflow ratio and converted to units of blood flow. NOS activity was determined from muscle homogenate using a commercial assay kit.

**RESULTS:** Nutritive blood flow increased in response to training [ $10.1 \pm 7.2$  ml/(100g \* min) pre vs.  $13.9 \pm 12.8$  ml/(100g \* min) post,  $p = 0.03$ ]. Treatment nutritive blood flows (ml/100g \* min) pre- and post-training, respectively, were: ACh ( $15.9 \pm 22.6$  pre,  $p = 0.07$  vs control)( $22.0 \pm 25.3$  post,  $p = 0.03$  vs control), SNP ( $30.2 \pm 19.0$ ,  $p < 0.01$ )( $45.9 \pm 39.9$ ,  $p < 0.01$ ), NE ( $7.9 \pm 8.1$ ,  $p = 0.07$ )( $9.4 \pm 12.0$ ,  $p = 0.11$ ), Phen ( $16.7 \pm 13.3$ ,  $p = 0.02$ )( $14.9 \pm 13.5$ ,  $p = 0.68$ ), L-NMMA ( $11.5 \pm 10.3$ ,  $p = 0.99$ )( $11.4 \pm 10.7$ ,  $p = 0.22$ ). Statistics compared treatments to respective controls. NOS activity ( $3786 \pm 1040$  vs.  $4478 \pm 2091$  dpm/ $\mu$ g protein,  $p = 0.100$ ) did not increase with training.

**CONCLUSIONS:** Exercise training increased resting nutritive exchange. Training did not increase total NOS activity or the response to ACh, SNP, or L-NMMA. Thus, it is unlikely that the increased nutritive exchange is due to increased NO production or action. However,  $\alpha$ -receptor blockade blunted vasoconstriction pre-training but not post-training indicating a decrease in  $\alpha$ -adrenergic vasoconstrictor activity. Therefore, enhanced nutritive exchange may be due to a reduced sympathetic tone.

**1621 Board #29 MAY 30 3:30 PM - 5:00 PM**

**The Red Blood Cell NOS System after Blood Donation and Re-infusion in Moderately Trained Subjects**

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(No relationships reported)

Transfusing Red Blood Cells (RBC) is the oldest form of blood doping and recent media reports suggest it is still widely used among different groups of athletes. Our research group has demonstrated that the procedure of blood-sampling, storage, and re-infusion in patients with hip-surgery induce an increase in nitric oxide synthase (NOS) activity in the RBC concentrate as well as in the patients' blood after re-infusion. These findings implicate that the RBC NOS system could potentially be used for the detection of autologous blood doping.

**PURPOSE:** The aim of the study was to demonstrate that blood donation and re-infusion causes a shift in NOS activity that can be used as an indicator of autologous blood doping.

**METHODS:** Moderately trained subjects received a medical examination including iron status and basal blood parameters. Subjects then donated 500 mL of blood according to standard blood donation procedure. After 2 weeks, the blood concentrate was re-infused. Blood samples were drawn off the subjects before, during and after the donation and re-infusion process. The withdrawn blood was analysed for routine blood parameters and NOS activation at pSer116 and pSer117. Furthermore, erythropoietin (Epo) levels were measured.

**RESULTS:** Routine blood parameters showed the expected changes over the time course of the study. pSer116 and pSer117 increased slightly after blood donation from basal values of  $10.8 \pm 4.0$  to  $12.0 \pm 4.0$  and from  $15.6 \pm 2.4$  to  $17.0 \pm 2.2$ , respectively, but values did not change significantly with the blood re-infusion. Furthermore, Epo levels rose from  $5.1 \pm 2.7$  mIU/mL to  $14.4 \pm 3.9$  mIU/mL after the blood donation and fell back to initial values ( $6.6 \pm 2.6$  mIU/mL) after the blood-re-infusion.



**CONCLUSIONS:** Blood withdrawal but not blood re-infusion activates the RBC NOS system. Possibly, this induction was caused by the increase in Epo, but other mechanisms seem also to be responsible for this observation. However, RBC NOS is no valuable parameter for the detection of blood doping.

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**1622** Board #30 MAY 30 3:30 PM - 5:00 PM

**Forearm Ischemia-reperfusion Injury Reduces FMD but Augments L-FMC Irrespective of Menstrual Cycle Phase**

Mark Rakobowchuk<sup>1</sup>, Emily R. Parsloe<sup>2</sup>, Sarah E. Gibbins<sup>1</sup>, Emma Harris<sup>1</sup>, Karen M. Birch<sup>1</sup>. <sup>1</sup>University of Leeds, Leeds, United Kingdom. <sup>2</sup>University of Cambridge, Cambridge, United Kingdom. (Sponsor: Keith P George, FACSM)  
(No relationships reported)

Twenty minutes of forearm ischemia followed by reperfusion is used as a model to induce endothelial injury. Exercise training does not protect from this effect however the impact of oestrogen availability has not been assessed, nor has the complete vascular response to this stimulus been quantified.

**PURPOSE:** To determine the impact of menstrual cycle phase on recovery from induced endothelial injury.

**METHODS:** 9 women (33 ± 10yr) attended the lab during the follicular, ovulation and mid-luteal phases of the menstrual cycle. After 30 minutes of supine rest, brachial artery vascular function was assessed using ultrasound and 5 minutes forearm ischemia. Subsequently, a 20-minute forearm ischemia-reperfusion period was completed. Following this period vascular function assessments were made 15, 30 and 45 minutes into recovery. FMD and low-flow mediated constriction (L-FMC) were determined at all time points.

**RESULTS:** FMD was reduced following ischemia-reperfusion but recovered at 30 and 45 minutes (PRE: 7.1 ± 1.0%, POST15: 4.5 ± 0.6%, POST30: 5.5 ± 0.7% POST45: 5.9 ± 0.4%, p < 0.01). L-FMC exhibited an inverse pattern when compared to FMD with more constriction apparent after vascular injury (PRE: -1.3 ± 0.4 %, POST15: -3.3 ± 0.6%, POST30: -2.5 ± 0.5% POST45: -1.5 ± 0.12%, p < 0.01). Endothelial sensitivity (sum of absolute values of FMD and L-FMC) was unaltered (PRE: 8.8 ± 0.9% POST15: 7.8 ± 0.5%, POST30: 8.1 ± 0.7% POST45: 7.4 ± 0.5%, p = 0.11). Data were unaffected by menstrual phase.

**CONCLUSIONS:** The forearm ischemia-reperfusion model elicits an alteration of vascular function that may be related as much to enhanced vasoconstriction as it is to impaired vasodilation. This suggests that throughout recovery from injury the haemodynamic and/or circulating vasoactive milieu alter vasodilatory and vasoconstrictive responses. Fluctuations in oestradiol however, have no effect upon these responses.

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**1623** Board #31 MAY 30 3:30 PM - 5:00 PM

**The Interval Between Pre-conditioning and Regional Ischemia is Critical to Cardioprotection in Perfused Rat Hearts**

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(No relationships reported)

Ischemic heart disease leading to cardiac cell death (infarct) is one of the leading contributors to heart failure. Pre-conditioning (PC) the heart with a brief period of global ischemia prior to regional ischemia (RI) has been shown to be cardioprotective.

**PURPOSE:** To determine the optimal time interval between PC and RI that produces maximal cardioprotection and assess gender differences.

**METHODS:** Female (31) and male (35) rats were anesthetized with Nembutal (50mg/kg body wt.) and hearts excised, weighed, and cannulated on a Langendorff apparatus. A balloon inserted into the left ventricle measured ventricular pressures and heart rate (HR). Following 30 min of baseline recordings, hearts were subjected to one of three conditions: 1) 30 min of RI by occluding the left anterior descending coronary artery, regional only (RO); 2) 5 min of global ischemia followed by 5 min of reperfusion, then 30 min of RI (PC5); 3) 5 min of global ischemia followed by 10 min of reperfusion, then 30 min of RI (PC10). Post RI hearts were reperused for 3 hrs before RI was reestablished and the heart perfused with Trypan Blue dye. The left ventricle was cut into 1 mm pieces and the non-stained occluded area stained with triphenyl tetrazolium chloride. Infarct size was determined from the ratio of dye absorbing living cells to the pale dead cells using color detection software.

**RESULTS:** Pre-RI the systolic - diastolic (i.e. delta pressures) for males and females were 144 + 4 mmHg and 144 + 3 mmHg, respectively. PC10 significantly (p<0.01) decreased infarct size in males (PC10: 29 + 2% vs. RO: 46 + 4%) and females (PC10:35 + 6% vs. RO: 55% + 4), however % recovery of delta pressure after 3 hrs of reperfusion was not significantly different between groups in males (RO: 59 +5%, PC5: 48 + 3%, PC10: 49 + 2%, p=0.113) or females between PC10 and RO (40 + 3% vs. 45 + 4%, p=0.376). In contrast, PC5 significantly decreased the functionality of the heart in females (26 + 2% vs. RO: 45 + 4%).

**CONCLUSIONS:** The results indicate that the time between PC and the onset of RI is critical to cardioprotection with 10 min reperfusion providing greater protection than 5 min in both genders. While limiting cell death, PC did not prevent loss of function, and it can decrease function in females if reperfusion time is too short.

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**1624** Board #32 MAY 30 3:30 PM - 5:00 PM

**Post Exercise Blood Pressure Response To Exercise With Blood Flow Restriction**

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(No relationships reported)

The restriction of muscle blood flow with short term low-intensity exercise has been shown to enhance muscle size and strength. Post exercise hypotension is consistently elicited following 30-60min bouts of moderate intensity (50-60% peak aerobic capacity) exercise. Following an acute bout of exercise, systemic resistance does not completely recover, resulting in post exercise hypotension.

**PURPOSE:** To determine if exercise with blood flow restriction in healthy individuals is as effective as traditional exercise in eliciting post exercise hypotension.

**METHODS:** Ten healthy (age =23±2y; VO<sub>2</sub>max=38.4±10ml\*kg<sup>-1</sup>\*min<sup>-1</sup>; bodyfat =18±5%) college-aged individuals volunteered to participate in this within subject's design. Participants were randomly assigned to one of two exercise trials: one with blood flow restriction and one without. The normal exercise (NE) trial consisted of level walking at 60% of heart rate max for a total of 60 minutes. Exercise with blood flow restriction (EBR) consisted of level walking at 53.6m/min (2.0mph) for 20 minutes (two bouts of 10 min). In order to create blood flow restriction, large blood pressure cuffs were placed around the most proximal portion of both legs. Prior to exercise, the pressure in each cuff was increased in stages of 120mmHg, 140mmHg, and 160mmHg while decreasing to 80mmHg and 100mmHg intervals between the first and second and second and third stages respectively. In both exercise trials, heart rate (HR), systolic blood pressure (SBP) and diastolic blood pressure (DBP) were assessed every 5 minutes. Post exercise HR, SBP, and DBP were assessed every 5 minutes for a total of 60 minutes.

**RESULTS:** SBP was significantly lower post NE at minutes 30(111±4 vs. 115±5 mmHg), 35(109±3 vs. 114±5 mmHg), 40(110±2 vs. 115.4±5 mmHg), and 50(111±4 vs. 113±4 mmHg) compared to EBR. DBP was significantly lower in the first 5 minutes post exercise (76±7 vs. 83±4 mmHg) in the NE vs. the EBR trial. No differences in post exercise heart rate were noted.

**CONCLUSION:** Exercise with blood flow restriction utilizing a lower duration and intensity of exercise does not yield the same post exercise hypotension as traditional moderate intensity exercise.

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**1625** Board #33 MAY 30 3:30 PM - 5:00 PM

**Participation in a 10K Running Race Significantly Decreases Post Exercise Blood Pressure**

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(No relationships reported)

Previous investigations have indicated that following aerobic exercise of various durations and intensities, blood pressure may drop significantly for a period of time (i.e. 1 to 24 hours). These investigations have mainly employed laboratory-based protocols administered at a particular prescribed exercise intensity.

**PURPOSE:** The primary purpose of this investigation was to determine if healthy, trained, normotensive male and female runners (18 to 39 years old) would show evidence of post exercise hypotension (PEH) following a competitive 10K running race.

**METHODS:** Nineteen male (n = 13) and female (n = 6) runners from the Medical Center 10K Classic road race participated in the study. Subjects reported to the Exercise Physiology lab the morning of the race to have their resting blood pressure taken and receive study instructions. Immediately following the 10K race, participants returned to the lab where they remained seated and their blood pressure was taken in 30-minute intervals for 1.5 hours (30 min, 60, min, & 90 min). All post exercise systolic (SBP, mm Hg) and diastolic (DBP, mmHg) blood pressures were then compared to the baseline prerace resting values using a repeated measures ANOVA.

**RESULTS:** The SBP was significantly lower ( $p < 0.05$ ) at all time intervals (30, 60 & 90 min) following the 10K running race compared to the prerace measurements (Pre SBP =  $116 \pm 11.6$  mmHg, Post 30 min SBP =  $101.5 \pm 10.4$  mmHg, Post 60 min SBP =  $90.5 \pm 15$  mmHg, and Post 90 min =  $99.7 \pm 15.1$  mmHg). There was no significant difference in the prerace DBP and any of the post race time intervals (Pre DBP =  $71.7 + 11.0$  mmHg, Post 30 min DBP =  $66.3 + 9.4$  mmHg, Post 60 min DBP =  $66.3 + 9.0$  mmHg, Post 90 min DBP =  $69.7 + 11.3$  mmHg).

**CONCLUSIONS:** The findings of the present investigation indicated that healthy normotensive runners demonstrate PEH as indicated by the drop in SBP for up to 90 minutes following a 10K running race. The PEH noted presently may have health-fitness benefits in healthy, trained normotensive runners. Future studies should track the blood pressure responses following a 10K running race for a longer period of time (3 to 24 hrs) and attempt to determine the potential mechanism(s) that lead to PEH in normotensive competitive runners.

**1626** Board #34 MAY 30 3:30 PM - 5:00 PM

**Exercise Timing Affects the Direction (Positive/Negative) of Relationships Between Blood Pressure and Sleep Architecture**

Dwight Joseph The<sup>1</sup>, Ben W. Cartner<sup>2</sup>, Kimberly Fairbrother<sup>2</sup>, Chelsea D. Curry<sup>2</sup>, Scott R. Collier, FACSM<sup>2</sup>. <sup>1</sup>Montana Tech, Butte, MT. <sup>2</sup>Appalachian State University, Boone, NC.

(No relationships reported)

Previously, our laboratory has shown that exercise at 7pm produced a greater dip in nocturnal blood pressure (BP) and more time in REM sleep than exercise at 1pm, yet exercise at 7pm was similar in benefits to morning exercise. The **PURPOSE** of this study was to determine the differences between exercise at 7am vs. 7pm in an older prehypertensive cohort.

**METHODS:** Thirteen 40-60 year old pre-hypertensive subjects (height =  $67.84 \pm 2.71$  in; weight =  $163.88 \pm 27.46$  lbs;  $VO_{2peak} = 38.31 \pm 7.89$  ml/Kg/min) performed 30 minute bouts of moderate intensity aerobic exercise (65% of  $VO_{2peak}$ ) on three separate, counterbalanced laboratory visits at 7am, 1pm, & 7pm. Ambulatory BP was monitored every 20 minutes for 24 hours after exercise. Sleep architecture was assessed using a Zeo™ ambulatory sleep EEG monitor.

**RESULTS:** Statistically significant ( $^*p \leq 0.05$ ;  $^{**}p \leq 0.01$ ) values for two different non-parametric, bivariate correlations are tabled below. The correlations for exercise at 7pm are in the opposite direction (positive or negative) of those for exercise at 7am and 1pm.

**CONCLUSIONS:** These data confirm REM sleep is only correlated with BP variables (Mean SBP & Mean DBP) for the 7pm exercise bout. Exercising at 7pm seems to produce a beneficial relationship between blood pressure and sleep architecture that is not observed following exercise at 7am/1pm.

|   | Spearman's Rank ( $\rho$ ) | Kendall's Tau ( $\tau$ ) |
|---|----------------------------|--------------------------|
| Exercise @ 7am: Mean DBP & Wakes              | -0.581*                    | -0.485*                  |
| Exercise @ 7am: Sleeping SBP & Wake Time      | -0.687**                   | -0.476*                  |
| Exercise @ 7am: % Dip in SBP Post Ex. & Wakes | 0.581*                     | 0.525*                   |
| Exercise @ 1pm: Awake DBP & Wake Time         | -0.783**                   | -0.614**                 |
| Exercise @ 1pm: Mean DBP & Wake Time          | -0.755**                   | -0.570**                 |
| Exercise @ 1pm: Sleeping DBP & Wake Time      | -0.634*                    | -0.464*                  |
| Exercise @ 7pm: Mean SBP & REM Sleep          | 0.609*                     | 0.490*                   |
| Exercise @ 7pm: Mean DBP & REM Sleep          | 0.729**                    | 0.570**                  |
| Exercise @ 7pm: % Dip in SBP Post Ex. & Wakes | -0.563*                    | -0.463*                  |

\* $p \leq 0.05$ ; \*\* $p \leq 0.01$

**1627** Board #35 MAY 30 3:30 PM - 5:00 PM

**The Effects Of Constant-load Exercise At Percentages Of The Ventilation Thresholds On The Magnitude Of Heart Rate Drift**

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(No relationships reported)

Traditionally cardiovascular drift (CVdrift), the changes in cardiovascular responses over time, despite no change in exercise intensity, has been examined at intensities set relative to a percentage of  $VO_{2max}$ . Previously little consideration has been given to the HR response relative to ventilation threshold (TH1) and respiratory compensation point (TH2).

**PURPOSE:** The purpose of this study was to investigate the effects of exercising at percentages of TH1 and TH2, on the magnitude of heart rate drift (HRdrift), a component of CVdrift.

**METHODS:** Four male cyclists age  $29 \pm 6$ yr, weight  $82.9 \pm 28.3$ kg, height  $176.1 \pm 8.3$ cm,  $VO_{2max}$   $56.3 \pm 14.7$ ml·kg<sup>-1</sup>·min<sup>-1</sup> volunteered for this study. Visit 1 consisted of a graded exercise test (GXT) to determine TH1 and TH2, and two power detection rides used to determine the workloads that would be used for the constant-load exercise (CLE) rides to fatigue. Visit 2 consisted of a randomized CLE ride to fatigue at a power output that elicited a  $VO_2$  that was either 5% below TH1 (-5%TH) or a  $VO_2$  that was midpoint of TH1 and TH2 (midTH) in a thermal neutral environment. Visit 3 consisted of the remaining CLE ride to fatigue. Heart rate was recorded every minute; expired air, blood pressure, and RPE were recorded for the last 2 minutes of every 10 minutes. A paired t-test was used to analyze the % change in HR and  $VO_2$  from minute 5 to fatigue during both trials ( $p < 0.05$ ).

**RESULTS:** Subjects had a  $21.7 \pm 9.3$  and  $17.8 \pm 4.6$  increase in HR and  $VO_2$  respectively for the -5%TH ride ( $220 \pm 47$ W) and a  $15.2 \pm 6.2$  and  $12.0 \pm 2.3$  increase in HR and  $VO_2$  respectively during the midTH ride ( $244 \pm 51$ W). Time to fatigue was  $93 \pm 18$  minutes and  $56 \pm 11$  minutes for the -5%TH and midTH rides respectively. HRdrift was significantly greater in the -5% TH ( $p < 0.02$ ). The change in  $VO_2$  between trials was not statistically significant ( $p < 0.09$ ). Terminal HR for -5%TH ride and midTH ride ( $177 \pm 8$  bpm and  $182 \pm 13$  bpm) drifted near TH2 HR ( $177 \pm 17$  bpm) determined from the GXT.

**CONCLUSION:** There was a statistically significant difference ( $p < 0.02$ ) in the magnitude of HRdrift for both trials. The terminal HR drifting to TH2 for both trials in each subject suggests that TH2 HR may represent an upper limit during CLE for cardiovascular parameters. The ventilation thresholds should be considered when designing protocols in future CVdrift studies.

**1628** Board #36 MAY 30 3:30 PM - 5:00 PM

**Relationships between Blood Pressures at Resting State and Anaerobic Threshold Point**

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(No relationships reported)

**PURPOSE:** It is a well-known fact that mild intensity exercise is safe and effective exercise for persons with lifestyle-related diseases. The mild intensity indicates the anaerobic threshold (AT) point in exercise. The AT point has been determined as a lactate threshold (LT), a double product breaking point (DPBP) or a ventilation threshold (VT). Recently, the heart sounds breaking point (HSBP), which was determined from change in amplitude of the first heart sound (AHS1) during graded exercise, is used as an AT point. The purpose of this study is to examine the relationship between systolic pressures (SBP) at rest and at AT point determined by HSBP, and also between both diastolic pressures (DBP). These results may be useful for the exercise prescription.

**METHODS:** Thirty subjects aged 19 - 79 years with a BMI of  $21.8 \pm 2.3$  kg/m<sup>2</sup>, underwent a graded cycle ergometer test. The work rate started at 20 watts and then increased by 10 watts every 90sec until 15-point of RPE was reached. The heart sound was collected in a personal computer via an A/D converter throughout the exercise test. For determining the HSBP of each subject, AHS1 of each stage was plotted on a graph versus workload. The point of the abrupt increase in AHS1 was determined from visual inspection. Blood pressure was determined from

recordings of cuff pressure, vessel sounds, and height of mercury for the last 30 sec of each stage during exercise. SBP was determined at the point of the first appearance of vessel sounds, while DBP at disappearance of the sounds at rest, and at Swan's fourth point during exercise.

**RESULTS:** The relationship between resting and AT point SBPs was significant, and also the relationship between both DBPs was significant. At AT point, four subjects whose resting SBP was over 130mmHg showed over 200mmHg of SBP. The subjects whose resting DBPs were over 90mmHg showed a tendency towards elevation of DBP at AT point exercise, it was over 100mmHg in middle and high aged persons. The DBPs of young and a few middle aged subjects showed a tendency of a small decrease from resting value at AT point exercise.

**CONCLUSIONS:** The AT point exercise was thought as a safe and effective intensity for making healthier body condition. However, this result indicates that a person having high SBP and/or DBP had better choose around 80% of an AT point intensity during cycle exercise.

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**1629** Board #37 MAY 30 3:30 PM - 5:00 PM

**Cardiovascular Changes During Championship In Professional Soccer Players**

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(No relationships reported)

**PURPOSE:** Aim of the present study was to evaluate the cardiovascular changes in a professional soccer team along one agonistic season, from the pre-championship training phase ( $T_0$ ), during the championship ( $T_1$ ) and in the detraining phase ( $T_2$ ).

**METHODS:** Obtained the informed consent, we included 24 healthy professional soccer players (age  $22 \pm 5$ ; weight  $70 \pm 7$  Kg). Anthropometric data, blood pressure and heart rate have been evaluated early morning, when all players have not eaten since 10 hours. Cardiac Echo-Doppler (GE Vivid 7) and the anterior descending artery flow (LAD) values were performed. All measurements have been repeated three times ( $T_0$ ,  $T_1$  and  $T_2$ ). In 2-tailed tests, a value of  $P < 0.05$  was considered statistically significant and calculated with a standard statistical package (SPSS for Windows version 12.0).

**RESULTS:** Obviously we observed a little but significant reduction of the blood pressure and heart rate in  $T_2$ . The echocardiographic measurements showed a statistically significant increase of the indexed left ventricular mass just in  $T_1$  (interventricular septum  $T_0 = 0.93 \pm 0.11$  cm;  $T_1 = 1.09 \pm 0.09$  cm;  $P < 0.0001$ ), without important differences in volumes ( $T_0 = 5.40 \pm 0.30$  cm;  $T_1 = 5.25 \pm 0.30$  cm;  $P < 0.053$ ). This increase was associate to a reduction of the ejection fraction ( $T_0 = 73.63 \pm 5.26\%$ ;  $T_1 = 69.74 \pm 6.05\%$ ;  $P < 0.002$ ) and an increase of the shortening fraction ( $T_0 = 34.8 \pm 4.04\%$ ;  $T_1 = 35.2 \pm 5.44\%$ ;  $P < 0.005$ ), without significant changes of the stroke volume. These findings may be due to a reduction of the longitudinal shortening velocity of the myocardial fibers ( $S'$   $T_0 = 0.12 \pm 0.02$  cm/sec;  $T_1 = 0.10 \pm 0.01$  cm/sec). In  $T_2$  we noted an increase of the shortening velocity of the myocardial fibers ( $0.13 \pm 0.02$  cm/sec;  $P = 0.002$ ) for an adequate functional adaptation. Moreover in the anaerobic training phase we observed a reduction of the LAD flow ( $T_0 = 0.19 \pm 0.05$  m/sec;  $T_1 = 0.17 \pm 0.03$  m/sec) with a successive significant increase in  $T_2$  ( $P < 0.0001$ ).

**CONCLUSION:** This first longitudinal study, regarding professional soccer players, demonstrates that the cardiac adaptation improves significantly only during the aerobic/anaerobic training phase. Our results may be contribute to modify the workout of the professional athletes.

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**1630** Board #38 MAY 30 3:30 PM - 5:00 PM

**Morphologic And Functional Cardiac Modifications In Adolescent Soccer Players**

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(No relationships reported)

**PURPOSE:** Almost all the study on athlete's heart have been carried out on adult players, while few data are now available on the cardiac adaptations to regular sport activity in adolescents. The study aims to describe the morphological and functional modification in a group of professional adolescent soccer players matched with a group of non-professional one in order to evaluate any possible differences and also relationship with the anthropometric parameters

**METHODS:** 40 professional male soccer players (PSP) and 47 non professional NPSP, were evaluated since the age of 12 up to 17 years. Once a year every athlete underwent to a 2 D echocardiography with the evaluation of the main morphological and functional left ventricle parameters including the wall thickness and systo-diastolic chamber sizes.

**RESULTS:** A significant increase of the absolute values of all the echocardiographic parameters examined ( $p < 0.05$ ) in adolescent PSP compared to NPSP has been found, especially for LVM. LVM values did not show any relationship to BSA measurements in both groups.

**CONCLUSION:** the data are indicative for an early cardiac remodeling especially in highly trained athletes. However there are no evident correlations between LVM and BSA values. Intensive training does not seem to have any influence on BSA growth while a positive factor on LVM has been verified.

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**1631** Board #39 MAY 30 3:30 PM - 5:00 PM

**Effect Of Acute Active Video Game On Pulse Wave Velocity In Young Health Adults**

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(No relationships reported)

Active video games are now highly popular and play a role in promoting physical activity. Although aerobic exercise improves arterial function, there is little information on the effects of active video game on arterial stiffness.

**PURPOSE:** The purpose of this study was to examine the acute effect of active video game on pulse wave velocity in young healthy subjects.

**METHODS:** Twenty-three healthy young subjects (age  $21 \pm 3$  years and body mass index  $22.6 \pm 1.9$  kg/m<sup>2</sup>) were randomly assigned to acute bout of active video game ( $n = 11$ , 50-minute, Nintendo Wii sports (boxing, tennis) and a walking exercise ( $n = 12$ , 30-minute, 60-70% of heart rate reserve) as a control exercise. Carotid-femoral pulse wave velocity as an index of aortic stiffness was measured using applanation tonometry (SphygmoCor, AtCor Medical, Australia). All variables were measured at baseline and 40 minutes after each exercise.

**RESULTS:** Walking exercise significantly decreased systolic blood pressure ( $116.2 \pm 10.7$  to  $106.8 \pm 9.6$  mmHg,  $p = 0.001$ ), but there was no significant changes following the active video game ( $111.1 \pm 12.4$  to  $110.1 \pm 10.6$ ,  $p = 0.612$ ). Carotid-femoral pulse wave velocity was decreased after walking exercise ( $6.28 \pm 0.61$  to  $6.03 \pm 0.57$  m/s) and increased after active video game ( $5.96 \pm 0.75$  to  $6.03 \pm 0.56$  m/s), but these changes were not statistically significant ( $p = 0.181$ ).

**CONCLUSIONS:** These findings suggest that an active video game does not decrease pulse wave velocity in young healthy adults. Further studies are needed to clarify the effects of long term active video game on arterial stiffness.

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**1632** Board #40 MAY 30 3:30 PM - 5:00 PM

**Active Video Game Does Not Attenuate A High Fat Meal Induced Vascular Dysfunction In Young Healthy Adults**

Eun-Sun Yoon, Soo-Hyun Park, Yong Hee Lee, Sae Young Jae. *University of Seoul, Seoul, Korea, Republic of.*

(No relationships reported)

**PURPOSE:** A high fat meal transiently decreases vascular function, while acute aerobic exercise improves vascular function. Active video games are now highly popular and play a role in promoting physical activity. Although studies suggest that acute aerobic exercise attenuates high fat meal induced vascular dysfunction, but it is not clear whether an active video game could attenuate vascular dysfunction after a high fat meal. We tested the hypothesis that an active video game would partially prevent the unfavorable effect of vascular function by high fat meal in young adults.

**METHODS:** Using a randomized cross over design, sixteen healthy young subjects (male 9, female 7; age  $24 \pm 4$  yrs, BMI  $22.4 \pm 2.1$  kg/m<sup>2</sup>) were assigned to both an active video game (60 minutes, Nintendo Wii sports (boxing, tennis) and a seated rest after a high fat meal. Endothelial function was measured by brachial artery flow mediated dilation and arterial stiffness was measured by carotid-femoral pulse wave velocity. These variables were measured at baseline, 3 and 5 hours after a high fat meal.

**RESULTS:** Blood triglyceride levels were similarly increased in two treatment conditions after a high fat meal and did not significantly different between two groups (active video game : 74.06±43.36, 160.63±106.20, 126.81±91.41mg/dl; control : 70.06±38.67, 168.38±85.89, 128.75±87.26mg/dl, p=0.878). Brachial artery flow mediated dilation was decreased in the group with seated rest(9.32±2.86 to 8.13±3.56%), but increased in the group with active video game(8.74±3.13% to 9.21±3.40%) at 3hr after a high fat meal. However, there was no significantly different between two groups(p=0.189). Carotid-femoral pulse wave velocity was similarly decreased in two treatment conditions after a high fat meal and did not significantly different between two groups (active video game group : 6.39±1.12, 6.08±0.94, 6.38±1.07m/s; control group : 6.34±0.85, 6.19±0.89, 6.28±1.01m/s, p=0.483).

**CONCLUSIONS:** These findings show that a high fat meal caused a temporary decrease in endothelial function, but these decreases were not significantly attenuated in the group with active video game compare to the group with seated rest. Therefore, active video game may not have a cardioprotective effect in young healthy adults exposed to acute high fat meal.

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**1633 Board #41 MAY 30 3:30 PM - 5:00 PM**

**Cardiovascular Fitness is Associated with Venous Compliance in Healthy Subjects**

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(No relationships reported)

Reduced venous outflow (VOF) is negatively associated with 6 minutes walk test performance in heart failure patients when compared to healthy age matched subjects, indicating that exercise intolerance may be linked to an insufficiency in venous circulation.

**PURPOSE:** Compare the relationship between venous compliance (VC) and cardiovascular fitness measured as maximal oxygen uptake ( $VO_{2max}$ ) in healthy subjects.

**METHODS:** Twenty-eight healthy subjects 20-70 years of age ( $46.4 \pm 16.2$  years,  $72.8 \pm 13.7$  kg,  $174 \pm 8.4$  cm, men n= 16, women n= 12) were recruited to a cross sectional study.  $VO_{2max}$  was measured during an individual ramp treadmill protocol. Resting venous and arterial flow and diameters were measured with ultrasound during a 10-minute occlusion protocol aiming to alter arterial and venous in- and outflow in the brachial vein and artery. Occlusion of VOF was achieved by occluding the upper arm to 7mmHg below diastolic blood pressure, and alternation in arterial inflow by occluding the wrist at 240mmHg. Vascular measures were normalized for dimensional scaling due to difference in subjects body composition. Measured diameters were scaled with fat free mass (FFM)<sup>-0.33</sup>, and measured VOF with FFM<sup>-0.67</sup>. Compliance (cross-sectional area/venous pressure) was expressed as the difference between resting and maximal occlusion compliance. Total blood, plasma volume and red cell mass were measured after the vascular examination with the improved CO-rebreathing method.

**RESULTS:** Mean  $VO_{2max}$  was  $3.38 \pm 0.8$  L · min<sup>-1</sup>, delta VC  $16.57 \pm 7.6$  mm<sup>2</sup> · mmHg<sup>-1</sup> · kg FFM<sup>-0.33</sup> and blood volume  $5.95 \pm 1.3$  L.  $VO_{2max}$  (L · min<sup>-1</sup>) was positively correlated with delta VC (mm<sup>2</sup> · mmHg<sup>-1</sup> · kg FFM<sup>-0.33</sup>) ( $r = 0.542$  and  $p = 0.004$ ) and VOF (cm · s<sup>-1</sup> FFM<sup>-0.67</sup>) ( $r = 0.554$  and  $p = 0.006$ ). Additionally a significant correlation was found between delta VC (mm<sup>2</sup> · mmHg<sup>-1</sup> · kg FFM<sup>-0.33</sup>) and total plasma ( $r = 0.598$  and  $p = 0.002$ ) and total blood volume ( $r = 0.638$  and  $p = 0.001$ ).

**CONCLUSION:**  $VO_{2max}$  is positively correlated with delta VC in the investigated population of healthy subjects. Additionally there is a positive correlation between  $VO_{2max}$  and VOF and total plasma volume. As  $VO_{2max}$  and arterial flow mediated dilatation previously have been positively correlated, the present result may indicate that exercise intolerance may also be linked to venous circulation.

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**1634 Board #42 MAY 30 3:30 PM - 5:00 PM**

**Effects Of The Combined Treatment Of Aerobic Exercise Training And Curcumin Intake On Arterial Function**

Nobuhiko Akazawa<sup>1</sup>, Youngju Choi<sup>1</sup>, Asako Miyaki<sup>1</sup>, Jun Sugawara<sup>2</sup>, Ryuichi Ajisaka<sup>1</sup>, Seiji Maeda<sup>1</sup>. <sup>1</sup>University of Tsukuba, Tsukuba, Japan. <sup>2</sup>National Institute of Advanced Industrial Science and Technology (AIST), Tsukuba, Japan.

(No relationships reported)

Reduction in arterial function with aging increases risk of cardiovascular disease. Lifestyle modifications, in particular aerobic exercise and dietary modifications, result in the favorable outcome in the vascular aging. Curcumin, a major component of turmeric, has an anti-inflammatory effect, therefore it is plausible to hypothesize that curcumin improves arterial function.

**PURPOSE:** The purpose of this study was to test the effects of curcumin ingestion alone and in combination with aerobic exercise training on arterial function in postmenopausal women.

**METHODS:** A total of 38 postmenopausal women were assigned randomly to four group: placebo (PLA), curcumin (CUR), exercise + placebo (EX+PLA), and exercise + curcumin (EX+CUR). Curcumin or placebo was ingested orally for 8 weeks. The exercise groups underwent 8 weeks moderate aerobic exercise training. PLA and CUR groups did not change their physical activity level. Before and after each intervention, carotid arterial compliance and flow-mediated dilation (FMD) were measured.

**RESULTS:** There were no differences in baseline carotid arterial compliance, FMD, and most other key dependent variables among the groups. Aerobic capacity in the EX+PLA and EX+CUR groups increased significantly after each intervention. Carotid arterial compliance increased significantly in CUR ( $0.087 \pm 0.005$  vs.  $0.097 \pm 0.006$  mm<sup>2</sup>/mmHg,  $P < 0.05$ ), EX+PLA ( $0.081 \pm 0.004$  vs.  $0.092 \pm 0.006$  mm<sup>2</sup>/mmHg,  $P < 0.05$ ), and EX+CUR ( $0.089 \pm 0.005$  vs.  $0.103 \pm 0.006$  mm<sup>2</sup>/mmHg,  $P < 0.05$ ) after each intervention. The change in carotid arterial compliance in EX+CUR was the greatest among the groups. FMD also increased significantly in CUR ( $2.7 \pm 0.5$  vs.  $4.4 \pm 0.7$  %,  $P < 0.05$ ), EX+PLA ( $2.7 \pm 0.6$  vs.  $4.6 \pm 0.7$  %,  $P < 0.05$ ), and EX+CUR ( $3.3 \pm 0.6$  vs.  $4.5 \pm 0.8$  %,  $P < 0.05$ ) after each intervention. There was no significant difference in the magnitude of increases in FMD among the groups.

**CONCLUSIONS:** The present study demonstrated that curcumin ingestion improved arterial function and that the combined aerobic exercise training and curcumin ingestion was more efficacious in increasing central arterial compliance than either treatment alone in postmenopausal women.

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**1635 Board #43 MAY 30 3:30 PM - 5:00 PM**

**Sex Differences in Cardiovascular Function at Rest and During Submaximal Exercise in Healthy Humans**

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(No relationships reported)

**BACKGROUND:** Differences in cardiovascular function between sexes has been documented at rest and maximal exercise; however, these differences during submaximal steady-state exercise are less clear. This study investigated the cardiovascular response to submaximal steady-state exercise between sexes.

**METHODS:** We recruited 31 male and 33 female (age=30±1 vs. 28±1yrs, ht=1.8±1.3 vs. 1.7±1.3m, wt=82±1.8 vs. 64±1.8kg, BSA=2.0±0.0 vs. 1.7±0.0m<sup>2</sup>, respectively,  $p < 0.001$  for ht, wt, and BSA). Study visit 1 included a maximal exercise test. Study visit 2 included 9 minutes of low and 9 minutes of moderate intensity submaximal exercise (40 and 75% of peak watts). Measurements included: intra-arterial blood pressure (SBP and DBP), cardiac index ( $Q_i$ ), heart rate (HR), oxygen consumption ( $VO_2$ ) and arterial catecholamines (epinephrine=EPI and norepinephrine=NE), and blood gases. Mean arterial pressure (MAP), stroke volume index ( $SV_i$ ), and systemic vascular resistance index ( $SVR_i$ ), arterial oxygen content ( $CaO_2$ ) and systemic oxygen transport (SOT) were calculated. We indexed  $Q$ ,  $SV$ , and  $SVR$  for BSA.

**RESULTS:** At rest,  $Q_i$ ,  $SV_i$ , SBP, MAP, NE,  $CaO_2$ , and SOT were lower in females compared to males ( $p < 0.05$  for all). In females at low intensity, these differences were retained, additionally EPI and DBP were lower ( $p < 0.05$  for all) despite a higher HR ( $p < 0.05$ ). At moderate intensity,  $VO_2$ ,  $Q_i$ ,  $SV_i$ , SBP, MAP, EPI, NE,  $CaO_2$ , and SOT were lower and  $SVR_i$  was higher in females ( $p < 0.05$  for all). The slope of the relationship between HR and  $Q_i$  was greater in females compared to males from rest to moderate exercise ( $14.7 \pm 1$  vs.  $21.4 \pm 1$ ,  $p < 0.001$ ).

**CONCLUSION:** This study demonstrates differences in the cardiovascular response to submaximal steady-state exercise between sexes. Men had higher  $Q$  and  $SV$  at both low and moderate intensities. Females demonstrated a higher HR at low intensity with an increased slope of HR throughout exercise. These data demonstrate differential regulation of cardiac output, with a greater reliance on HR in females, during steady-state submaximal exercise.

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1636 Board #44 MAY 30 3:30 PM - 5:00 PM

**Sex Affects the Ventricular-Vascular Coupling Ratio Following 8 Weeks of Endurance Training**

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(No relationships reported)

**BACKGROUND:** The ventricular-vascular coupling ratio (VVC) is determined by the ratio of arterial elastance (Ea) to ventricular elastance (Elv). Previous work has shown that endurance exercise training can attenuate Ea, and, thus, reduce the coupling ratio. The role of sex in the VVC response to endurance training has not yet been elucidated.

**PURPOSE:** To determine the role of sex in changes in VVC after an 8-week endurance exercise intervention.

**METHODS:** Baseline and post training measurements were obtained in 53 previously sedentary subjects (25 women and 28 men), including: brachial blood pressures and end-systolic pressure (BP and ESP) using a standard cuff and applanation tonometry, and ultrasound images of the heart. Simpson's rule was used to calculate heart volumes. Elastances were determined from the formula  $Ea=ESP/SV$  and  $Elv=ESP/ESV$ . These values were then indexed to body surface area (EaI and ElvI). A VO<sub>2</sub> peak test was also performed. Subjects completed an 8-week endurance training program which consisted of 30-60 min of endurance exercise at 60-90% of max HR 3 times per week. Pre- and post-intervention values were compared between sexes using a repeated measures (2x2) ANOVA.

**RESULTS:** Subjects mean age at baseline was 24.7±4 yr, average BSA was 1.73±0.07 and mean VO<sub>2</sub> peak was 34.8±9.8 ml/kg/min. Compared to men, women had higher EaI (women=0.86 before and 0.87 mmHg/ml/m<sup>2</sup> after training; men=0.60 and 0.62 mmHg/ml/m<sup>2</sup>, p<0.05) and higher Ea/ElvI before and after training, p<0.05. Women decreased Ea/ElvI (from 0.41 to 0.37 mmHg/ml/m<sup>2</sup>, p<0.05). EaI was not altered by training in either group, but training increased ElvI (from 1.25 to 1.43 mmHg/ml/m<sup>2</sup>) in women only (p<0.05).

**CONCLUSION:** Women and men exhibit different VVC responses to endurance exercise training. EaI was not altered by training in either sex, while women augmented ElvI following training. As a result, women decreased Ea/ElvI suggesting training induced improvement in ventricular performance and energetics in women but not in men.

Study Funding: NHLBI 1R01HL093249-01A1 (Fernhall)

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1637 Board #45 MAY 30 3:30 PM - 5:00 PM

**Acute Arterial Compliance Responses to Whole-Body Vibration and Resistance Exercise in Postmenopausal Women**

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(No relationships reported)

No studies to date have investigated the acute arterial compliance responses to resistance and whole-body vibration exercise in postmenopausal women.

**PURPOSE:** To investigate the acute arterial compliance responses to high-intensity resistance exercise with and without whole-body vibration exercise in postmenopausal women.

**METHODS:** Seven women (58 ± 2 years) participated in this randomized crossover study. 1-RM testing on the leg press, seated row, hip extension, shoulder press, hip abduction, and hip adduction exercise machines. The exercise and control protocols, random in order and separated by 2-week washout periods, were comprised of whole-body vibration + resistance exercise (WBV), resistance exercise only (RES), or no exercise (CON). For the whole-body vibration, subjects stood barefoot on a teeterboard whole-body vibration plate for 5, 1-minute intervals at 20 Hz and 1.25 mm (amplitude), followed by the resistance exercise. For the resistance exercise, subjects completed 3 sets of 10 repetitions 80% 1RM. Arterial compliance measurements were obtained by radial applanation tonometry before (Pre) and immediately after (Post) each protocol.

**RESULTS:** There were significant (p < 0.05) time effects for heart rate (HR) and augmentation index (AI); and significant (p < 0.01) protocol × time interactions for HR, ejection duration (ED) and the Buckberg sub-endocardial viability ratio (SEVR). HR increased pre to post exercise for WBV (Pre - 67.4 bpm ± 2.6 vs. Post - 73.9 ± 4.1 bpm) and RES (Pre - 67.0 ± 3.7 bpm vs. 78.6 ± 6.1 bpm). AI significantly (p < 0.05) decreased post exercise for each condition (WBV Pre 35.4 ± 2.7% vs. Post 32.3 ± 3.7%; RES Pre 35.1 ± 4.1% vs. Post 30.1 ± 3.9%; CON Pre 38.9 ± 2.8% vs. Post 37.4 ± 2.0%). ED significantly (p < 0.05) increased and SEVR significantly (p < 0.05) decreased post exercise for WBV and RES, however, there were no differences in Post ED or SEVR between WBV and RES protocols.

**CONCLUSIONS:** Arterial compliance responses, as measured by the augmentation index, were not altered by the addition of whole-body vibration to acute resistance exercise. Our findings suggest that whole-body vibration exercise may be added to resistance exercise without inducing greater cardiovascular stress.

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1638 Board #46 MAY 30 3:30 PM - 5:00 PM

**von Willebrand Factor and Blood Flow Response to Whole Body Vibration in Diabetic Peripheral Neuropathy**

Michael M. Lockard, Nathan J. Kessler, Junggi J. Hong, Rachel A. Siebuhr. Willamette University, Salem, OR. (Sponsor: Peter Harmer, FACSM)

(No relationships reported)

Elevated plasma levels of von Willebrand factor antigen (vWF:Ag), indicative of endothelial damage, have been associated with diabetes mellitus and impaired vascular health. Whole body vibration (WBV) is an emerging treatment modality for diabetics with potential to enhance endothelial maintenance and peripheral blood flow; however, the chronic effects of WBV are unknown.

**PURPOSE:** To identify the chronic effects of four weeks of WBV treatment on vascular endothelium in diabetics with peripheral neuropathy, and to determine whether these WBV-induced changes are correlated with changes in peripheral blood flow.

**METHODS:** Subjects were 11 diagnosed diabetics with peripheral neuropathy (6 male, 5 female), mean age 58.5±11.4 years, and BMI 32.4±5.5 kg/m<sup>2</sup>. Subjects underwent three WBV sessions per week for four weeks. Each session included four three-minute treatments at a frequency of 25 Hz. Blood samples were analyzed in duplicate for vWF:Ag via ELISA test. Toe-brachial index, the rate of systolic pressure at the brachial artery compared to the great toe, was used to assess peripheral blood flow. Final testing was performed at least 24 hours after the most recent vibration treatment to reduce the potential acute effect of vibration therapy.

**RESULTS:** Plasma vWF:Ag decreased significantly with WBV from 117.8±35.7% to 96.3±25.1% (p=0.032). No gender difference in plasma vWF:Ag was observed. The change in plasma vWF:Ag was significantly correlated with the WBV-induced change in TBI (r=-0.635, p=0.036).

**CONCLUSION:** These data suggest that regular treatment with WBV decreases chronic endothelial damage associated with diabetic peripheral neuropathy, and that this change is associated with improved peripheral blood flow.

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1639 Board #47 MAY 30 3:30 PM - 5:00 PM

**Mechanoreceptors in Skeletal Muscles Lead to Augmented Pressor Response in Obese Children**

Hosung Nho, Hyun-Min Choi, Joon-Sung Park, Kwang-Il Kim, Hyun-Tae Seo, Kyung-Ae Kim, Jong-Kyung Kim, Hye-Lim Yoo. Kyung Hee University, Yong In, Korea, Republic of.

(No relationships reported)

**Mechanoreceptors in Skeletal Muscles Lead to Augmented Pressor Response in Obese Children** Hosung Nho, Hyun-Min Choi, Joon-Sung Park, Kwang-Il Kim, Hyun-Tae Seo, Kyung-Ae Kim, Jong-Kyung Kim, Hae-Lim Yoo Graduate School of Physical Education, Kyung Hee University, Yongin, Republic of Korea

Previous studies strongly indicate that the muscle metaboreflex evokes altered cardiovascular responses to exercise in obese children. However, the effect of the mechanoreflex, another component of exercise pressor reflex (EPR), on the hemodynamic responses is not well understood.

**PURPOSE:** To investigate the effects of the mechanoreflex on the cardiovascular responses in obese children.

**METHODS:** Thirty subjects (8 obese and 13 lean groups, body mass index:  $28.4 \pm 1.0$  vs.  $18.8 \pm 2.3$  kg/m<sup>2</sup>, respectively) participated. The testing protocol involved 5 min of baseline and 1 min brief passive dorsiflexion of the foot.

**RESULTS:** Mean arterial blood pressure (MAP) increased with the mechanoreflex activation in both groups, however, the peak MAP was significantly higher in obese groups. Inasmuch as cardiac output (CO) tended to be lower, the increase in MAP in lean groups was mainly due to lower levels of total vascular conductances (TVC) (see Table). On the other hand, the higher MAP in obese groups was due to both increase in CO and decrease in TVC. There was no difference between two groups during cold pressor test.

| Event | $\Delta$ HR (bpm) | $\Delta$ SV (ml)   | $\Delta$ CO (L/min) | $\Delta$ MAP (mmHg) | $\Delta$ TVC (ml/min/mmHg) |
|-------|-------------------|--------------------|---------------------|---------------------|----------------------------|
| Lean  | $-4 \pm 2^*$      | $-0.6 \pm 0.8$     | $-0.2 \pm 0.1^*$    | $8 \pm 1^*$         | $-4.5 \pm 0.7^*$           |
| Obese | $0 \pm 3$         | $4.8 \pm 1.3^{\#}$ | $0.4 \pm 0.1^{\#}$  | $15 \pm 3^{\#}$     | $-4.2 \pm 1.2^*$           |

\*A significant effect of the mechanoreflex, # vs. Lean.

**CONCLUSIONS:** This augmented pressor response was associated with an augmented increase in both CO and peripheral vasoconstriction in obese children. These results may imply that mechanic stimuli induced by muscle contraction contribute to the overactive EPR observed in obese groups.

1640 Board #48 MAY 30 3:30 PM - 5:00 PM

### Single Leg Counter-weighted Cycling Elicits Similar Cardiovascular Responses To Double Leg Cycling: Implications For Rehabilitation

Keith J. Burns, Brandon S. Pollock, Phil LaScola, John McDaniel PhD., Kent State University, Kent, OH. (Sponsor: Ellen Glickman, FACSM)

(No relationships reported)

**BACKGROUND:** Peripheral adaptations to whole body aerobic exercise may not be optimized in individuals with central cardiovascular or pulmonary limitations due to their reduced exercise capacity. Single-leg cycling reduces the active muscle mass and may allow them to exercise at greater peripheral intensity without increasing central demand. However, single-leg cycling is hard to coordinate due to the need to recruit hip flexor muscles during the second half of the crank cycle (180 to 360). Incorporating a counterweight on the non-used crank arm may minimize this difficulty imparted during this exercise.

**PURPOSE:** Determine the cardiovascular responses to double-leg cycling and single leg cycling with and without the use of a counter weight.

**METHODS:** Six healthy volunteers participated in three cycling trials consisting of double-leg cycling, single-leg cycling without the use of a counterweight and single-leg cycling with the use of 9 kg counterweight attached to the crank on the opposite side of the active leg. Each trial consisted of 5 minutes at three workloads: 40, 80 and 120 watts. Pedaling rate was kept constant at 80 rpm. During each workload VO<sub>2</sub>, RER, HR and RPE were obtained. VO<sub>2</sub> and RER were used to calculate cycling efficiency.

**RESULTS:** Statistical analysis revealed a significant main effect of intensity and condition on VO<sub>2</sub>, HR, RER and efficiency. Paired T-test analysis indicated, on average, across all three workloads the use of a counterweight reduced VO<sub>2</sub> ( $23.7 \pm 6.8$  to  $18.1 \pm 5.3$  ml/kg/min), RER ( $0.96 \pm 0.04$  to  $0.91 \pm 0.02$ ), HR ( $143 \pm 18$  to  $120 \pm 19$  bpm) and RPE ( $14.8 \pm 2.2$  to  $12.2 \pm 2.2$ ) and increased efficiency ( $13.3 \pm 0.03$  to  $17.8 \pm 0.04$  %) compared to the non-counterweight condition. VO<sub>2</sub>, HR and efficiency were not, however, different between the single-leg counterweight and double leg cycling conditions while RPE and RER were higher with the counterweight ( $12.2 \pm 2.2$  and  $0.91 \pm 0.02$ ) compared to the double leg condition ( $10.7 \pm 1.6$  and  $0.84 \pm 0.04$ ).

**CONCLUSION:** Based on these data, counterweighted single leg cycling provides an exercise modality that allows for greater exercise intensity at the peripheral level, without increasing central cardiovascular and pulmonary demand and therefore may be beneficial to those with cardiovascular or pulmonary limitations.

1641 Board #49 MAY 30 3:30 PM - 5:00 PM

### Determinants of Exercise Cardiac Output in Paralympic Athletes with Locomotor Impairments

Marco Bernardi<sup>1</sup>, Silvia Carucci<sup>2</sup>, Alessandro D'Alessio<sup>3</sup>, Emanuele Guerra<sup>4</sup>, Angelo Rodio<sup>5</sup>, Yaghesh Bhambhani<sup>6</sup>. <sup>1</sup>School of Specialization in Sports Medicine - Sapienza University of Rome; <sup>2</sup>Italian Paralympic Committee, Rome, Italy. <sup>3</sup>School of Specialization in Sports Medicine - Sapienza University of Rome, Italy, Rome, Italy. <sup>4</sup>Sapienza University of Rome, Rome, Italy. <sup>5</sup>Italian Paralympic Committee, Rome, Italy. <sup>6</sup>University of Cassino, Cassino, Italy. <sup>7</sup>Faculty of Rehabilitation Medicine, University of Alberta, Edmonton, AB, Canada.

(No relationships reported)

Stroke volume (SV) during arm cranking exercise (ACE) is significantly lower in individuals with paraplegia (PA), compared to other wheelchair confined subjects and to able bodied individuals, for a reduced cardiac preload due to venous pooling in the lower body. At our best knowledge, no such data exist on top level PA athletes (PA-A).

**PURPOSE:** The purposes of this study was to: (1) assess the cardiac output determinants (SV and heart rate -HR) in Paralympic PA-A (N = 16) and those with lower limb amputation (AMP-A, N=10) and poliomyelitis (PM-A, N =6), (2) compare their relationships between aerobic fitness (peak oxygen uptake - VO<sub>2</sub>peak) and maximal SV, and (3) examine the inter-relationships between oxygen pulse (O<sub>2</sub> pulse) and both SV and (a - v)O<sub>2</sub>diff in these athletes.

**METHODS:** Each athlete completed a continuous maximal ACE test up to volitional fatigue to assess VO<sub>2</sub>peak. In a different session subsequent cardiac output determinations from carbon dioxide re-breathing at 30%, 50% and 70% of VO<sub>2</sub>peak were carried out.

**RESULTS:** PA-A showed maximal ACE SV values ( $107 \pm 28.0$  ml) significantly lower than in AMP-A/PM-A ( $137 \pm 20.5$  ml) with a concomitant higher HR ( $136 \pm 16.4$  vs  $116 \pm 11.2$  beats •min<sup>-1</sup>). Maximal SV was significantly correlated with VO<sub>2</sub>peak in both PA-A (R<sub>2</sub> = 0.809) and AMP-A/PM-A (R<sub>2</sub> = 0.577) groups, with the following overall equation:

$$VO_{2peak} (ml \cdot min^{-1}) = 0,0165 SV + 0,3423 (R^2 = 0,6502).$$

Significant correlations were observed between O<sub>2</sub> pulse and SV in both PA-A (R<sub>2</sub> = 0.83) and AMP-A/PM-A (R<sub>2</sub> = 0.62) but not between O<sub>2</sub> pulse and (a - v)O<sub>2</sub>diff. O<sub>2</sub> pulse was a valid predictor of SV as there were no outliers in both groups of athletes (Bland-Altman analysis).

**CONCLUSIONS:** This study shows that maximal SV, lower in PA-A than in AMP-A/PM-A, is a significant determinant of VO<sub>2</sub>peak in Paralympic athletes with locomotor impairments. O<sub>2</sub> pulse at the submaximal level of VO<sub>2</sub> peak in which maximal SV is reached ( $62 \pm 10.1\%$  in PA-A and  $57 \pm 13.9\%$  in AMP-A/PM-A) can be used to characterize differences in aerobic fitness between Paralympic athletes and predict exercise SV when direct measurement is not possible.

Acknowledgements: Funded by Italian Ministry of Health (Conv. 2007-3), Sapienza - University of Rome, and Italian Paralympic Committee.

1642 Board #50 MAY 30 3:30 PM - 5:00 PM

### Left Ventricle speckle tracking in Young Elite Athletes

Alessio De Luca<sup>1</sup>, Laura Stefani<sup>1</sup>, Gianni Pedrizzetti<sup>2</sup>, Stefano Pedri<sup>1</sup>, Giorgio Galanti<sup>1</sup>. <sup>1</sup>Sports Medicine, Florence, Italy. <sup>2</sup>Civil Engineering Department, Trieste, Italy.

(No relationships reported)

**PURPOSE:** Regular training, induces in adult myocardial adaptation, so-called "athletes heart". The assessment of myocardial function is currently possible by deformation parameters. Aim of study is to verify the role of rotation and twist parameters for better characterize the heart performance in trained elite young athletes from different kind of sports.

**METHODS:** 50 young athletes (16 cyclists, 17 soccer players, 17 basket players) regularly trained at least three times a week for at least 9 months a year and 10 young controls (mean age  $18.5 \pm 0.5$  years) were evaluated either by 2D echocardiography or by a Speckle Tracking (ST) multi-layer approach to calculate Left Ventricle (LV) endocardial and epicardial rotation, twist, circumferential strain (CS) and longitudinal strain (LS). Data were compared by ANOVA test.

**RESULTS:** All the found values were within the normal range (fig. 1). Left Ventricle Diastolic Diameter (LVDD,  $51.7 \pm 2.6$  mm, p=.001), Cardiac Mass index (CMi,  $114.5 \pm 18.5$  g/m<sup>2</sup>, p<.01), epi-CS, epi-LS, epicardial apex rotation and the Endo/Epi twist were significantly higher only in cyclists. In all the groups, a physiological difference of the Endo/Epi basal circumferential strain and twist values have been found. A weak but not significant relationship between the Endo and twist values and LVDD ( $r^2=0.44$  p=.005) and CMi was also reported in cyclists.

**CONCLUSIONS:** Progressive increase of apical LV twist may represent an important component of myocardial remodelling. This aspect is particularly evident in the young cyclists group where the CMi and the LVDD are higher. ST multilayer approach completes the LV performance evaluation in young trained athletes showing values similar to adults.

1643 Board #51 MAY 30 3:30 PM - 5:00 PM

### The Influence of Cold Water Immersion on Limb and Cutaneous Blood Flows Following Exercise

Christopher Mawhinney<sup>1</sup>, Helen Jones<sup>1</sup>, David A. Low<sup>2</sup>, Chang Hwa-Joo<sup>1</sup>, Keith P. George<sup>1</sup>, Daniel J. Green<sup>3</sup>, Warren Gregson<sup>1</sup>. <sup>1</sup>Liverpool John Moores University, Liverpool, United Kingdom. <sup>2</sup>Imperial College London, London, United Kingdom. <sup>3</sup>The University of Western Australia, Perth, Australia.  
(No relationships reported)

Cold-water immersion is a commonly employed treatment to facilitate recovery from exercise-induced muscle damage. Benefits may partly arise from reduction in limb blood flow, however no study has comprehensively investigated the influence of different degrees of cooling on femoral blood flow responses following exercise.

**PURPOSE:** To determine the influence of cold (8°C) and cool (22°C) water immersion on lower limb and cutaneous blood flow following exercise.

**METHODS:** Twelve males (25±1.36yrs) completed a continuous cycle exercise protocol at 70% peak power output until a core temperature of 38°C was attained. In a randomized order, subjects were then placed in a semi-reclined position and hoisted into either 8°C or 22°C water to the iliac crest for 10 min or rested (Control). Rectal and thigh skin temperature, deep and superficial muscle temperature ( $T_m$ ), thigh and calf skin blood flow (laser Doppler flowmetry) and superficial femoral artery blood flow (duplex ultrasound) were measured prior to and after 30 min immersion. Vascular conductance was calculated for cutaneous and femoral flow and mean arterial pressure. Data were analyzed using repeated measures ANOVA. Cutaneous data is presented as % of pre-immersion.

**RESULTS:** Compared with Control, femoral artery conductance was reduced to a similar extent in both immersion conditions (Cold, 1.58±0.13; Cool, 1.76±0.20; Control, 2.38±0.22 ml·min<sup>-1</sup>·mmHg,  $p < 0.01$ ). When compared to control, thigh (-72.07±3.43%; Cool, -61.05±5.73%; Control, -21.85±8.04%,  $p < 0.01$ ) and calf skin conductance (Cold, -65.41±7.09%; Cool, -53.62±4.50%; Control, -28.48±7.39%,  $p < 0.01$ ) was similar between immersion conditions. The greatest reduction in  $T_m$  occurred at a depth of 1cm and was dependent on the condition (Cold, 31.10±0.48°C; Cool, 33.96±0.38°C; Control, 36.22±0.31°C,  $p < 0.01$ ). Deep  $T_m$  (3cm) decreased over the recovery period, with the magnitude of  $T_m$  decrease dependent on the condition (Cold, 35.52±0.2°C; Cool, 36.00±0.15°C; Control, 36.91±0.09°C,  $p < 0.01$ ).

**CONCLUSION:** A core temperature load of similar magnitude induces similar reductions in femoral and skin blood flows, irrespective of the lower body being immersed in cold or cool water. Cold-water may be more effective in the treatment of exercise-induced muscle damage by virtue of a greater reduction in  $T_m$ .

1644 Board #52 MAY 30 3:30 PM - 5:00 PM

### Effects of Dietary Fish Oil on Exercising Muscle Blood Flow in Chronic Heart Failure Rats

Clark T. Holdsworth<sup>1</sup>, Steven W. Copp<sup>1</sup>, Daniel M. Hirai<sup>1</sup>, Scott K. Ferguson<sup>1</sup>, K Sue Hageman<sup>1</sup>, Charles L. Stebbins<sup>2</sup>, David C. Poole, FACS<sup>1</sup>, Timothy I. Musch, FACS<sup>1</sup>. <sup>1</sup>Kansas State University, Manhattan, KS. <sup>2</sup>University of California, Davis, Davis, CA.  
(No relationships reported)

Impaired vasomotor control in chronic heart failure (CHF) limits the delivery of O<sub>2</sub> to skeletal muscle during exercise. Previous results demonstrate significant increases in skeletal muscle blood flow (Q) during exercise with omega-3 polyunsaturated fatty acid (PUFA) supplementation via fish oil (FO) versus safflower oil (SO) in healthy rats (Stebbins CL et al., Int J Sport Nutr Exerc Metab 20:475-86, 2010). Whether PUFA supplementation with FO will improve vasomotor control in CHF and skeletal muscle Q during exercise remains to be determined.

**PURPOSE:** This investigation tested the hypothesis that PUFA supplementation with FO would augment the skeletal muscle Q response to exercise in rats with CHF when compared to SO.

**METHODS:** CHF was induced in male Sprague-Dawley rats (568 ± 24 g) by myocardial infarction produced by left coronary ligation. Rats were then randomized to dietary FO (20% docosahexaenoic acid and 30% eicosapentaenoic acid, n = 8) or SO (5% safflower, n = 6) supplementation for 6 weeks. After 6 weeks of dietary intervention, rats remained on their respective diets until final experiments were conducted. Following acute instrumentation and recovery (> 1 hour), mean arterial pressure (MAP), skeletal muscle Q to the total hindlimb and individual muscles (via radiolabeled microspheres), and blood lactate concentration were determined during submaximal treadmill exercise (20 m · min<sup>-1</sup>, 5% incline).

**RESULTS:** Left ventricular end-diastolic pressure (LVEDP) measured in the SO and FO groups during instrumentation were similar and demonstrated moderate CHF (LVEDP; SO: 11 ± 1; FO: 10 ± 2 mmHg,  $p > 0.05$ ). During submaximal exercise, MAP (SO: 132 ± 3; FO: 138 ± 4 mmHg), total hindlimb skeletal muscle Q (SO: 113 ± 15; FO: 92 ± 7 ml · min<sup>-1</sup> · 100 g<sup>-1</sup>) and blood lactate (SO: 4.0 ± 0.8; FO: 5.1 ± 0.6 mmol · l<sup>-1</sup>) were similar ( $p > 0.05$ ) between groups. In addition, all 28 individual hindlimb muscle Q's were similar ( $p > 0.05$ ) between SO and FO groups.

**CONCLUSION:** These data suggest that PUFA supplementation with FO in rats with moderate CHF does not increase the skeletal muscle Q response to submaximal whole body exercise.

Support: NIH HL-108328, AHA Midwest Affiliate

1645 Board #53 MAY 30 3:30 PM - 5:00 PM

### The Changes Of Muscle Blood Flow And Oxy-hemoglobin Saturation After Different Exercise Intensity In Water

Nai-Wen Kan<sup>1</sup>, Kuei-Yu Chien<sup>1</sup>, Mei-Chieh Hsu<sup>1</sup>, Yung-Hua Lin<sup>2</sup>, Yea-Lih Lin<sup>1</sup>. <sup>1</sup>National Taiwan Sport University, Taoyuan, Taiwan. <sup>2</sup>National Taipei University, New Taipei, Taiwan.  
(No relationships reported)

Water aerobics can improve circulation and muscle blood flow (MBF) which may improve oxygen availability and utilization by tissue to have cardiovascular protective effect.

**PURPOSE:** This study was to understand the changes of MBF and muscle oxygen saturation (SmO<sub>2</sub>) with different exercise intensity in three styles of water exercise moment.

**METHODS:** We recruited 12 menopausal women (age: 57-65 years old) respectively completed, water running, rocking, and scissor, three trails of water exercise moments by random and crossover trial. Each moment was carried out three stages of six-minutes testing including low (50±5%), medium (65±5%), and high (80±5%) intensity determined by heart rate reserve (HRR). The MBF and SmO<sub>2</sub> were detected over both of 4x8 cm<sup>2</sup> biceps brachii and quadriceps femoris muscles area at same time by two optical probes of near-infrared spectroscopy (NIRS).

**RESULTS:** There was no significant difference in change rates of MBF after completing each intensity level of three water exercise moments. We found significant changes of SmO<sub>2</sub> (oxy-hemoglobin / total hemoglobin) in upper arm after three stages of exercise and period of recover but the phenomenon did not be revealed in frontal thigh. The change rate of SmO<sub>2</sub> between upper and lower limbs existed positive correlation ( $p < .05$ ):  $r = 0.75$  (after low intensity running),  $r = 0.86$  (after medium intensity running),  $r = 0.83$  (after low intensity scissor), and negative correlation ( $p < .05$ ):  $r = -7.2$  (after low intensity rocking), and  $r = -7.2$  (after high intensity rocking).

**CONCLUSIONS:** In water rocking trails, upper arms may have relative exerted than lower limbs for reaching target HRR, so they appear negative correlation of SmO<sub>2</sub> changes unlike water running and scissor steps. Different exercise trials in water for menopausal women may induce the change of oxygen re-distribution between upper and lower limbs during recover time.

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## B-25 Exercise is Medicine/Poster - Cardiovascular System, Cardiovascular Disease Management, Children and Elderly

May 30, 2012 1:00 PM - 6:00 PM  
ROOM: Exhibit Hall

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1646 Board #54 May 30 2:00 PM - 3:30 PM

### Endurance Exercise Training and Curcumin Supplementation Inverses Lead-Induced Cardiotoxicity

Mahdi Hossein Zadeh<sup>1</sup>, Valiollah Dabidi Roshan<sup>2</sup>, Javad Ashrafi<sup>2</sup>, Jonathan Myers, FACSM<sup>3</sup>, <sup>1</sup>Aalborg University, Center for Sensory-Motor Interaction (SMI), Aalborg, Denmark. <sup>2</sup>College of Physical Education and Sport Sciences, University of Mazandaran, Babolsar, Iran, Babolsar, Iran, Islamic Republic of. <sup>3</sup>Cardiology Division, VA Palo Alto Health Care System, Stanford University, Palo Alto, CA, USA, Palo Alto, CA.  
(No relationships reported)

**BACKGROUND:** According to the American Heart Association, air pollution can develop cardiovascular disease. Lead is an environmental pollutant that can induce to long-lasting health problems including cardiovascular toxicity. Apelin is a novel endogenous peptide, and heat shock protein (HSP72) is detected in a variety of tissues and organs; both apelin and HSP72 play important protective role in the cardiovascular system.

**PURPOSE:** To investigate the cardioprotective effects of aerobic exercise training and/or curcumin supplementation, an antioxidant, alone or combined on left ventricular apelin, HSP72, total antioxidant capacity (TAC), and malondialdehyde (MDA) in rats chronically exposed to lead.

**METHODS:** Forty male Wistar rats were randomly divided to 5 groups: (1) lead acetate; (2) curcumin; (3) treadmill running; (4) treadmill + curcumin; and (5) sham-treated. The rats in groups 1 to 4 received lead acetate (20 mg/kg). Groups 3 and 4 underwent treadmill running, 15 to 22 m/min for 25 to 64 minutes, 5 times a week for 8 weeks, while groups 2 and 4 received curcumin solution (30 mg/kg) intraperitoneally. The sham group received curcumin solvent (ethyl oleat), only.

**RESULTS:** Lead administration resulted in a significant decrease in apelin (38%, P < 0.001), and TAC levels (27%, P < 0.001), and significantly increased HSP72 (15%, P < 0.01) and MDA (71%, P < 0.01) in the left ventricle in comparison to the sham group. However, both treadmill running and curcumin supplementation resulted in a significant increase in heart mass (12%, P < 0.01), as well as apelin (89%, P < 0.001), and TAC (27%, P < 0.001) levels, and significantly decreased HSP72 (57%, P < 0.01) and MDA levels (84%, P < 0.01) in comparison to the lead only group.

**CONCLUSIONS:** These results suggest a cardioprotective effect of concomitant antioxidants and regular endurance training in ameliorating lead-induced cardiotoxicity.

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1647 Board #55 May 30 2:00 PM - 3:30 PM

### Three Decades Of Participation In Cardiac Rehab

Allison Poremba, BS, Kirk Hendrickson. *Beaumont Health System, Royal Oak, MI. (Sponsor: Barry A. Franklin, FACSM)*  
(No relationships reported)

**HISTORY:** An 84-year-old male has a history of coronary disease, including 2 four-vessel coronary artery bypass graft (CABG) surgeries; 1980 and 2003, and an angioplasty in 2003 to an occluded graft. In 2010, he underwent a cardiac catheterization as a follow-up to an abnormal graded exercise stress test (GXT).

**PHYSICAL EXAMINATION:** The patient was asymptomatic after initial CABG (1980) and began a progressive walking program. Prior to surgery he had anginal symptoms.

**DIFFERENTIAL DIAGNOSIS:** Myocardial ischemia

**TEST AND RESULTS:** Status post initial CABG (04/1980): Exercise capacity = 7.4 metabolic equivalents (METs); unremarkable exercise ECG; body mass index (BMI) = 25.5 kg/m<sup>2</sup>.

Status post secondary CABG (03/2003): Exercise capacity = 6.0 METs; unremarkable exercise ECG; BMI = 26.5 kg/m<sup>2</sup>. Lipid values (10/2003): Total cholesterol (TC), HDL-C, LDL-C, triglycerides (TG) and glucose (G) were 144, 33, 76, 174, and 99 mg/dL, respectively; HbA1c = 5.9.

Percutaneous Coronary Intervention (09/2003): Stent placed in saphenous vein graft supplying obtuse marginal branch.

Recent GXT (02/2010): Exercise capacity = 6.2 METs; horizontal/downsloping ST depression; BMI = 25.0 kg/m<sup>2</sup>. Lipid values (02/2010): TC, LDL-C, TG, and G were 110, 55, 34, 104 and 104 mg/dL, respectively; HbA1c = 5.7.

Cardiac catheterization (04/2010): Left heart catheterization revealed native left anterior descending coronary artery occlusion; medical management was recommended.

Lower extremity arterial Doppler (06/2011): > 75% stenosis in right and left femoral arteries, signifying peripheral vascular disease (PVD).

**FINAL WORKING DIAGNOSIS:** Coronary artery disease/PVD

**TREATMENT AND OUTCOMES:** He began cardiac rehabilitation in 1980 and has been a participant for the past 31.5 years. His current lifestyle includes regular aerobic exercise and a heart healthy diet. He exercises 3 days/week for ~ 60 minutes/session using stationary cycle ergometry, arm-leg ergometry, and walking. He is physically active at home and regularly performs domestic chores and yard work. He denies cardiac complaints but was limited by leg fatigue on his most recent GXT; PVD was diagnosed in 2011. Most notably, the patient's BMI and functional capacity have remained largely unchanged over the past 3 decades, and he has experienced no acute cardiac events.

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1648 Board #56 May 30 2:00 PM - 3:30 PM

### The Associations Of Plasma Fibrinogen With Self-reported Leisure-time Physical Activity And Sitting Time In Australian Adults

Bethany J. Howard<sup>1</sup>, Alicia A. Thorp<sup>1</sup>, Balkau Beverley<sup>2</sup>, Neville Owen<sup>1</sup>, David W. Dunstan<sup>1</sup>, <sup>1</sup>Baker IDI Heart & Diabetes Institute, Melbourne, Australia. <sup>2</sup>INSERM CESP U<sup>1018</sup>, Villejuif, France. (Sponsor: Charles Matthews, FACSM)  
(No relationships reported)

Plasma fibrinogen, an inflammatory marker is positively associated with all-cause and cardiovascular mortality. Leisure-time physical activity (LTPA) has been shown to be inversely associated with fibrinogen, indicating a protective role. Recent studies have shown that sedentary behaviour (sitting), independent of LTPA is associated with an increased risk of all-cause and cardiovascular mortality, however, the association of plasma fibrinogen with daily sitting time has not been studied.

**PURPOSE:** To examine the associations of daily LTPA and sitting time with plasma fibrinogen in Australian adults.

**METHODS:** Plasma fibrinogen was measured in 2,346 men and 3,052 women aged  $\geq 30$  years (mean age 54 years) without cardiovascular disease from the 2004-2005 Australian Diabetes, Obesity and Lifestyle (AusDiab) study. Multivariate linear regression analyses examined associations of self-reported daily LTPA (hr/day) and sitting time (hr/day) with plasma fibrinogen (as a continuous measure), adjusting for potential confounding variables, including age, smoking, education and energy intake.

**RESULTS:** Each 1 hour increment per day in LTPA was associated with a 0.06g.l-1 (95% CI: -0.09, -0.03],  $P \leq 0.001$ ) and a 0.07g.l-1 (95% CI: -0.14, -0.01],  $P < 0.05$ ) reduction in plasma fibrinogen for men and women respectively. For daily sitting time, each 1 hour increment per day was associated with a 0.02g.l-1 increase in plasma fibrinogen in men (95% CI: 0.01, 0.03],  $P \leq 0.001$ ) and in women (95% CI: 0.002, 0.04],  $P < 0.05$ ). These associations remained significant for men and women following further adjustment for sitting time and LTPA in the respective models, but remained significant in men only with further adjustment for BMI.

**CONCLUSIONS:** This is the first study to describe a deleterious association between daily sitting time and plasma fibrinogen, independent of LTPA. While the findings from this study will need to be examined in prospective settings, the results suggest that in addition to the promotion of regular physical activity during leisure time, preventative efforts could be directed at reducing sitting time to attenuate the deleterious effects known to be associated with fibrinogen.



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1649 Board #57 May 30 2:00 PM - 3:30 PM

**Cardiorespiratory Fitness And The Risk Of Cardiovascular Disease Mortality In Men With Hypercholesterolemia**

Xuemei Sui<sup>1</sup>, Duck-chul Lee<sup>1</sup>, Enrique G. Artero<sup>1</sup>, Timothy S. Church, FACSM<sup>2</sup>, Gregory A. Hand, FACSM<sup>1</sup>, Steven N. Blair, FACSM<sup>1</sup>. <sup>1</sup>University of South Carolina, Columbia, SC. <sup>2</sup>Pennington Biomedical Research Center, Baton Rouge, LA.  
(No relationships reported)

**PURPOSE:** Elevated blood cholesterol is associated with increased risk of cardiovascular disease (CVD). Whether higher cardiorespiratory fitness (CRF) confers protection against CVD in individuals with manifest hypercholesterolemia is poorly understood. This longitudinal study sought to examine the association between CRF and risk of death from CVD in men with hypercholesterolemia in the Aerobics Center Longitudinal Study.

**METHODS:** Participants were 8,920 men (mean  $\pm$  SD age 45.9  $\pm$  8.7 years, range from 20 to 82) with no history of CVD and cancer, and received a preventive examination at the Cooper Clinic in Dallas, TX during 1974 - 2001. At baseline, all men had hypercholesterolemia on the basis of measured fasting blood cholesterol  $\geq$  6.20 mmol/L. CRF was quantified as maximal treadmill exercise test duration and was grouped for analysis as low (lowest 20% of exercise duration), moderate (middle 40%), and high (upper 40%) Using Cox regression analyses, we computed hazard ratios and 95% confidence intervals.

**RESULTS:** During an average of 17 years of follow-up, 329 CVD deaths occurred. Age-adjusted CVD mortality rates per 10,000 person-yrs according to low, moderate, and high CRF groups were 34.9, 19.4, and 16.8 (trend  $P < 0.0001$ ). After further control for baseline year of examination, body mass index, smoking, alcohol intake, physical activity, hypertension, diabetes, fasting blood cholesterol, and family history of CVD, hazard ratios (95% confidence interval) for CVD deaths across moderate and high categories of CRF (with low fit as referent = 1.00) were: 0.65 (0.49-0.86), 0.54 (0.38-0.78). There was an inverse association between CRF and CVD death within both normal weight men (trend  $P < 0.0001$ ) and overweight/obese men (trend  $P = 0.01$ ). After stratifying data by baseline physical activity level, an inverse association between CRF and CVD death was observed in sedentary men (trend  $P = 0.0004$ ); and a borderline significance was found in active men (trend  $P = 0.08$ ).

**CONCLUSIONS:** Among men with hypercholesterolemia, higher CRF is associated with lower risk of dying from CVD, independent of other clinical risk factors. Our findings underscore the importance of promoting CRF in the primary prevention of CVD in patients with hypercholesterolemia. Supported by NIH grant DK088195.

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1650 Board #58 May 30 2:00 PM - 3:30 PM

**Feasibility Of Aerobic Interval Training In Cardiac Rehabilitation**

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(No relationships reported)

There is growing evidence that high-intensity aerobic interval training (AIT) is more efficient than continuous moderate exercise training in improving aerobic capacity, both in healthy and in cardiac patients. It is therefore important to provide efficient exercise training in the health care system. However, how easily AIT is performed in a clinical outpatient setting is not clear, in regard to both achieving exercise intensity and exercise adherence.

**PURPOSE:** The aim of the study was to assess feasibility of AIT in cardiac rehabilitation (CR) in two Norwegian hospitals.

**METHODS:** 90 patients (80 men/10 women, mean age 57 $\pm$ 8) referred to CR, diagnosed Myocardial Infarction (MI, n=61), Acute Coronary Syndrome treated with PCI (n=7) or Coronary Artery Bypass graft (CABG, n=22), were invited to participate. Cardiopulmonary exercise test was performed before and after intervention to determine exercise tolerance, peak oxygen consumption (VO<sub>2</sub>peak) and peak heart rate (HRpeak). The intervention consisted of 12 weeks of AIT, twice a week with 4x4 intervals with 3 minutes of active break between. Target heart rate (THR) was set to 85-95% of HRpeak, and all patients exercised with a heart rate (HR) monitor. HR monitor data were downloaded regularly to assess exercise intensity and to give feedback to the participants. Main outcome measure was VO<sub>2</sub>peak, secondary outcome was exercise adherence. Paired Students T-test was used to analyse change within group.

**RESULTS:** There were 7 drop-outs (6 men) during the intervention period, due to orthopaedic problems (3), withdraw (3), and gastro intestinal problems (1). 83 patients completed the training programme (92%), and 80 of them logged 17 training sessions or more (median 24, range 7-24). THR was achieved by all except one. No adverse events were noticed during the training period. VO<sub>2</sub>peak changed from 34 $\pm$ 6.3 to 37.5 $\pm$ 6.7 ml/kg/min ( $p=0.001$ ), weight from 88.1 $\pm$ 14.1 to 87.3 $\pm$ 13.7 kg ( $p=0.005$ ), resting HR from 59 $\pm$ 9 to 57 $\pm$ 8 beats/min ( $p=0.011$ ), systolic blood pressure from 139 $\pm$ 20 to 135 $\pm$ 14 mmHg ( $p=0.056$ ), and diastolic blood pressure from 85 $\pm$ 11 to 83 $\pm$ 8 mmHg ( $p=0.047$ ).

**CONCLUSIONS:** AIT increased VO<sub>2</sub>peak significantly, was conducted without adverse events at THR, with an excellent exercise adherence and low drop-out rate. AIT should be considered as an option in cardiac rehabilitation.

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1651 Board #59 May 30 2:00 PM - 3:30 PM

**Women Doing Tai Chi During Phase III Cardiac Rehabilitation Have Better Physical Functioning Than Men**

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(No relationships reported)

Exercise is well-recognized and effective for secondary prevention in patients with coronary heart disease (CHD). Traditional cardiac rehabilitation (TCR) efforts are targeted towards optimal physical functioning following a CHD event. Tai Chi exercise appeals to women as an adjunct physical activity for cardiac rehabilitation. **PURPOSE:** Examine gender differences in physical functioning.

**METHODS:** Secondary analysis using data from a cross-sectional study examining the effects of Classic Wu style Tai Chi compared to TCR, among phase III cardiac rehabilitation adults  $\geq$  45 years. Physical functioning tests included a 2-minute step-in-place test to assess aerobic endurance, single leg stance and functional reach tests to assess balance, arm curl and chair stand tests to assess strength, and back scratch and chair-sit-and-reach tests to assess flexibility.

**RESULTS:** Subjects (n=51) were 70 $\pm$ 8 years (range=49-86 years), and attended cardiac rehabilitation for 45 $\pm$ 37 months. Coronary artery bypass surgery (65%) was the most commonly self-reported cardiac event, followed by angioplasty/stent (57%), and a myocardial infarction (51%). Compared to men, women attended Tai Chi more than TCR (33% vs. 73%,  $X^2=6.84$ ,  $p<0.01$ ). Women scored  $\geq$  50th percentile on all physical functioning measures, while the men scored  $\geq$  50th percentile only on the balance and strength measures; compared to norms (Table).

**CONCLUSIONS:** Tai Chi appeals to women following a CHD event. Tai Chi offers additional options for women to improve physical functioning, whether as an adjunct to a TCR program, as part of a maintenance program for persons with CHD, or as an exercise alternative at any point along this continuum.

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Table: Physical Functioning Compared to Norms

|   | Women, n=15 |                          | Men, n=36   |                          |
|---|-------------|--------------------------|-------------|--------------------------|
|   | mean ± SD   | 50th % score, age=71 yrs | mean ± SD   | 50th % score, age=69 yrs |
| Aerobic Endurance, steps in 2-min.        | 89.7 ± 17.2 | 84                       | 87.5 ± 19.9 | 101                      |
| Balance                                   |             |                          |             |                          |
| Functional Reach, inches                  | 16.7 ± 4.0  | 10.5                     | 17.1 ± 3.3  | 15                       |
| Single Leg Stance, Right (number of sec.) | 27.1 ± 23.7 | 17.2                     | 37.1 ± 23.5 | 27                       |
| Single Leg Stance, Left (number of sec.)  | 30.0 ± 22.5 | 17.2                     | 27.9 ± 23.8 | 27                       |
| Strength                                  |             |                          |             |                          |
| Upper body, arms curls in 30 sec.         | 15.2 ± 3.2  | 15                       | 17.8 ± 5.1  | 18                       |
| Lower Body, chair stands in 30 sec.       | 13.7 ± 3.3  | 13                       | 12.1 ± 3.1  | 15                       |
| Flexibility                               |             |                          |             |                          |
| Shoulder (back scratch), inches           | -1.6 ± 4.2  | -1.5                     | -5.9 ± 5.1  | -4.0                     |
| Hamstring (sit-and-reach), inches         | -0.4 ± 5.7  | 1.5                      | -3.1 ± 5.8  | 0                        |

**1652 Board #60 May 30 2:00 PM - 3:30 PM****Change In Total Volume Of Physical Activity And Its Relationship With Change In Arterial Stiffness**

Marquis Hawkins<sup>1</sup>, Kelley Pettee Gabriel<sup>2</sup>, Jennifer Cooper<sup>1</sup>, Kristi Storti<sup>1</sup>, Kim Sutton-Tyrrell<sup>1</sup>, Andrea Kriska, FACSM<sup>1</sup>. <sup>1</sup>University of Pittsburgh, Pittsburgh, PA. <sup>2</sup>The University of Texas Health Science Center at Houston, Austin, TX.

(No relationships reported)

Arterial stiffness (AS) is a subclinical measure of cardiovascular disease that predict future cardiovascular events. Physical activity (PA) has been shown to reduce AS; however, the specific mechanisms are unknown.

**PURPOSE:** To determine the impact of PA on arterial stiffness in overweight, sedentary adults (20-45yrs) participating in a lifestyle intervention.

**METHODS:** The Slow Adverse Vascular Effects of excess weight (SAVE) trial is a study evaluating the relationships between weight loss, dietary sodium, and vascular health. Subjects were randomly assigned to a regular or reduced sodium diet, with all receiving one-year nutrition and PA intervention. Data was collected at baseline and 12 months follow-up. PA Intensity was assessed with the ActiGraph accelerometer. AS was assessed by brachial-ankle PWV (baPWV) using an automated device. Mixed models examined the associations between changes over 12 months in time spent in light intensity PA (LPA), moderate to vigorous PA (MVPA), sustained bouts of MVPA (>8 minutes), sedentary activity, total accelerometer counts (counts/day) on change in baPWV. Models were adjusted for time since baseline visit, age, sex, race, and smoking status, homeostatis model of assessment of insulin resistance (HOMA score), body mass index (BMI) and accelerometer wear time.

**RESULTS:** MVPA significantly increased from baseline to 12 months while time spent in LPA significantly decreased. BMI decreased from baseline to 12 months. Mean baPWV was similar at each time point. Change in baPWV was inversely related to change in total counts per day in the fully adjusted models (p=0.02). BaPWV and MVPA bouts were inversely related (p=0.07) when adjusting for age, race, gender, smoking status, and accelerometer wear time but was further attenuated when BMI was added to the model (p=0.12). Change in sedentary time was positively related to change in arterial stiffness in women (p=0.02) but not men.

**CONCLUSIONS:** Total accelerometer counts appeared to be more important for reducing arterial stiffness than time spent in any intensity of activity.

**1653 Board #61 May 30 2:00 PM - 3:30 PM****High Intensity Exercise Better For Improving Cardiovascular Function And Ventilatory Efficiency In Coronary Disease Patients**

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(No relationships reported)

High intensity interval training (HIT) has been shown to be more effective than moderate intensity continuous training (MIT) for improving maximal oxygen uptake (VO<sub>2</sub>peak) in patients with coronary heart disease (PCHD), suggesting greater cardioprotective benefits. Whether HIT is more effective for improving newly emerged cardiopulmonary exercise testing variables (CPXv), such as VE/VCO<sub>2</sub> slope, OUES and peak oxygen pulse is not known.

**PURPOSE:** Our objective was to compare the effects of HIT and MIT on CPXv associated with cardiorespiratory function and prognosis in PCHD.

**METHODS:** Fifty-eight PCHD (aged 61±1.7 yrs; 71% men) with optimized treatment underwent maximal CPX as part of their clinical evaluation. PCHD were assigned to either MIT (n=18), consisting of 30 minutes of continuous aerobic exercise at 70 to 75% of maximal measured heart rate (HRmax) or HIT (n=19), consisting of a total of 30 minutes, divided in two minutes intervals at 60% and 90% of HRmax. Both protocols were performed 3 times per week for an average of 4.2±2.5 months. A control group (CG) was set (n=21) and did not perform any exercise routine during the experimental period. PCHD that changed their clinical status (medications and diseases) were excluded from the study. Groups were all similar in baseline.

**RESULTS:** Except for the VE/VCO<sub>2</sub> slope, the HIT group exhibited better improvements in all CPXv when compared to MIT (Table 1). No differences were found in CG for all CPXv.

**CONCLUSIONS:** HIT was more effective for improving CPX clinical valuable variables other than VO<sub>2</sub>peak when compared to MIT. These findings have important implications for exercise prescription in rehabilitation programs.

*Acknowledgements: FAPERJ and CNPq.*

1654 Board #62 May 30 2:00 PM - 3:30 PM

**Physical Improvements after Yoga for People with Chronic Stroke**

Arlene A. Schmid<sup>1</sup>, Kristine K. Miller<sup>1</sup>, Marieke Van Puymbroeck<sup>2</sup>, Tracy A. Dierks<sup>3</sup>, Peter Altenburger<sup>3</sup>, Nancy Schalk<sup>4</sup>, Linda S. Williams<sup>1</sup>, Erin DeBaun<sup>1</sup>, Teresa Damush<sup>1</sup>. <sup>1</sup>Indiana University/Roudebush VAMC, Indianapolis, IN. <sup>2</sup>Indiana University, Bloomington, IN. <sup>3</sup>Indiana University, Indianapolis, IN. <sup>4</sup>Heartland Yoga, Indianapolis, IN. (Sponsor: NiCole Keith, FACSM)  
(No relationships reported)

**PURPOSE:** Assess the impact of therapeutic-yoga on physical performance measures in people with chronic stroke.

**METHODS:** Forty-seven individuals with stroke were recruited and randomized 3:1 to yoga or waitlist control. The yoga group completed one hour yoga sessions twice a week for 8 weeks. Yoga was taught by a certified yoga therapist and included modified physical postures, yoga breathing, bilateral movements, and concluded with relaxation while seated, standing, and supine. Assessments before and after the 8 weeks included: flexibility via passive range of motion (PROM) for the hamstrings (HS) and active range of motion (AROM) for hip flexion, cervical rotation, and cervical lateral flexion; strength with the chair to stand and arm curl and hip flexion manual muscle test; and endurance with a 6 minute walk. We compared groups with a t-test/Mann Whitney. We used paired t-tests/Wilcoxon non-parametric tests to compare baseline and 8-week data.

**RESULTS:** The average age of participants completing the study was 64, 76% were male, and 63% were white. There were no differences in demographics or outcomes between the yoga and control groups. There were no improvements in the waitlist control group. In the yoga group (n=29), improvements were found in flexibility with PROM and AROM, arm curl, and endurance, see Table. The chair to stand test and hip flexion AROM did not change (p>.05).

| Variable                        | Baseline   | 8 weeks    | p value |
|---------------------------------|------------|------------|---------|
| Left hamstring PROM             | -22.20±9.8 | -12.10±4.3 | <.001   |
| Right hamstring PROM            | -19.25±5.5 | -12.20±4.4 | <.001   |
| Left cervical Rotation          | 54.45±8.3  | 65.85±8.2  | <.001   |
| Right cervical rotation         | 57.65±8.9  | 65.55±8.0  | .002    |
| Left cervical lateral flexion   | 19.4±10    | 27.05±9.6  | .001    |
| Right cervical lateral flexion  | 15.4±8.8   | 23.8±8.3   | <.001   |
| Arm curl strength               | 13.76±4.1  | 15.4       | .003    |
| 6-minute walk, walking capacity | 869±380    | 949±370    | .002    |

**CONCLUSIONS:** These findings suggest therapeutic-yoga improved flexibility, arm strength, and endurance for individuals post-stroke. Therapeutic-yoga requires repetitive, slow and sustained muscle activation which may contribute to these findings. Further testing, however, is warranted as these findings are preliminary.

1655 Board #63 May 30 2:00 PM - 3:30 PM

**The Antihypertensive Effects of Aerobic Exercise Training: A Meta-Analysis**

Hayley V. MacDonald, TaShauna U. Goldsby, Blair T. Johnson, Tania B. Huedo-Medina, Linda S. Pescatello, FACSM. University of Connecticut, Storrs, CT.  
(No relationships reported)

Meta-analyses report aerobic exercise (AE) training reduces blood pressure (BP) 3-5 mmHg but have yet to demonstrate how this effect might vary according to patient characteristics, Frequency, Intensity, Time and Type (FITT) of the AE intervention, and other factors.

**PURPOSE:** To investigate the effectiveness of AE training as antihypertensive therapy while exploring factors likely to moderate the BP response to AE training.

**METHODS:** A systematic search was conducted to locate relevant randomized controlled trials. Studies were included if they had adults (≥19 yr); a non-exercise, non-diet control, or comparison group or session; and reported pre and post-BP for AE and control groups and the FITT of the AE intervention. Studies were excluded if they involved any dietary or medication intervention, and/or special population with diseases unrelated to cardiovascular disease. Analyses followed random-effects assumptions.

**RESULTS:** 32 studies were included yielding 45 interventions with 1906 participants (exercise n= 998, control n= 908). Participants were white (93%), middle-aged (49.6±12.7yr) women (48%) and men (52%) who were overweight [body mass index (BMI) 27.4± 2.4kg•m<sup>-2</sup>] and had pre-hypertension [systolic BP (SBP) 125.4±22.9/diastolic BP (DBP) 78.0±14.8mm Hg] with 12.8% taking antihypertensive medication (n= 244). AE interventions were performed at moderate to vigorous intensity (6.3±1.7 MET) for 37.6 ±12.4 min•session<sup>-1</sup>, 3.5±1.1 d•wk<sup>-1</sup> for 22.7±23 wk. SBP (d+=-0.22; 95%CI:-0.36,-0.08; -1.2±5.8 mmHg) and DBP (d+=-0.22; 95%CI:-0.36,-0.08; -1.8±3.3 mmHg) decreased following AE training compared to control. SBP was reduced to greater levels in individuals who were older (β=-0.37, p<=.01) and had a higher BMI (kg•m<sup>-2</sup>) (β=-0.35, p<.05). DBP was reduced to greater levels as baseline BP increased (β=-0.36, p<.05) and among those taking antihypertensive medications (β=-0.76, p<.05).

**CONCLUSIONS:** Our results confirm AE training reduces BP, but our overall result of 1-2 mmHg is 30-80% less than past meta-analyses, likely due to our use of relatively rigorous effect size calculation methods. More importantly, our results demonstrate that the antihypertensive effects of AE are more pronounced in those were older, had higher BP, greater BMI, or taking antihypertensive medications.

1656 Board #64 May 30 2:00 PM - 3:30 PM

**The Effect of Supervised vs. Unsupervised Summer Break on Cardiac Autonomic Modulation in Adolescents.**

Marco Meucci<sup>1</sup>, Hannah Crawford<sup>2</sup>, Chelsea Curry<sup>2</sup>, Hannah Wheeler<sup>2</sup>, Carol Cook<sup>2</sup>, Kris Hartley<sup>2</sup>, Scott R. Collier, FACSM<sup>2</sup>. <sup>1</sup>University of Rome, Rome, Italy. <sup>2</sup>Appalachian State University, Boone, NC.  
(No relationships reported)

Active adolescents report higher levels of HRV when compared to age-matched sedentary adolescents counterparts. Yet, few children take part in physical training as most adolescents participate in play-based physical activity. However, the effect of a short-term, play-based physical activity program on cardiac autonomic modulation in adolescents has not been established.

**PURPOSE:** Therefore, the purpose of this study was to investigate the effects of 4 (4w) and 8 weeks (8w) of supervised play-based physical activity vs. an 8-week unsupervised summer break (C) on HRV in adolescents.

**METHODS:** 22 adolescents (8 to 12 years-old) were divided into three groups blinded to the investigators: The 4 (n=6) and 8 (n=6) week activity groups performed supervised, play-based physical activity 6 hours/day, 5 times/wk vs. a control group (n=10) which has been instructed to maintain regular summer break habits. HRV was assessed via heads-up tilt (supine at 0 degrees and heads-up tilt at 80 degrees) both pre and post intervention. HRV data was collected via 3-lead EKG (BioPac, Systems, inc.) while simultaneous beat-to-beat blood pressure was collected using finger plethysmography (Finometer) in 10-min epochs.

**RESULTS:** TP increased at rest and with tilt following 8 weeks of activity (resting pre 7479.759 ± 2326.283 to post 12007 ± 3392.293 and tilt pre 2183.125 ± 850.642 to post 2938.125 ± 1121.615). nLF show significant decreases at rest for 8 weeks of activity (pre 0.488 ± 0.065 to post 0.470 ± 0.062) and increases for 8 weeks control (pre 0.052 ± 0.075 to post 0.644 ± 0.072). nHF increased after 8 weeks training (pre 0.489 ± 0.062 to post 0.51 ± 0.062) and decreased following the control period (pre 0.394 ± 0.072 to post 0.336 ± 0.71). LF/HF ratio was better preserved in the 8 week activity group (pre 115.2 ± 60.347 to post 115.262 ± 78.235) vs the control group (pre 263.550 ± 69.682 to post 199.250 ± 90.338).

**CONCLUSIONS:** 8 weeks of play-based physical activity can increase HRV enhancing sympathovagal balance in adolescents.

Supported by a grant from the BeActive/Appalachian Partnership. (PI - Scott Collier, PhD, FACSM)

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1657 Board #65 May 30 2:00 PM - 3:30 PM

**The Influence Of Aerobic Exercise Training On Blood Pressure Among Non-Hispanic Blacks: A Meta-analysis**

TaShauna U. Goldsby, Hayley V. MacDonald, Blair T. Johnson, Tania B. Huedo-Medina, Linda S. Pescatello, FACSM. *University of Connecticut, Storrs Mansfield, CT.*

(No relationships reported)

**PURPOSE:** Nearly 41% of non-Hispanic blacks in the United States have hypertension (HTN), a higher prevalence than any other ethnic group. Because aerobic exercise lowers blood pressure (BP) 5-7 mmHg, it is recommended as a lifestyle treatment to prevent, treat, and control HTN. Currently, there is no convincing evidence to evaluate these recommendations among non-Hispanic blacks. Therefore, we reviewed studies evaluating the efficacy of aerobic exercise training to reduce BP among non-Hispanic blacks.

**METHODS:** A systematic search was conducted to locate relevant studies in electronic databases. Studies included enrolled 100% non-Hispanic black adults 19y+; had a non-exercise, non-diet control or comparison group; reported pre- and post-intervention BP measurement; and specified the frequency, intensity, time and type (FITT) of the aerobic exercise intervention. Studies were excluded if they involved any special population with chronic diseases unrelated to cardiovascular disease and/or were prospective or cross-sectional studies. Analyses followed random-effects assumptions.

**RESULTS:** 9 trials met the inclusion criteria including 10 interventions (exercise n=133, control n= 98) involving 231 participants (83% women, 17% men) 32.6±3.5y with normal BP to pre-HTN (122.3±11.3/76.3±8.2mmHg) and a body mass index (BMI) of 29.4±7.5kg/m<sup>2</sup>. Exercise interventions were performed at moderate intensity (5.9±2.1 METs) for 43.8±10.8min•session<sup>-1</sup>, 3.6±1.1 d•wk<sup>-1</sup> for 13.5±7.1 wk. Modalities were primarily walking, jogging, or treadmill (k=7), cycling (k=2), and rowing (k=1). Systolic BP (d=-0.62, 95% CI: -1.10, -0.14; I<sup>2</sup> = 68.5; -5.4 mm Hg) and diastolic BP (d=-0.69; 95% CI: -1.09, -0.28, I<sup>2</sup> = 42.6; -5.2 mm Hg) exhibited moderate to large reductions.

**CONCLUSIONS:** Our findings indicate that aerobic exercise training is efficacious for lowering BP among non-Hispanic blacks yielding BP reductions of equal to or greater magnitude than those reported in other racial/ethnic groups. The current paucity of data limit model testing of moderators; thus, it remains unknown what patient characteristics and FITT features of exercise interventions are associated with the greatest BP benefits among non-Hispanic blacks.

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1658 Board #66 May 30 2:00 PM - 3:30 PM

**The Relation Between The Blood Pressure Response To Exercise During Training And Detraining Periods**

Emily A. Moker<sup>1</sup>, Lori A. Bateman<sup>2</sup>, William E. Kraus, FACSM<sup>2</sup>, Linda S. Pescatello, FACSM<sup>1</sup>. <sup>1</sup>University of Connecticut, Storrs, CT. <sup>2</sup>Duke University, Durham, NC.

(No relationships reported)

Exercise training lowers blood pressure (BP) 5-7 mmHg, but the relation between the BP response to exercise training and detraining is unclear.

**PURPOSE:** To examine the BP response after 6m of training followed by 2wk of detraining among a subsample from the Studies of a Targeted Risk Reduction Intervention through Defined Exercise study.

**METHODS:** Subjects were 38 men and 37 women 50.2±10.6y with a body mass index of 30.5±3.2kg-m<sup>-2</sup> and resting BP of 120.0±13.7/79.1±9.2mmHg. Subjects completed 1 of 3 types of exercise training: aerobic (AE) vigorous intensity (n=34); resistance training (RT) (n=28); or AE vigorous and RT (n=13). Simple linear and multivariable regression tested the response of BP to exercise and detraining. Chi square tested the frequency of subjects that increased/decreased BP after training and detraining.

**RESULTS:** Among the total sample, BP was not different after training and detraining, regardless of modality (p>.05). However, subjects who responded to the BP lowering effects of exercise training reduced BP 10.0±6.7/9.1±4.9 mmHg; whereas those that did not respond increased BP 9.6±7.6/6.2±5.3 mmHg (p<.001). The SBP/DBP response to training and detraining was negatively correlated (r=-0.474/-0.540, p<.01). Interestingly, 65.5% of participants that reduced SBP after training (n=19), increased SBP after detraining; and 73.7% of the participants that increased SBP after training (n=28), decreased SBP after detraining (p<.05). Similarly, 80.6% of the participants that reduced DBP after training (n=28), increased DBP after detraining, and 81.3% of the participants that increased DBP after training (n=26), decreased DBP after detraining (p<.001). The SBP response to detraining (r=-0.521, p<.001), resting SBP (r=-0.444, p<.001), and the metabolic syndrome (r=0.288, p<.01) accounted for 44.8% of variability in the SBP response to training (p<.001). The DBP response to detraining (r=-0.553, p<.001), resting DBP (r=-0.450, p<.001), and the metabolic syndrome (r=0.463, p<.001) accounted for 60.1% variability in the DBP response to training (p<.001).

**CONCLUSIONS:** Future work is needed to elucidate mechanisms that explain why some people lower BP with exercise training, while others lower BP with detraining. Grant: 1R01HL57354; 2003-2008; NCT00275145

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1659 Board #67 May 30 2:00 PM - 3:30 PM

**Effectiveness Of A Home-based Exercise Program On Fitness And Blood Pressure Of Hypertensive Patients**

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(No relationships reported)

The benefits of exercise in reducing blood pressure (BP) have been mostly described in studies conducted in university-based programs that are difficult to generalize to more representative populations.

**PURPOSE:** This study aimed to investigate the influence of a long-term home-based exercise program on BP, biochemical variables and functional capacity of hypertensive patients

**METHODS:** In this controlled clinical trial, 29 patients with hypertension underwent 16 months of exercise composed by 30 minutes of light to moderate intensity walking, followed by stretching exercises. Longitudinal changes in BP, aerobic capacity, flexibility, lipid profile and glucose were assessed every two months.

**RESULTS:** Mean compliance in the experimental group was 83±7% of the planned exercise sessions. Differently from experimental group, no differences were found in control group comparisons after 16 months, except for weight and skin sum fold (higher 3.6±0.2 kg and 3.0±1.2 cm, respectively). In the experimental group, when compared to baseline, differences in weight and body fat were only found after 6 months of exercise, remaining relatively stable thereafter (78.9±9.9 kg vs. 73.5±7.9 kg and 33.5±4.6% vs. 28.8±3.1%, respectively). Aerobic capacity, expressed by the ratio between heart rate and workload, and flexibility, were improved after 16 months of exercise (p<0.05 for all comparisons). The most striking differences in systolic BP were found in the first 6 months of exercise (141.1±19.8 mmHg vs. 134.7 mmHg, p<0.05 - baseline vs. 6th month, respectively). Even though significant differences were remained after 16 months of exercise, no further reductions were observed after the first 6 months of exercise. Except for glucose and LDL cholesterol, the exercise program led to significant but modest benefits in all other biochemical variables.

**CONCLUSIONS:** The home-based exercise program was revealed as an effective strategy for improving in functional capacity, biochemical variables and most importantly, blood pressure control of stage I and II hypertensive patients. Paulo T.V. Farinatti, CNPq Research Grant Recipient

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1660 Board #68 May 30 2:00 PM - 3:30 PM

**Effects Of Circuit Class Training As A Replacement For Usual Physiotherapy In Patients After Stroke**

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(No relationships reported)

Most patients who suffer a stroke experience reduced walking competency and health-related quality of life (HRQoL). A key factor in effective stroke rehabilitation is intensive, task-specific training. Task-oriented circuit class training (CCT) is a physiotherapy intervention used to improve gait and gait related activities in patients with stroke.

**PURPOSE:** To study the effects of CCT as a replacement for usual physiotherapy (usual PT) for stroke patients in a single-blinded, randomized controlled trial.

**METHODS:** Patients discharged from inpatient rehabilitation to an outpatient rehabilitation clinic were included and randomly allocated to CCT, 2 sessions per week for 90 minutes during 12 weeks, or to usual PT in one of nine rehabilitation centres. The primary outcome was the mobility domain of the Stroke Impact Scale (SIS, version 3-0). Secondary outcomes were standing

balance, self-reported abilities, mobility, instrumental activities of daily living, fatigue, anxiety and depression. All outcomes were assessed in a repeated measurement design for 24 weeks. Between-group differences were analyzed using random coefficient analysis, according to intention-to-treat analysis.

**RESULTS** 126 patients were included in the CCT group and 124 in the usual PT group. One patient dropped out from the CCT and seven from the usual PT group. CCT was a safe intervention and no serious adverse events were reported. Significant differences were found for gait speed ( $\beta = 0.091$  (0.023),  $p < 0.001$ ), and walking distance ( $\beta = 20.002$  (7.442),  $p = 0.004$ ) in favour of the CCT group, but no significant between-group differences were found for the SIS-mobility domain ( $\beta = 0.049$  (0.682);  $p = 0.47$ ) at 12 weeks. No significant between group differences were found for the secondary outcomes, except for the Nottingham Extended ADL Leisure and the memory and thinking domain of the Stroke Impact Scale at 12 weeks. With exception of gait speed ( $\beta = -0.035$  (0.017),  $p < 0.05$ ), no significant between-group differences were found at follow-up.

**CONCLUSION** Task-oriented CCT is a safe replacement for usual PT in patients who are discharged from an inpatient rehabilitation setting to the community and need further training of gait- and gait-related activities in an outpatient clinical setting.

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1661 Board #69 May 30 2:00 PM - 3:30 PM

**Stroke Outpatients with Different Physical Fitness Level Need Individualized Exercise Prescription?**

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(No relationships reported)

**PURPOSE:** Previous studies showed that moderate intensity physical activity could promote physical fitness in stroke patients. However, there is a diversity of the mild stroke, the exercise recommendation may not fit all patients. This study aimed to investigate the effects of exercise on physical fitness for mild stroke outpatients with different fitness level.

**METHODS:** This was a quasi-experimental study. The participants were distributed into exercise and control group. Each group was categorized into three subgroups: low(Lf), moderate(Mf) and high(Hf) fitness group based on the quartile of baseline 6-minute walk test (6MWT) performance. Exercise group received 3 sessions of supervised exercise class (1 session/month) and 12-week home-based exercise program. Each exercise educational class contained the warm up, cardiopulmonary fitness training, strengthening and balance training for 40 minutes. Control group received only one exercise consultation session during the first visit. Outcome measures include the body composition, muscle strength, (6MWT), gait speed, flexibility, and Berg balance scale(BBS). Measurement was conducted at baseline and the 12<sup>th</sup> week.

**RESULTS:** Eighty five mild stroke patients were recruited: 42 in exercise group and 43 in control group. There were 71 males and 14 females; with mean age 62.8±9.5yrs. After 12 weeks, the exercise group demonstrated greater improvements than the control group on most physical fitness measure. The exercise program seemed to have more positive effects in Mf group than the LF and HF groups, including waist circumference (↓1.89 vs. ↑0.38cm,  $p = 0.01$ ), 6MWT (↑97.8 vs. ↓30.6m,  $p = 0.001$ ), 10 meter walk time (↓1.84 vs. ↓0.04sec,  $p < 0.001$ ), upper limb muscle strength index (lb/kg, ↑0.41 vs. ↓0.12,  $p < 0.001$ ), lower limb muscle strength index (lb/kg, ↑0.73 vs. ↓0.22,  $p = 0.001$ ) and BBS (↑1.64 vs. ↓0.14,  $p = 0.04$ ).

**CONCLUSIONS:** Supervised exercise class combined with home exercise program potentially improved physical fitness for mild stroke outpatient, especially in Mf group. The result may attribute to that (1) Lf group may have more disabilities that affect them to participate in the exercise; (2) the exercise intensity is not enough for the Hf group. More studies are recommended to find out the individualized prescription for patients with different fitness.

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1662 Board #70 May 30 2:00 PM - 3:30 PM

**Improvements in Lipoprotein Subfractions and Oxidized Low-Density Lipoprotein Following Lifestyle Intervention in Obese Latino Adolescents**

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(No relationships reported)

**PURPOSE:** The distribution of cholesterol among different low-density lipoprotein (LDL) and high-density lipoprotein (HDL) subfractions, in conjunction with oxidized LDL concentrations are novel biomarkers of cardiovascular disease risk. These measures may be more responsive to lifestyle changes than traditional cholesterol measures and may give light to early alterations in the atherogenesis process. Whether these measures can be improved through diet and exercise in high-risk populations of youth has not been established. Therefore, the purpose of this study was to examine the impact of a lifestyle intervention on the distribution of cholesterol among LDL and HDL subfractions as well as oxidized LDL in a sample of high-risk Latino adolescents.

**METHODS:** Fifteen (7 male; 8 female) obese (BMI percentile = 96.4 ± 4.5) Latino adolescents (15.0 ± 1.0 years) completed a 12-week lifestyle intervention that included weekly nutrition education classes and 180 minutes of moderate to vigorous exercise per week (3 X 60 minute sessions). Fasting blood samples were collected at baseline and 12-week follow-up. The distribution of cholesterol in HDL and LDL subfractions was measured via polyacrylamide gel electrophoresis and oxidized LDL was quantified via competitive enzyme-linked immunosorbent assay. Paired sample t-tests were used to determine difference ( $p < 0.05$ ) between baseline and 12-week post-intervention.

**RESULTS:** The intervention resulted in an increase in mean LDL-particle size (269.3 ± 0.9 to 271.6 ± 0.7Å,  $p = 0.0003$ ), a 65.6% decrease in the amount of total cholesterol in the more atherogenic small LDL particles (1.6 ± 0.5 to 0.6 ± 0.3%,  $p = 0.007$ ), a 19.6% increase in the amount of HDL cholesterol in the more antiatherogenic large HDL particles (22.4 ± 2.9 to 26.8 ± 2.7%,  $p = 0.007$ ) and a 21.8% decrease in oxidized LDL (58.7 ± 10.3 to 45.9 ± 17.5U/L,  $p = 0.001$ ). The improvements in lipoprotein subfractions and oxidized LDL were observed in the absence of significant weight loss (90.7 ± 6.8 to 89.9 ± 7.2kg).

**CONCLUSIONS:** These findings suggest that lifestyle interventions may improve the cardiovascular health of high-risk youth by shifting the lipoprotein profile towards a less atherogenic phenotype. These measures should be considered as potential targets for determining the success of prevention programs in the future.

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1663 Board #71 May 30 2:00 PM - 3:30 PM

**Effects Of High-intensity Task-oriented Training On Energy-cost Of Walking And Walking Capacity In Subacute Stroke.**

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(No relationships reported)

Patients with stroke have reduced aerobic capacity, but also use more energy during walking. While decreased aerobic capacity can limit a person's ability to perform activities, higher energy-cost of the activities a person performs, caused by decreased motor control, may also limit the ability to function for a prolonged period of time. Physical therapy is therefore often aimed at improving aerobic capacity and optimizing gait economy. Previous studies suggest that a task-oriented training paradigm is beneficial to improve walking ability.

**PURPOSE:** To investigate the effects of high-intensity task-oriented training on the energy-cost of walking and walking capacity in patients with subacute stroke compared to a low-intensity physical therapy program.

**METHODS:** Forty-four patients with stroke were included in this randomized controlled trial at 2 to 8 weeks post stroke. The high-intensity training incorporated a high aerobic workload during 4 weeks. Energy-cost of walking was calculated using the Physiological Cost Index (PCI) in heartbeats/meter. Heart rate was measured with a Polar Heart Monitor during the 6 Minute Walk Test (6MWT). Walking capacity was assessed using the distance covered during the 6MWT. Between group differences were analyzed using the Students T-test.

**RESULTS:** Differences between groups on baseline were not significant. Energy-cost of walking decreased by 0.01 beats/meter in the high-intensity group but increased by 0.03 beats/meter in the low-intensity group. Analysis showed a non-significant difference in favor of the high-intensity task-oriented training for the PCI ( $p = 0.43$ ). Significant differences in favor of the high-intensity group were found for the distance covered during the 6MWT ( $p = 0.02$ ). The high-intensity group showed an increase on post intervention assessment of 59 m. (mean 460 m. to 519 m.), whereas the low-intensity group only showed an increase of 21 m. (mean 401 m. to 422 m.).

**CONCLUSIONS:** The effectiveness of a high-intensity task-oriented training program exceeds a low-intensity physical therapy-program in terms of walking capacity in patients with subacute stroke. There is a trend for a positive effect on energy-cost of walking. In a future larger sample study more responsive measures to evaluate energy-cost of walking should be used in a longer intervention.

1664 Board #72 May 30 2:00 PM - 3:30 PM

**Effects of Circuit Training Workout or Walking Exercise on Diabetic-Hypertensive Elderly Subjects**

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(No relationships reported)

**PURPOSE:** The arterial blood pressure (ABP) and glycaemia can be controlled by the combination of regular physical exercise (PE) and drugs. There are different types of PE, for instance, continuous and intermittent exercises. It is known that the prescription of circuit training workout intermittent exercise (CTW) for the elderly is not common. Thus, the aim of the present study was to verify the acute (before and after a single session of PE) and chronic (after 12 weeks of training) effects of CTW or walking exercise training (WET) on capillary glucose (CG), arterial blood pressure, and physical fitness of elderly women.

**METHODS:** Twenty-three diabetic-hypertensive subjects, who were medicated with beta-blockers or angiotensin-converting enzyme inhibitor, were subjected to WET (n = 9) and to CWT (n = 14) three times a week, intensity of 40 to 60% of maximum heart rate, and 11 to 13 scores related to Borg scale. The CG concentration was determined by a portable glucometer (ONE TOUCH®). In order to measure the ABP, we used a sphygmomanometer and an arm stethoscope. The comparison between the pre and post intervention was made by paired Student's t test ( $P \leq 0.05$ ).

**RESULTS:** After acute bout of CWT and WET, the CG concentration (mg/dL) was reduced from  $103 \pm 12$  to  $91 \pm 12$  and from  $98 \pm 11$  to  $91 \pm 10$ , respectively. In relation to chronic exercise, it was also observed reductions in CG concentrations, being: CWT: from  $92 \pm 12$  to  $84 \pm 10$ ; and WET: from  $97 \pm 10$  to  $86 \pm 6$  ( $P \leq 0.05$ ). The systolic blood pressure (SBP; mmHg) increased after acute CWT (from  $127 \pm 12$  to  $121 \pm 11$  ( $p \leq 0.05$ ), and decreased after WET (from  $143 \pm 11$  to  $133 \pm 17$ ); whereas, in the last case, no statistical difference was observed.

**CONCLUSIONS:** The both types of exercise (CWT and WET [both acute and chronic]) contributed to reduced capillary glucose as well as improved glucose metabolism, once, probably, increased the glucose uptake from skeletal muscle cells. In addition, both CWT and WET subjects had positive adherence to the program; this occurrence is suggested to be an important part of the elderly diabetic-hypertensive treatment.

1665 Board #73 May 30 2:00 PM - 3:30 PM

**Effect Of STEPTM And Home Monitoring In Rural Primary Care On Blood-pressure Metabolic Syndrome**

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(No relationships reported)

Adults with metabolic syndrome (MetS) are at a high risk for developing type II diabetes and cardiovascular disease (CVD). As well, rural populations have lower access to lifestyle modifications (recreational centres) to manage this condition. MetS is a clustering of risk factors that increase the risk of CVD. The first line of therapy for MS is lifestyle intervention that includes aerobic activity. Aerobic activity is known to have a blood pressure (BP) lowering affect in those with MetS, and subsequently targets another prominent CVD risk factor (hypertension).

**PURPOSE:** To evaluate the effect of a 6 month exercise intervention at the primary care level in conjunction with home BP monitoring technology to decrease risk factors of CVD and type II diabetes in adults with MetS.

**METHODS:** Adults with MetS (n=64; mean age=56.4 years; 71.6% female) were recruited from rural southwestern Ontario and reported to the rural family health clinic for three visits (baseline, V0; 3 months, V1; 6 months, V2). At each visit, resting BP was measured, waist circumference (WC) was measured, a predictive fitness (VO<sub>2</sub>max) test was offered and exercise was prescribed using the Step Test Exercise Prescription (STEPTM). Home-monitoring technology included a BlackberryTM and a BP monitor.

**RESULTS:** Clinic systolic BP (SBP; mmHg) showed a decrease from V0 ( $141.9 \pm 19.4$ ) to V2 ( $133.1 \pm 13.3$ ;  $p < 0.001$ ) and home SBP followed the same pattern decreasing from  $129.4 \pm 16.3$  at V0 to  $124.4 \pm 12.9$  at V2 ( $p = 0.001$ ). Clinic diastolic BP (DBP; mmHg) showed significant decreases from V0 ( $86.8 \pm 10.9$ ) to V1 ( $83.8 \pm 10.5$ ;  $p < 0.01$ ) and continued to decrease into V2 ( $81.5 \pm 9.7$ ;  $p < 0.05$ ). Home DBP showed the same pattern as clinic DBP, decreasing from  $83.4 \pm 10.3$  at V0 to  $81.5 \pm 9.2$  at V1 ( $p < 0.05$ ) and continuing to decrease to  $79.8 \pm 9.1$  at V2 ( $p < 0.01$ ). VO<sub>2</sub>max (ml/kg/min) increased from V0 to V1 ( $30.9 \pm 7.3$  to  $32.3 \pm 7.3$ ;  $p = 0.01$ ) and remained elevated into V2. WC (cm) showed a decrease from V0 ( $105.1 \pm 13.0$ ) to V1 ( $102.9 \pm 12.4$ ;  $p < 0.01$ ) and continued to decrease into V2 ( $100.7 \pm 12.0$ ;  $p < 0.001$ ).

**CONCLUSIONS:** A lifestyle intervention in primary care using STEPTM with home BP monitoring technology decreased both SBP and D BP at home and in the clinic as well as increased fitness and decreased WC in adults from rural communities with MetS. Supported by CIHR Grant #CCT-83029

1666 Board #74 May 30 2:00 PM - 3:30 PM

**Nationwide Prevalence of Ideal Cardiovascular Health and Relationship with Cardiovascular Disease and All-Cause Mortality**

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(No relationships reported)

The American Heart Association recently defined 7 ideal health metrics setting a goal to improve the cardiovascular health of Americans by 20% by 2020. However, the prevalence of ideal cardiovascular health for U.S. adults and its relationship with cardiovascular disease (CVD) and all-cause mortality remain less explored.

**PURPOSE:** We estimated the nationwide prevalence of ideal cardiovascular health (i.e., ideal levels of all 7 factors) and the combined effects of 7 ideal health metrics and CVD and all-cause mortality in U.S. men and women.

**METHODS:** We followed 15,801 men and women, ages 20-89 years, who completed a health and medical evaluation from the Third National Health and Nutrition Examination Survey. We classified all participants as ideal, intermediate, and poor categories of health behaviors (not smoking, BMI, physical activity, healthy diet) and health factors (total cholesterol, blood pressures, glucose), respectively. They were further categorized as having 0 to 7 combined ideal health metrics.

**RESULTS:** Approximately 0.8% had ideal cardiovascular health, and 11.8% had intermediate and 87.4% had poor cardiovascular health. During an average of 13.7 years of follow-up, there were a total of 1,343 CVD deaths and 3,251 all-cause deaths. After adjustment for age, sex, race, alcohol intake, education, poverty-income ratio, and family history of CVD, there was a strong inverse association between the number of ideal health metrics and CVD and all-cause mortality ( $P$  for trend  $< 0.001$ ). The hazard ratios (95% CI) of CVD events across 0, 1, 2, 3, 4, 5, 6, 7 combined ideal health metrics were: 1.00 (reference), 0.79 (0.67, 0.92), 0.69 (0.59, 0.81), 0.63 (0.53, 0.75), 0.45 (0.36, 0.57), 0.36 (0.25, 0.53), 0.32 (0.16, 0.62), and 0.0 (no events). Approximately 64% (95% CI, 48%-75%) of total CVD deaths might have been avoided if men and women had maintained intermediate or ideal cardiovascular health. Men and women with poor cardiovascular health compared with intermediate or ideal cardiovascular health had a shorter life expectancy by 9.1 years (95% CI, 5.7-12.2 years).

**CONCLUSIONS:** The prevalence of ideal cardiovascular health is extremely low in U.S. men and women. We need to increase healthy low-risk populations at the population and individual levels using the primordial prevention, which is a key to CVD prevention.

1667 Board #75 May 30 2:00 PM - 3:30 PM

**Maintaining Healthy Lifestyles and Risk of Cardiovascular Disease and All-Cause Mortality in Men**

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(No relationships reported)

The long-term effect of maintaining healthy lifestyles on cardiovascular disease and all-cause mortality in U.S. population has not been thoroughly explored.

**PURPOSE:** We examined the effects of maintaining healthy lifestyle factors (i.e., not smoking, moderate or high fitness, and normal waist girth) over 16 years on cardiovascular disease (CVD) and all-cause mortality in U.S. men.

**METHODS:** We identified a total of 5,330 men, ages 20-78 years, who had completed two preventive medical examinations between 1970 and 2001 (mean interval between examinations, 4.9

years) in the Aerobics Center Longitudinal Study. We followed these participants from the second examination to the date of death or through December 31, 2003. A low-risk profile was defined as not smoking, moderate or high fitness, and normal waist girth; and they were further categorized as having 0, 1, 2, or 3 combined low-risk factors in both examinations. A healthy lifestyle group was defined as those participants who had maintained 3 combined low-risk factors at both examinations, whereas an unhealthy lifestyle group was defined as those participants who had maintained "0, 1, or 2" combined low-risk factors in both examinations.

**RESULTS:** During an average of 11.4 years of follow-up, there were a total of 62 CVD deaths and 216 all-cause deaths. After adjustment for age, examination year, and baseline multiple risk factors (i.e., alcohol intake, high density lipoprotein cholesterol and total cholesterol levels, diabetes mellitus, systolic blood pressure, history of hypertension, family history of CVD, and interval between examinations in years), men who maintained a healthy lifestyle had a 52% lower risk of CVD (95% CI, 11%-74%) and a 38% lower risk of all-cause mortality (95% CI, 16%-55%) compared with men with an unhealthy lifestyle. Men with a healthy lifestyle had an 8.2-year (95% CI: 4.1-10.6) longer life expectancy as compared with men with an unhealthy lifestyle. Approximately 40% (95% CI, 13%-58%) of CVD deaths might have been avoided if the men had maintained a healthy lifestyle over 16 years.

**CONCLUSIONS:** Maintaining a healthy lifestyle for long-term is associated with lower risk of CVD and all-cause mortality in men. Comprehensive nationwide primordial prevention efforts are needed to support the attainment of healthy lifestyles for lifetime.

**1668** Board #76 May 30 2:00 PM - 3:30 PM

**Exercise Capacity, Left Ventricular Hypertrophy and Mortality**

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(No relationships reported)

Left ventricular hypertrophy (LVH) is an independent risk factor for mortality. Exercise capacity is inversely associated with lower mortality risk and lower left ventricular mass (LVM). The association between exercise capacity and LVM has not been adequately studied.

**PURPOSE:** Assess the association between LVH, exercise capacity and mortality risk.

**METHODS:** Exercise capacity and echocardiographic evaluations were performed in 1,467 men (age: 61±12) at the V.A. Medical Center, Washington, DC. We established three fitness categories based on the

MET level achieved. Low-Fit: Peak MET level within the 25<sup>th</sup> percentile (n=311); Moderate-Fit: MET levels between the 26<sup>th</sup> and 75<sup>th</sup> percentile (n=770); and High-Fit: MET levels > 80<sup>th</sup> percentile (n=386). LVM was calculated by a standardized formula (Penn) and was indexed to body size.

**RESULTS:** For every 1-MET increase in exercise capacity the risk of LVH was lowered by 15% (HR=0.85; CI: 0.78-0.91). After adjusting for age and BP, mortality risk was 49% (HR=0.51; CI: 0.36-0.73) and

67% (HR=0.33; CI: 0.18-0.61) lower for Moderate and High-fit individuals with LVH compared to Low-fit. To further explore the fitness-mortality association, we assessed the mortality risk individuals with low fitness and no LVH and compared them to moderate and high-fit individuals with LVH. Mortality rate for High-fit individuals with LVH was 38% lower when compared to those without LVH, but unfit (Table).

**CONCLUSIONS:** An inverse and graded association was noted between exercise capacity and mortality risk in those with and without LVH. Mortality risk was significantly reduced in those with LVH but fit when

compared to those without LVH, but Unfit. Thus, it is better to be fit and have LVH than unfit and no LVH.

Mortality Risk According to Fitness and LVH

|          | Low-Fit/No LVH      | High-Fit/No LVH    | Low-Fit/LVH         | High-Fit/LVH |
|----------|---------------------|--------------------|---------------------|--------------|
| Referent | 0.42<br>(0.31-0.57) | 1.16<br>(0.85-1.6) | 0.62<br>(0.45-0.86) |              |

**1669** Board #77 May 30 2:00 PM - 3:30 PM

**Effect Of An Office Worksite-based Yoga Program On Heart Rate Variability: A Randomized Controlled Trial**

Birinder Cheema<sup>1</sup>, Angeliqe Houridis<sup>1</sup>, Lisa Busch<sup>1</sup>, Verena Raschke-Cheema<sup>1</sup>, Geoff Melville<sup>1</sup>, Paul Marshall<sup>1</sup>, Dennis Chang<sup>1</sup>, Bianca Machliss<sup>2</sup>, Chris Lonsdale<sup>1</sup>, Julia Bowman<sup>1</sup>, Ben Colagiuri<sup>3</sup>. <sup>1</sup>University of Western Sydney, Campbelltown, NSW, Australia. <sup>2</sup>Yoga Synergy Pty, Bondi Junction, Australia. <sup>3</sup>University of New South Wales, Kensington, NSW, Australia.

(No relationships reported)

Chronic work-related stress is an independent risk factor for cardiometabolic diseases and associated mortality, particularly when compounded by a sedentary work environment.

**PURPOSE:** To determine if an office worksite-based yoga program could improve physiological stress, evaluated via heart rate variability (HRV), and physical and psychological health outcomes.

**METHODS:** Thirty-seven healthy adults employed in university-based office positions were randomized upon the completion of baseline testing to an experimental or control group. The experimental group completed a 10-week yoga program, prescribed three sessions per week during lunch hour (50 min per session). An experienced instructor led the sessions, which involved asanas (postures), vinyasa (exercises), pranayama (breathing exercise) and meditation. The primary outcome was the high frequency (HF) power component of HRV. Secondary outcomes included additional HRV parameters (i.e. low frequency (LF) and total power, and LF:HF), musculoskeletal fitness (i.e. push-up, side-bridge, and sit & reach tests) and psychological indices (i.e. state and trait anxiety, quality of life and job satisfaction).

**RESULTS:** Thirty-four participants, 17 per group, completed the study and were included in per protocol analyses. Measures of HRV all failed to change in the experimental group versus the control group, except that the experimental group significantly increased LF:HF versus control (p=0.04), contrary to our hypothesis. Flexibility, evaluated via sit & reach test increased in the experimental group versus the control group (p<0.001). No other adaptations were noted. Post hoc analysis comparing participants who completed ≥70% of yoga sessions (n=11) to control (n=17) yielded the same findings, except that the high adherers also reduced state anxiety (p=0.04) and tended to reduce HF power (p=0.07) and increase push ups (p=0.11).

**CONCLUSIONS:** A 10-week yoga intervention delivered at the office worksite during lunch hour did not improve HF power or other HRV parameters. However, improvements in flexibility, state anxiety and musculoskeletal fitness were noted with high adherence. Future investigations should involve more frequent and longer durations of yoga training, and cohorts who suffer from high work-related stress.

**1670** Board #78 May 30 2:00 PM - 3:30 PM

**The Effects of Intermittent Hypoxic Exposure on Heart Rate Variability in a Sedentary Population.**

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(No relationships reported)

Heart rate variability (HRV) is a reliable, non-invasive means of predicting future cardiovascular health. Increased HRV is associated with increased physical fitness, while lower HRV is indicative of future cardiovascular disease. Recent research has suggested that intermittent hypoxic exposure (IHE) may enhance exercise tolerance in unhealthy adults, however, little is known about the effects of IHE on HRV in a middle aged, sedentary population.

**PURPOSE:** To examine the effects of 4 weeks of IHE on HRV in a middle aged, sedentary population.

**METHODS:** Sixteen participants (5 male, 11 female, aged 56.3±5.1 years, BMI 28.9±6.2, mean±SD) were exposed to 16 IHE sessions [IHE: 5 min normobaric hypoxia (FIO<sub>2</sub> = 0.16 at week 1, decreasing to FIO<sub>2</sub> = 0.10 at week 4); 5 min ambient air, repeated for 1 hour, n=8] and [Control (C): 5 min placebo (FIO<sub>2</sub> = 0.21); 5 min ambient air, repeated for 1 hour; n=8]. Arterial blood pressure (BP), HRV and oxygen consumption (VO<sub>2</sub>) were monitored during lying (last 5 min of a 10 min period), standing, sub-maximal exercise (75% of age predicted HR<sub>max</sub>) and recovery (last 3 min of a 5 min period) pre- and post- intervention.

**RESULTS:** Relative to the control group the IHE group decreased lying HR by 9.1 ± 8.3% (mean ± 90% confidence limits) [IHE: 59.2 ± 6.1 to 56.8 ± 6.2 beats/min; and C: 64.6 ± 11.0 to 66.2 ± 9.2 mean ± SD beats/min for the pre and post groups respectively]. Standing HR decreased by 6.8 ± 8.6% in the IHE compared to the control group (IHE: 70.8 ± 5.7 to 68.8 ± 4.9 beats/min, C: 74.7 ± 15.2 to 75.2 ± 12.6 beats/min). HRV (rMSSD) increased in the IHE group relative to the C group during lying (76.8 ± 67.0%; IHE: 32.51 ± 15.12 to 35.95 ± 12.07 rMSSD; C: 21.04 ± 8.75 to 20.35 ± 9.54 rMSSD) and exercise (23.2 ± 27.7%; IHE: 4.13 ± 1.86 to 5.08 ± 2.96; C: 4.64 ± 3.84 to 4.06 ± 2.58; rMSSD; mean ± SD beats/min for the pre and post groups). There were no changes between groups in resting BP or VO<sub>2</sub>, standing or recovery HRV.

**CONCLUSIONS:** These findings suggest 16 IHE sessions in a sedentary population may improve resting HRV and HR, but has little effect on resting BP or submaximal VO<sub>2</sub>. As HRV is generally associated with improved health, this may prove beneficial for patients unable to engage in more traditional physical activity. More research with a larger population is needed to test these findings.

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1671 Board #79 May 30 2:00 PM - 3:30 PM

### Cardiovascular Health Benefits Of Moderate-To-Vigorous And Vigorous Physical Activity In Healthy Adolescents

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(No relationships reported)

**PURPOSE:** Physical activity (PA) is inversely associated with clustering of cardiovascular disease (CVD) risk factors in children and adolescents. We examined the impact of PA on surrogate markers of cardiovascular health in healthy adolescents.

**METHODS:** In a prospective, cross-sectional study, 52 adolescents (28 females, mean age 14.5 ± 0.7 years, BMI 20.1 ± 2.5 kg/m<sup>2</sup>) were investigated. Microvascular function was assessed by peripheral arterial tonometry to determine the reactive hyperemic index (RHI). Autonomic tone was assessed by time-domain analysis of heart rate variability and vagal activity was measured using the root mean square of successive normal-to-normal intervals (RMSSD). Cardiopulmonary exercise testing was performed to determine peak oxygen uptake (VO<sub>2peak</sub>) and maximum power output. PA was assessed by accelerometry for 8 consecutive days. We applied two different models and dichotomized the cohort into two activity groups (low vs. high) based on the daily time spent in moderate-to-vigorous PA (MVPA, 3000-5200 counts.min<sup>-1</sup>, model 1) and vigorous PA (VPA, >5200 counts.min<sup>-1</sup>, model 2). Data were adjusted for age, sex, skinfold, and pubertal status.

**RESULTS:** In a multivariate regression analysis MVPA was an independent predictor for RMSSD (beta=0.416, P=0.022), and VPA was independently associated with maximum power output (beta 0.310, P=0.009). In model 1, the high MVPA group exhibited a higher vagal tone (RMSSD 49.9±12.9 vs. 38.4±12.4 ms, P=0.006) and a lower systolic blood pressure (106.7±9.8 vs. 113.2±7.0 mmHg, P=0.031). In comparison, in model 2, the high VPA group had higher maximum power output values (3.8±0.6 vs. 3.5±0.6 watt kg<sup>-1</sup>, P=0.010). In both models, no significant differences were observed for RHI, VO<sub>2peak</sub> and body composition.

**CONCLUSIONS:** In healthy normalweight adolescents, PA intensity reveals different beneficial effects on cardiovascular health-related parameters. In particular, MVPA had favourable effects on vagal tone and systolic blood pressure, whereas VPA contributes to an improvement in exercise capacity.

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1672 Board #80 May 30 2:00 PM - 3:30 PM

### Effects Of Exercise On Postural Balance And Mobility In Rural And Urban-dwelling Elderly Adults

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(No relationships reported)

The increased risk of falling among the elderly is closely associated with reduced postural stability and impaired walking performance. Strength and balance exercise has been shown to improve balance, mobility, and reduce fall risk in urban-dwelling elderly adults. However, it remains unclear whether such exercise programs are as effective among elderly adults living in rural communities.

**PURPOSE:** To determine the effect of a combined strength and balance exercise program and unstructured exercise on postural balance and mobility in rural-dwelling (RD) and urban-dwelling (UD) elderly adults.

**METHODS:** A cross-sectional analysis of postural balance and physical performance measures from 106 elderly adults (mean age 778.2 yrs) including 43 RD (23 structured exercisers, 9 unstructured exercisers, and 11 sedentary) and 47 UD (30 structured exercisers, 9 unstructured exercisers, and 8 sedentary) adults was performed. Postural balance was assessed using single limb balance and modified CTSIB tests. Mobility was assessed using Timed "Up and Go" (TUG), 20 meter walking performance (WP), and chair stand (CS) tests. We determined the effects of exercise and dwelling location on balance and mobility using a 2 X 3 MANOVA.

**RESULTS:** For RD and UD elderly adults, structured exercisers performed 64.7% (p=0.009), 28.8% (p=0.005), and 63.8% (p=0.005) better on the TUG, WP, and CS, respectively, compared to the sedentary group. Although there was no main effect of living location on balance and mobility measures (p=0.073), living location and exercise groups had an interactive effect on balance and mobility (p=0.048). For RD elderly, mobility test scores for the sedentary group (WP 6.5 s, TUG 12.7 s, CS 15.1 s) were similar to both exercise groups (WP 5.5 s, TUG 10.8 s, CS 11.0 s). However, UD sedentary elderly adults exhibited greater times for all mobility measures compared to their exercising counterparts (WP 8.20 vs. 5.07 s, TUG 15.6 vs. 9.41 s, CS 19.6 vs. 10.80 s; respectively).

**CONCLUSIONS:** Among both RD and UD elderly, exercise performed in an organized strength and balance class or independently improves mobility. Moreover, RD sedentary elderly exhibit greater mobility as compared to their UD counterparts, possibly due to a higher demand from activities of daily living associated with a rural environment.

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1673 Board #81 May 30 2:00 PM - 3:30 PM

### Effects Of A 15 Week Exercise Intervention On Postural Control Components In Community Dwelling Older Adults

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(No relationships reported)

1 in 3 older adults will experience a fall each year. Falls are the leading cause of accidental death in adults over 65 years, and are the leading cause of nonfatal injuries and hospital admissions for trauma. Falls often lead to adverse changes in confidence and lifestyle that trigger a cyclical decline in health and postural control. Postural control can be broken down into its component systems: visual, somatosensory, and vestibular. Decreased fitness is known to negatively affect postural control.

**PURPOSE:** To analyze the impact of a traditional group fitness program (fitness) and a Wii exercise program (fitness + cognition + visual) on individual's component postural control systems.

**METHODS:** 89 community dwelling seniors were randomized into 1 of 3 groups (Control, Wii-Fit, Traditional Group-Fit). Interventions were delivered 3 times per week, for 15 weeks. Neurocom SOT was used to assess postural control before and after the intervention.

**RESULTS:** The Wii-Fit group showed significant improvement in their vestibular and visual components after 15 weeks of exercise. There was a significant difference between pre vestibular scores (0.70 ± 0.17) and post vestibular scores (= 0.75 ± 0.16), p=0.006. The visual scores showed a significant difference between pre (0.80 ± 0.16) and post (0.87 ± 0.07), p=0.011 as well. There was no significant improvement in somatosensory scores. The traditional exercise group did improve significantly in pre (0.84 ± 0.08) and post (0.87 ± 0.06) scores for vision, p=.002. However, they did not improve significantly in vestibular or somatosensory components. The control group did not show any significant improvements in any components.

**CONCLUSIONS:** Results indicated that both intervention programs were successful at improving postural control. It appears the most amendable component to postural control is the visual system, as both groups showed significant improvement. Additionally, interventions that include virtual environments have a greater impact on the vestibular system than traditional exercise programs. This may be due to the added head movement, eye tracking, and cognitive stimulation inherent in gaming. This further elucidates how different exercise programs targeting older adults affect specific components of postural control.



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1674 Board #82 May 30 2:00 PM - 3:30 PM

**Effect of Tai Chi on Physical Function during Dietary Weight Loss in Obese, Older Women**

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(No relationships reported)

**BACKGROUND:** The increased prevalence of obesity-related disability and loss of physical function is a major public health problem, especially in older women. Research has shown that obesity and declines in physical functioning are preventable and treatable via regular physical activity. Tai Chi, a low-impact martial art, is an alternative exercise modality that shows promise as an intervention strategy to improve physical function. Nonetheless, the addition of Tai Chi exercise to dietary weight loss has not been examined in obese older women.

**PURPOSE:** The purpose of this study was to study the effects of Tai Chi during dietary weight loss on measures of physical function.

**METHODS:** A 16 week intervention was performed in 27 obese (BMI =  $34.6 \pm 4.1$  kg/m<sup>2</sup>) women randomized to either a Tai Chi during weight loss (TCWL, (n = 14, age =  $60.4 \pm 5.9$  yrs) or weight loss only group (WL, n = 13, age =  $62.7 \pm 6.0$  yrs). Both groups completed one weekly 45 minute dietary session based on a modified Dietary Approaches to Stop Hypertension diet, while the TCWL group completed three, 45 minute session of a modified Yang style Tai Chi per week. Body mass was measured using a balance beam scale and height via a stadiometer. Outcome measures included 400 meter walk, short physical performance battery (SPPB), timed up and go (TUG), seated sit and reach, grip and leg strength. Between-group comparisons for changes were done using analysis of covariance (ANCOVA) adjusted for baseline values.

**RESULTS:** There was a decrease in body mass in the TCWL ( $-2.2 \pm 0.9$  kg, p = 0.033) and WL ( $-3.7 \pm 0.9$  kg, p < 0.001) groups, but there were no between-group differences. The TCWL group had significant improvements in flexibility whereas the WL group did not ( $5.4 \pm 8.9$  cm, p = 0.041 vs.  $2.5 \pm 6.6$  cm, p = 0.198;  $2.72 \pm 3.13$  cm, p = 0.393) and leg strength ( $39.6 \pm 67.2$  N, p = 0.046 vs.  $10.5 \pm 42.5$  N, p = 0.390;  $36.8 \pm 18.8$  N, p = 0.062). The WL group worsened in their TUG time ( $1.03 \pm 1.0$  sec, p = 0.003) but the TCWL group did not ( $0.48 \pm 0.93$  sec, p = 0.075;  $-0.57 \pm 0.30$  sec, p = 0.069). There were no significant differences between groups in 400 meter walk time, SPPB, and grip strength changes.

**CONCLUSIONS:** Tai chi did not have a significant additive effect on most global measures of physical function but may increase leg strength during dietary weight loss in obese older women.

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1675 Board #83 May 30 2:00 PM - 3:30 PM

**Can Yoga Improve Balance Performance in Older adults?**

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(No relationships reported)

Falling is a significant contributing factor to morbidity and mortality in older adults. Improving the ability to modulate postural sway and control center of mass (COM) during static and dynamic tasks may reduce fall risk.

**PURPOSE:** To study the effects of a 32-week Hatha Yoga intervention on static and dynamic balance performance in healthy older adults.

**METHODS:** Twenty older adults (70.6  $\pm$  3.8 yrs) participated in a yoga program, twice per week, for 32 weeks. Static sway was assessed under double-legged stance conditions with eyes open and eyes closed and dynamic balance was evaluated during normal walking. Reflective markers were placed on the subject's bony landmarks (head, trunk, pelvis, upper extremities, and lower extremities) and recorded by an 11-camera motion capture system. Tri-planar COM positions were estimated using a 15-segment, rigid mathematical model based on motion capture data and body mass. Coordinates of the center of pressure (COP) were obtained via force platforms. Outcome variables for static sway measurement were average displacement and normalized area of sway of COP. Outcome variables of dynamic balance included displacement, velocity, and acceleration of COM in X, Y, and Z axes and maximum COM-COP separations in the horizontal plane. Paired t-tests and covariate analyses were used to detect significant differences in these variables following the 32-week Yoga intervention.

**RESULTS:** There were no statistically significant differences in static sway measures after the intervention. Conversely, COM acceleration and COM-COP separation in the anteroposterior direction were significantly smaller than those at the baseline ( $-16.8\%$ , p < .01;  $-17.6\%$ , p < .001; respectively), even after adjusting for the walking speed. Moreover, the average COM-COP separation decreased significantly by 15.9% following the Yoga intervention (p < .001).

**CONCLUSIONS:** Improvements in dynamic balance but not static sway were found after the 32-week Yoga intervention designed specifically for older adults. Significantly reduced COM acceleration and maximum COM-COP separation in the direction of propulsion may decrease the risk of forward falling.

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1676 Board #84 May 30 2:00 PM - 3:30 PM

**Effect of Wheelchair Tai Chi Intervention on Physical Health among Elderly with Disability**

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(No relationships reported)

**PURPOSE:** The purpose of the study was to examine the effect of Wheelchair Tai Chi Modified 10-Form (WTC10) intervention on select physical health variables among the elderly with disability.

**METHODS:** Thirty elderly with disability (using wheelchair or walker) from 3 assisted living facilities were recruited from Metro Atlanta area. Twelve joined WTC10 intervention group ( $85.70 \pm 7.67$  years) and 18 joined the control group ( $89.91 \pm 7.71$  years) at their will after signing the informed consent forms. Only the WTC10 group received a 12 week Tai Chi intervention, twice a week and an hour each time. A pretest and a posttest were performed for both groups at the beginning and at the end of the intervention. Seven in the WTC10 group and 14 in the control group completed the study. The selected physical health measurements included rest heart rate (HR), systolic (SBP) and diastolic blood pressure (DBP), function reach (FR), and Pain Self Efficacy Questionnaire (PSEQ). A Mixed-Model ANOVA and Bonferroni pos hoc test (p < .05) were employed to examine the differences between the pre-test and post-[Unsupported Character - Codename &shy;]test within each group and between the two groups.

**RESULTS:** No statistically significant differences were found from the Mixed-Model ANOVA and Bonferroni analyses among the comparisons of the aforementioned five variables between two groups. However, the WTC10 group had improvements among the five aforementioned variables with the rest HR decreased 4.25 beats/min, and SBP and DBP decreased 18.75 and 19.25 units, respectively, after the WTC10 intervention. Whereas, the control group had increased rest HR 3.90 beats/min, and increased SBP 14.60 units. Therefore, there were interactions among the heart rate and blood pressure (WTC10 Group: pretest HR  $71.5 \pm 5.19$  vs posttest  $67.25 \pm 8.38$  beats/min, and pretest SBP/SBP  $137 \pm 38/97 \pm 25$  vs posttest  $118 \pm 14/78 \pm 8$ ; and Control Group: pretest HR pretest  $70.80 \pm 10.05$  vs posttest  $74.70 \pm 11.85$  beats/min, and pretest SBP/DBP  $112 \pm 7/71 \pm 8$  vs posttest  $126 \pm 27/69 \pm 15$ ).

**CONCLUSIONS:** A 12 week WTC10 intervention may have positive effect on the rest heart rate and blood pressure among the elderly with disability, and the WTC10 is a feasible exercise for the elderly with disability.

Supported by National Institute of Disability Rehabilitation and Research Grant #: H133E080003

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1677 Board #85 May 30 2:00 PM - 3:30 PM

**Age-related Site-specific Thigh Muscle Loss Is Associated With Amount Of Vigorous Physical Activity**

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(No relationships reported)

We recently demonstrated that age is associated with site-specific loss of skeletal muscle mass in men and women. Interestingly, in the anterior and posterior regions of the thigh, age-related muscle loss was observed in the quadriceps but not in the posterior region. The cause of age-related site-specific muscle loss is unknown.

**PURPOSE:** To investigate the relationship between age-related site-specific loss of thigh muscle and accelerometer-determined daily physical activity.

**METHODS:** Fifty-one middle-aged and old women aged 52-83 years (means [SD], age 66.0 [7.1] yrs, height 1.53 [0.05] m, weight 52.4 [5.4] kg, and body mass index 22.4 [2.5] kg/m<sup>2</sup>) volunteered. Muscle thickness (MTH) was measured by B-mode ultrasound at five sites on the anterior (quadriceps [QF] 30%, 50%, and 70% of thigh length) and posterior (hamstring [HM] 50% and 70% of thigh length) aspects of the thigh. MTH was expressed in terms relative to thigh length (MTH/L). Habitual daily activities during consecutive 30 days were recorded using an accelerometer, and the exercise intensity was classified 10 graded levels from sedentary (level 0) to light (levels 1-3), moderate (levels 4-6) and vigorous (levels 7-9) exercise. Total duration time (minute) for each level of exercise intensity was calculated. Physical-activity-related energy expenditure (EE) was estimated.

**RESULTS:** The daily step count and physical-activity-related EE averaged 7826 (SD 3183) steps per day and 177 (SD 85) kcal, respectively. Age was inversely correlated with the QF-50% MTH/L ( $r=-0.286$ ,  $P=0.042$ ), but not the HM-50% MTH/L ( $r=0.102$ ,  $P=0.474$ ). Age was also inversely correlated with the ratio of QF/HM 50% MTH ( $r=-0.330$ ,  $P=0.018$ ), thus the site-specific muscle loss of the thigh was observed in the present sample. There were no significant correlations between the QF/HM 50% MTH ratio and daily step counts ( $r=0.205$ ,  $P=0.150$ ), duration time of light ( $r=0.204$ ,  $P=0.150$ ) as well as moderate ( $r=0.145$ ,  $P=0.308$ ) intensity exercise, and physical-activity-related EE ( $r=0.223$ ,  $P=0.116$ ). However, the QF/HM 50% MTH ratio was significantly correlated to duration time of vigorous intensity exercise ( $r=0.287$ ,  $P=0.041$ ).

**CONCLUSIONS:** Age-related site-specific loss of thigh muscle is associated with amount of vigorous physical activity in middle-aged and old women.

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1678 Board #86 May 30 2:00 PM - 3:30 PM

**Prevention Of Falls By Outdoor-walking In The Elderly At Risk ("Power") - A Pilot Study**

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(No relationships reported)

**BACKGROUND:** A broad range of factors contribute to falls in older people with the frequency of falls rising with age. It has been shown that morbidity and mortality associated with falls can be reduced by physical activity. We aimed to test the feasibility and acceptability of a program of regular assisted outdoor walking for nursing home residents including a possible impact on the prevention of falls.

**METHODS:** We included five nursing homes; three of these were assigned for the intervention and two for the control group. Inclusion criteria were age above 65 years and increased risk of falls. The intervention group ( $n=32$ ) benefited from regular assisted outdoor walking, the control group ( $n=20$ ) did not practice physical activities. We evaluated participants at the start of the study (T0) and after 6 months (T1) for history of falls, physical and cognitive impairment. In addition we performed qualitative interviews with nursing home managers.

**RESULTS:** The program was evaluated positively by the participating nursing homes. Half of the participants reported an improvement in their general condition, general mood and walking ability. There was a slight intervention effect on depressive symptoms, but no differences between intervention and control group in the proportion of falls, in regard to risk of falls and functional status (daily activities).

**CONCLUSIONS:** This study shows the feasibility of implementing a simple program of outdoor walking for elderly people in nursing homes. A sufficiently powered randomized controlled trial is necessary to show a possible effect on the number of falls and additional secondary outcomes.

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1679 Board #87 May 30 2:00 PM - 3:30 PM

**Development Of A Visual Anticipatory Training And Balance Evaluation System For Elderly**

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(No relationships reported)

Balance dysfunction in older persons often causes them suffering fall accidents. High insurance cost was found in medical care for elderly fall every year. Anticipatory balance training is a useful method that is gradually adopted in rehabilitation clinic; especially for aging person. Therefore, developing a system based on anticipatory balance theory may provide a useful selection for balance rehabilitation.

**PURPOSE:** The purpose was to develop a system that can be used to assess and train balance function for elderly.

**METHODS:** The system consisted of a customized forceplate which could detect subject's center of force (COF) in real time. System software contained two modules: assessment module and rehabilitation module. The two modules can simultaneously execute and communicate with TCP/IP technique. Assessment module could measure real-time COF changes, and rehabilitation module could provide video-game based rehabilitation program on balance training. To achieve anticipatory balance training, a PC game that fitted training requirement in visual alert and body balance control was included. The real-time COF data, game scores (GS) and game finished time (GFT) were collected for performance analysis.

**RESULTS:** Two subjects (66 y/o female and 26 y/o female) were recruited to use the system. The results showed that elderly had larger COF distance and velocity than that of adults (the following %diff = (elderly-adult)/adult: total COF distance = 75.0%, total COF distance in anterior posterior (AP) direction= 79.1%, total COF distance in lateral medial (LM) direction =65.7%, COF average velocity= 67.2%, COF average velocity in AP direction= 58.8%, COF average velocity in LM direction =108.7%). It means young adult had more effective moving pattern than elderly when they were asked to do the same tasks. Although the elderly subject did more shifting of COF to do the tasks, the performance in the game was still lower than adult (GFT in seconds: adult= 49.47, elderly= 41.97; GS: adult= 11, elderly= 6).

**CONCLUSIONS:** The results found elderly had less effective moving pattern in COF-shifting tasks and lower performance in rehabilitation game playing. The preliminary study showed the system can distinguish the different performance between adult and elderly, and it may be used as a new selection for balance rehabilitation.

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1680 Board #88 May 30 2:00 PM - 3:30 PM

**Effects Of Taichi Training On Health Status In Normoweight, Overweight And Obese Postmenopausal Women**

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(No relationships reported)

In older people, obesity is a public health issue. Physical activity appears to be one of the most efficient interventions used for weight loss. However, depending on the type of activity, the drop out and/or the injury rate can be relatively high. In addition, 65% of older people are sedentary. On the other hand, emergent practices such as Taichi have been shown to have increasing success among older people. It has been shown that Taichi had beneficial effects on health status in community-living older adults. However, its specific effects in obese postmenopausal women are still unknown.

**PURPOSE:** The aim of the present study was to investigate the effectiveness of 12 weeks of Taichi on health status in obese postmenopausal women compared with normoweight and overweight postmenopausal women.

**METHODS:** Sixty-two postmenopausal women were recruited. Women were divided in 3 groups according to their fat mass percentage (40%). Body composition, blood pressure, muscle strength, functional capacities, physical activity level, energetic balance and general health perception were measured before and after the intervention.

**RESULTS:** We observed that body weight ( $p=0.029$ ), BMI ( $p=0.028$ ), systolic ( $p=0.010$ ) and diastolic ( $p=0.007$ ) blood pressure as well as fat mass percentage ( $p=0.011$ ) significantly decreased in obese postmenopausal women while general health perception ( $p=0.033$ ) and chair stand test score ( $p=0.020$ ) significantly increased. In overweight women, systolic ( $p<0.001$ ) and diastolic ( $p=0.033$ ) blood pressure significantly decreased while chair stand ( $p=0.027$ ) and balance ( $p=0.009$ ) tests scores significantly increased. In normoweight women, waist circumference ( $p=0.018$ ), systolic ( $p=0.015$ ) and diastolic ( $p=0.037$ ) blood pressure significantly decreased while chair stand test score ( $p=0.001$ ) significantly increased. The effectiveness of the intervention was identical in the 3 groups.

**CONCLUSIONS:** Our results showed that Taichi may be effective in enhancing body composition, functional capacity and in lowering blood pressure, independently of the obesity status. This activity may thus be considered as an effective alternative for weight loss programs in obese postmenopausal women. Further larger studies are needed to confirm our results.

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**1681** Board #89 May 30 2:00 PM - 3:30 PM

**Recreational Soccer Safety for Senior Players**

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(No relationships reported)

Soccer is a worldwide sport professionally and recreationally practiced and has its benefits and risks. In relation to cardiovascular risks (CVR) the intensity of exercise might be the trigger for adverse outcomes.

**PURPOSE:** To evaluate the CVR of recreational soccer game for senior players.

**METHODS:** 27 voluntary male subjects were selected by their game skill fullness and assembled in two age groups, under (n=10; 47 + 2 yrs old; G1) and over (n=17; 57 + 5 yrs old; G2) 50 yrs old. They all were successfully submitted to a maximal treadmill test (Balke protocol), preceded and proceeded by a blood sampling for analysis of metabolic markers of exertion: acidosis (pH, HCO<sub>3</sub><sup>-</sup>, pCO<sub>2</sub>), hemoconcentration (Ht and Hb) and muscle damage (CK and AST). They also were assessed during 20x20 minutes soccer games of 6x6 and 5x5 players in a 814m<sup>2</sup> turf field. The game measurements included resting blood pressure (BP) and heart rate (HR) before and immediately after the game. During the game were registered maximum, average, and minimum HR, distance, maximum and minimum speed (GPS monitor - Garmin® Forerunner 305). The two groups (G1 and G2) were set up in teams either inside the group (6x6 or 5x5) or mixed up with 3 G2 plus 3 G1 for 6x6 games (67.8 m<sup>2</sup>/player) or 3 G2 plus 2 G1 for 5x5 games (81.4 m<sup>2</sup>/player). The statistical comparisons inter or intra groups were undertaken by Student's t test or ANOVA, for p<0.05.

**RESULTS:** Both groups were similar in anthropometry, resting values of BP, HR and responded similarly to the maximum treadmill test by reducing blood levels of pH, HCO<sub>3</sub><sup>-</sup>, and pCO<sub>2</sub> and increasing values of Ht, Hb, AST and CK. However, the younger group presented slightly higher VO<sub>2</sub>max (11.9%) than the older (p=0.07). The game performance differed groups only by younger covering larger distance (16.1%) with higher average speed (21.1%) and presenting higher average HR (10.7%) than the older. However these differences disappeared during the aged-mixed teams. In both age groups, the maximum HR registered during the game surpassed the expected values from the treadmill test, although in both cases the HR remained under the maximum values predicted by age.

**CONCLUSIONS:** Besides being intense and emotional, the recreational soccer is yet a suitable physical activity for senior cardiorespiratory fitness. Supported by CNPq, CAPES and FUNDAP.

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**1682** Board #90 May 30 2:00 PM - 3:30 PM

**Ageing And Strength Reduction; Inactivity Or Ageing?**

Eivind Wang, Lubomir Kafonek, Jan Helgerud, Klaus Jungbluth, Jan Hoff. *Norwegian University of Science and Technology, Trondheim, Norway.*  
(No relationships reported)

**PURPOSE:** Muscular strength shows an average decrease with age. The reduced strength is related to the ageing process, but might to a larger degree be a result of inactivity. The hypothesis for this study is that strength training responses in young and old subjects is not different.

**METHODS:** 12 old (60 ± 6 yr) and 13 young (22 ± 2 yr) subjects trained maximal strength training 4 sets of 4 repetitions at ~90% of one repetition maximum (1RM) 3 times a week for 8 weeks in a hack squat and a knee extension apparatus. None of the subjects performed strength training on a regularly basis before participating in the study.

**RESULTS:** At pretest the old group showed significantly (p<0.05) lower 1RM in hack squat (190 ± 35 kg vs. 207 ± 37 kg including bodyweight) and knee extension (84 ± 13 kg vs. 105 ± 15 kg) compared to the young group. Following training 1RM improved significantly (p<0.05) in both squat: 33 ± 15% (old); 30 ± 14% (young) and knee extension: 28 ± 12% (old); 31 ± 10% (young), but with no differences between the groups. Also dynamic rate of force development (RFD) displayed no differences between groups. Knee extension static RFD and electromyogram root mean square (EMGRMS)/maximal M-wave (Mmax) measured in vastus lateralis, vastus medialis and rectus femoris displayed no significant differences within or between groups except for a vastus lateralis increase of 21 ± 26% within the old group.

**CONCLUSIONS:** Old and young subjects showed similar training responses when employing maximal strength training. Young subjects showed a higher initial strength baseline compared to old. EMGRMS/Mmax could not detect the strength responses following the training intervention. The old subjects seem to have a large potential for strength improvements similar to the young subjects, indicating that the major part of strength reduction with age might be an activity component rather than an aging component.

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**1684** Board #92 May 30 2:00 PM - 3:30 PM

**Physical Activity and Brachial Arterial Flow-Mediated Vasodilatation in 20-69-y-old Women**

Hong Juan Li<sup>1</sup>, Chun Yan Zhang<sup>1</sup>, Le Qin Chen<sup>2</sup>. <sup>1</sup>Beijing Sport University, Beijing, China. <sup>2</sup>Shanxi Normal University, Linfen, China.  
(No relationships reported)

Endothelial dysfunction plays an important role in the development of cardiovascular disease as a concomitant disorder of atherosclerosis. Physical activity was a protecting factor of cardiovascular health. However, the Age-related change of endothelial function and relationship of physical activity and endothelial function in women are unclear.

**PURPOSE:** the purpose of present study is to explore the age-related change of brachial arterial flow-mediated vasodilatation (FMD) in women, and association of physical activity level and FMD.

**METHODS:** 405 healthy women aged 20-69 were recruited from Haidian District, Beijing, China. Physical activity history was investigated by questionnaires. High-resolution Doppler Ultrasonography Equipment with a 7.5-MHz transducer (UNEX) was used to record the resting brachial arterial parameters and flow-mediated vasodilatation (FMD) after reactive hyperemia. Written informed consent was signed by each participant for the measurement.

**RESULTS:** the resting brachial arterial diameter and flow-mediated maximal dilation diameter were increased in the women over 40-y old, comparing to the 20-39-y group (resting diameter and deflation diameter were 3.26±0.36mm vs 3.52±0.51mm and 3.62±0.37mm vs 3.90±0.55mm, respectively. P=0.000), and the time for reaching maximal flow velocity was reduced (24.55±16.02s vs 20.64±16.24s, respectively. P=0.018). FMD was significantly decreased in 60-69-y group, comparing to younger age-group (9.24±2.64 vs 11.39±2.19, P<0.05). Maximal blood flow velocity is lower in group with moderate or higher physical activity, comparing to group with lack or lower physical activity (7.35 ± 5.21 vs 8.49 ± 5.40 m / s, P <0.05).

**CONCLUSIONS:** changes in brachial arterial diameter in resting and maximum diastolic diameter might be related to endothelial function. Resting brachial artery diameter and maximal dilation diameter over 40-yrs was increased might be a predictor of endothelial dysfunction. FMD in women over 60 declined significantly, which might be related to increased cardiovascular risk. Moderate physical activity or exercise might have a protective effect on endothelial function. Supported by the National Science and Technology Infrastructure Program of China 2006BAK33B02.

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**1685** Board #93 May 30 2:00 PM - 3:30 PM

**Combined Physical Exercise Program Has a Beneficial Effect on Exercise Capacity and MMSE**

Yi-Sub Kwak<sup>1</sup>, Jin Han<sup>2</sup>. <sup>1</sup>Dong-Eui University, Busan, Korea, Republic of. <sup>2</sup>Inje University, Busan, Korea, Republic of.  
(No relationships reported)

Dementia population in worldwide is considerable in the aged people. Exercise regulates the brain function, but the mechanism by which it does so is unknown.

**PURPOSE:** The effect of regular exercise on cognitive function and exercise capacity in senile dementia patient was investigated.

**METHODS:** Thirty female patients with senile dementia who participated in the study were divided into two groups: the exercise group (EG, n=15) and the control group (CG, n=15). The exercise group completed regular exercise program, and their cognitive function (MMSE: mini-mental state examination), activities of daily living (ADL) and exercise capacity (cardiopulmonary function, muscle strength, muscle endurance, flexibility, balance, agility) levels were evaluated at baseline, 6 months and after 12 months. Subjects exercised 30-60 minute a day, 2-3 times per week for 12 months.

**RESULTS:** MMSE and ADL score were significantly enhanced in exercise group with senile dementia, compared to these of control group ( $p < 0.05$ ). Exercise capacities in exercise group also increased as period dependent manner.

**CONCLUSIONS:** These results suggested that senile dementia may improve by participating in a regular exercise program.

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**1686**     *Board #94*     **May 30**     **2:00 PM - 3:30 PM**

**Growth Mixture Modeling of Screening Time Among US Children**

Youngdeok Kim, Peter D. Hart, Rose M. Carter, Joshua T. Haley, Minsoo Kang, FACSM. *Middle Tennessee State University, Murfreesboro, TN.*

*(No relationships reported)*

**PURPOSE:** The screening time, such as TV viewing and computer/video game, are the growing risk factors of obesity among the children, which may consequently be linked to chronic diseases in later years. Given that the childhood is an important period in which one's habitual behaviors are being confirmed, more information is needed in order to reduce the screening time during this period. The purpose of this study was to explore the longitudinal trajectory of screening time for better understanding of individual variations in the development of screening time.

**METHODS:** Data from the Youth Media Campaign Longitudinal Survey (YMCLS) which was conducted from 2002 to 2006 among US children aged 9-13 were analyzed in this study. A remaining sample of 1,623 children in 2006 after completion of follow-up surveys for each of four consecutive year were used. The screening time was obtained by a self-reported measure asking time spent in watching TV, playing video or computer games at a day before interview with the exception of time spent doing homework on computer. Latent growth modeling (LGM) was applied to investigate the latent trajectory of screening time and growth mixture modeling (GMM) was further applied for taking into account population heterogeneity of growth parameters (i.e., intercept and slopes) across unknown subpopulations using latent trajectories classes. Demographic variables used in GMM for predicting latent trajectories classes and growth parameters were gender, baseline age, parental education level, and family income.

**RESULTS:** The LGM with a quadratic function showed better model fit indices with the parameter estimates of 98.65 for minutes of screening time at baseline, 10.93 minutes for growth rate, and -1.64 minutes for acceleration rate. Following GMM revealed three latent trajectories classes with heterogeneous growth parameters [i.e., normal incliners (87.6%), decliners (6.3%), and drastically incliners (6.1%)].

**CONCLUSIONS:** The findings indicated that the growth trajectories of screening time among US children varied across different subpopulations. Disparities in screening time among these subpopulations should be take into consideration when targeting the population in promoting healthy behaviors.

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**1687**     *Board #95*     **May 30**     **2:00 PM - 3:30 PM**

**The effect of Arch Rehabilitation Exercise Program on Plantar Pressure and Growth index in Children with Obesity Autistic**

Jae Soon Chung<sup>1</sup>, Soung Yob Rhi, FACSM<sup>2</sup>. <sup>1</sup>*Chungju National Univ., Chungju, Korea, Republic of.* <sup>2</sup>*Seoul National Univ., Seoul, Korea, Republic of.*

*(No relationships reported)*

**The purpose of this study** was to the effect arch rehabilitation exercise program on plantar pressure and growth index in children with obesity autistic. Following written, informed consent, 10 obesity autism (mean age = 9.11 $\pm$ 1.45 years; mean wt = 46.92 $\pm$ 9.53 kg; mean ht = 127.27 $\pm$ 10.71 cm; mean BMI = 28.97 $\pm$ 2.41) and 10 normal obesity children (mean age = 9.62 $\pm$ 1.50 years; mean wt = 50.28 $\pm$ 9.39 kg; mean ht = 133.46 $\pm$ 11.55 cm; mean BMI = 28.23 $\pm$ 3.84) completed a battery of test to determine growth index (height, weight and BMI) and plantar pressure.

**RESULTS** from the intermittent arch rehabilitation exercise program have shown that growth index was improved [ height increased significantly before exercise in between obesity autism group and normal obesity children group ( $p < .05$ ), before and after exercise in autism group ( $p < .01$ ) and normal children group ( $p < .01$ ), BMI decreased significantly after exercise in between obesity autism and normal obesity children ( $p < .05$ ). ] and plantar pressure measurement was improved [ average pressure left increased significantly before and after exercise in obesity autism group ( $p < .01$ ), average pressure right increased significantly before and after exercise in obesity autism group ( $p < .01$ ), rear foot pressure left increased significantly before and after exercise in obesity autism ( $p < .05$ ), rear foot pressure right increased significantly before and after exercise in obesity autism ( $p < .05$ ). ].

**CONCLUSIONS:** The lower plantar pressure found in obesity autism children suggests that foot pressure characteristic of obesity autism children may be caused by obesity. It is postulated that these foot pressure changes, which may affect the functional capacity and stabilization of rear foot pressure might be normalized if moderate weight bearing and arch rehabilitation exercise program continues throughout childhood and into adulthood.

\* jsm71@hanmail.net

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**1688**     *Board #96*     **May 30**     **2:00 PM - 3:30 PM**

**Long-term Effects Of Exercise And Activity Prescription In Children With CMT: An Exercise-Is-Medicine™ Case Study**

Robert D. Chetlin, Corrie Mancinelli, Steven Wheeler, Laurie Gutmann. *West Virginia University, Morgantown, WV. (Sponsor: Robert R. Kraemer, FACSM)*

*(No relationships reported)*

Charcot-Marie-Tooth disease (CMT), the most commonly inherited peripheral neuropathy (1-in-2,500 persons), affects motor & sensory nerves and is characterized by progressive extremity weakness & atrophy, foot & gait abnormalities, chronic pain/fatigue, and balance deficits. ~30 CMT types/subtypes are known; CMT1a is most common (~70% of all cases). There is no treatment to slow or prevent the disease process.

**PURPOSE:** To evaluate the effects of a 1-year, home-based exercise & activity Rx, combining resistance and endurance training, in a CMT1a pediatric patient.

**METHODS:** A 16 year-old girl, genetically diagnosed with CMT1a, participated in the study. Subject followed a home-based training program, with resistance (using "Therabands") and aerobic (using "Dance-Dance-Revolution") exercise, each performed 3 days/week for 1 year. Outcomes included isometric strength, body composition, MVO<sub>2</sub>, blood lipids, and postural stability, taken at baseline, 6 months, and 1 year. Percent changes were calculated over the study duration.

**RESULTS:** Clinical improvements were seen in max upper & lower body strength, lean mass, bone mineral density, body fat %, MVO<sub>2</sub>, exercise tolerance, triglycerides, LDLs, total cholesterol, and sensory responses associated with balance and postural stability.

| Variable                       | Baseline | 6 months | 1 year | % Change |
|--------------------------------|----------|----------|--------|----------|
| Ht (cm)                        | 158.7    | 160.0    | 160.0  | 0.8      |
| Wt (kg)                        | 51.7     | 52.6     | 54.4   | 5.2      |
| BMD (g/cm <sup>2</sup> )       | 0.99     | 1.00     | 1.02   | 3.0      |
| Lean Mass (kg)                 | 30.1     | 30.9     | 31.1   | 3.3      |
| Fat Mass (kg)                  | 18.8     | 19.0     | 19.3   | 2.6      |
| Total Mass (kg)                | 50.5     | 51.4     | 53.2   | 5.3      |
| Body Fat %                     | 37.2     | 37.1     | 36.6   | -1.6     |
| Total UE Strength (kg)         | 67.2     | 75.2     | 79.0   | 17.6     |
| Total LE Strength (kg)         | 91.5     | 91.6     | 100    | 9.3      |
| Total Exercise Time (min)      | 8:02     | 10:00    | 11:56  | 48.5     |
| Time to MVO <sub>2</sub> (min) | 6:37     | 8:08     | 9:56   | 50.1     |
| Max Work (W)                   | 91.0     | 111.0    | 133.0  | 46.1     |
| MVO <sub>2</sub> (ml/kg/min)   | 27.2     | 24.4     | 31.1   | 14.3     |
| Fasting Glucose (mg/dl)        | 83.0     | 87.0     | 90.0   | 8.4      |
| Triglycerides (mg/dl)          | 145.0    | 111.0    | 69.0   | -52.4    |
| LDLs (mg/dl)                   | 163.0    | 140.0    | 127.0  | -22.1    |
| HDLs (mg/dl)                   | 54.0     | 47.0     | 51.0   | -5.5     |
| Total Cholesterol (mg/dl)      | 246.0    | 209.0    | 192.0  | -21.9    |

**CONCLUSIONS:** This case study demonstrated that an Exercise-Is-Medicine™ rubric (1-year combined resistance & endurance training), clinically improved strength, body composition, MVO<sub>2</sub>, exercise tolerance, balance, postural stability, and heart disease risk in a 16 year-old girl with CMT1a. This is also the first clinical or scientific exercise study, to our knowledge, which resulted in beneficial changes in afferent function in a CMT patient.

**1689** Board #97 May 30 2:00 PM - 3:30 PM

**Using a Technology-Based Prenatal Physical Activity Program: A Pilot Study**

Bridget Melton<sup>1</sup>, Helen Bland<sup>1</sup>, Elaine Marshall<sup>1</sup>, Michael Schmidt<sup>2</sup>, Kent W. Guion<sup>3</sup>, Jacquelyn Nagle<sup>4</sup>. <sup>1</sup>Georgia Southern University, Statesboro, GA. <sup>2</sup>University of Georgia, Athens, GA. <sup>3</sup>Georgia Health Sciences University, Augusta, GA. <sup>4</sup>University of Pittsburgh, Pittsburgh, PA. (Sponsor: Jim Morrow, FACSM)  
(No relationships reported)

Recent studies have linked excessive gestational weight gain to childhood obesity. Health educators now use pregnancy as a critical point of intervention to impact health outcomes for mother and child. However, little is known about the feasibility of using technology enhanced intervention modalities to impact women's health behaviors.

**PURPOSE:** To examine the feasibility of a technology enhanced physical activity (PA) program to control excessive gestational weight gain in pregnant women. A 6-week online PA course was administered while the participants were in their second trimester. The learning module included: Benefits of Exercise During Pregnancy; Safety Concern for Pregnancy; Nutrition During Pregnancy; Improving Birth Outcomes; Childhood Obesity; and After the Baby Is Here. Each module included an online presentation, discussion, ask the expert blog, a knowledge test (self-quiz) and weekly PA logs.

**METHODS:** The study was a pilot non-randomized controlled trial with pregnant women that followed women from their first trimester (intervention group, online education [n=16]; control group, usual care [n=6]). PA patterns were assessed via accelerometer data at 1st, 2nd and 3rd trimester; content knowledge, self-efficacy and benefits and exercise precaution were assessed pre and post intervention. Course satisfaction was assessed by a participant focus group (N = 11). Repeated measure ANOVA analyses determined significant differences between pre- and post- test.

**RESULTS:** There was a significant increase in the intervention group pre and post content knowledge (p<0.05), however no significant changes were detected in the self-efficacy or benefits/safety of prenatal exercise (p>0.05). There was a trend toward an increased in PA patterns, normal birth weights, and normal gestational weight gain. Although gestational weight gain and birth weight were measured, the sample size did not allow for significance to be detected. The results from the focus group showed good feasibility and acceptability for delivery of online content material, web link, social networking and self-monitoring.

**CONCLUSIONS:** This pilot online PA intervention mode demonstrated feasibility in application and promoted increases in knowledge for the participants.

**1690** Board #98 May 30 2:00 PM - 3:30 PM

**Physical Activity Patterns in Postpartum Latinas: Madres para la Salud**

Colleen Keller<sup>1</sup>, Barbara E. Ainsworth, FACSM<sup>1</sup>, Michael Belyea<sup>1</sup>, Allison Nagel-Williams<sup>1</sup>, Stephen Herrmann<sup>2</sup>, Sonia Vega-Lopez<sup>1</sup>, Paska Permana<sup>3</sup>, Kathie Records<sup>1</sup>, Dean V. Coonrod<sup>4</sup>. <sup>1</sup>Arizona State University, Phoenix, AZ. <sup>2</sup>University of Kansas, Kansas City, KS. <sup>3</sup>Phoenix VA Health Care System, Phoenix, AZ. <sup>4</sup>Maricopa Integrated Health System, Phoenix, AZ.  
(No relationships reported)

**INTRODUCTION:** The post-partum period is a critical time for loss of pregnancy-associated weight gain. Among young Latinas, overweight and obesity rates are high and leisure-time moderate- and vigorous intensity physical activity (PA) is low.

**PURPOSE:** To describe the volume and types of PA performed by postpartum Latinas prior to initiating Madres para la Salud, a social-support mediated walking intervention to promote post-partum weight loss.

**METHODS:** 139 women (age = 28.3 ± 5.6 years and BMI = 29.7 ± 3.5 kg.m<sup>2</sup>) completed the Stanford Brief Activity Survey (SBAS) and concurrently wore an ActiGraph GT3X accelerometer (AG) and an Omron HJ-720ITC pedometer, and kept a PA record (PAR) to identify the type and duration of activities performed. The SBAS rates occupational and leisure-time PA to compute a 5-point PA rating from inactive to very hard PA. The AG Freedson and Matthews cut-points were used to compute PA intensities. AG min.d-1 and steps.d-1 were averaged over 7 days. The PARs were coded using the 2011 Compendium of PA with MET intensity cut-points as sedentary (1.0-1.5), light (1.6-2.9), moderate (3.0-5.9), and vigorous (≥ 6.0).

**RESULTS:** Only 33 women in the sample were employed. Most demonstrated inactive-to-low PA [SBAS categories: inactive (51%), light (37%), moderate (11%)]. AG wear time was: 849.7 ± 140.6 min.d-1 (14.1 hr.d-1). AG durations in min.d-1 were: sedentary (512.0 ± 169.9), light (242.4 ± 51.4), moderate lifestyle (78.3 ± 39.9), moderate walking (16.6 ± 14.4), and vigorous (0.34 ± 1.5). Pedometer steps.d-1 were low (total = 4,973 ± 2,202 steps; aerobic = 412 ± 774). PAR showed most min.d-1 in sedentary (158.2 ± 75.4) and light-intensity PA (412.4 ± 131.0), with less moderate (157.8 ± 106.1) or vigorous (9.8 ± 32.4) intensity PA.

**CONCLUSIONS:** Post-partum Latinas enrolled in our study showed low levels of moderate- and vigorous intensity PA on all measures. An intervention designed to increase walking to 150 min.wk-1 and/or 30 min.d-1 is warranted. Supported by NIH R010356-01A2

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1691 Board #99 May 30 2:00 PM - 3:30 PM

**Physical Activity And Cardiovascular Risk In Individuals With A Low Ankle Brachial Index**

Marquis Hawkins<sup>1</sup>, Kelley Pettee Gabriel<sup>2</sup>, Molly Conroy<sup>1</sup>, Jennifer Cooper<sup>1</sup>, Kim Sutton-Tyrrell<sup>1</sup>. <sup>1</sup>University of Pittsburgh, Pittsburgh, PA. <sup>2</sup>The University of Texas Health Science Center at Houston, Austin, TX. (Sponsor: Andrea Kriska, FACSM)  
(No relationships reported)

Individuals with a low ankle brachial index (ABI) are often inactive and both characteristics are associated with an increased risk for cardiovascular (CVD) events. Given that individuals with a low ABI may have difficulty performing activities of higher intensity due to symptoms incurred during exercise, examining the role of lower intensity physical activity (PA) on CVD risk in these individuals is important.

**PURPOSE:** To examine the relationship between intensity of physical activity and cardiovascular risk in a nationally representative sample of United States adults with a normal and below normal ABI.

**METHODS:** In 2003-04, the National Health and Nutrition Examination Survey included an accelerometer PA module and collected ABI data. Sedentary activity, light intensity PA (LPA), and moderate-to-vigorous intensity PA (MVPA), were defined with the following cutpoints values: 0-100, 100-1952, &gt;1952, respectively. Individuals were classified as having a normal (1-1.4) or below normal (0.4-0.99) ABI. The Framingham risk score was used to determine 10 year risk of developing CVD. Multivariable regression models were used to determine the relationship between average time spent per day in various PA intensities and CVD risk in both ABI groups.

**RESULTS:** Individuals with a normal ABI spent significantly more time engaging in MVPA (p=0.001) and less time in sedentary pursuits (p=0.018) when compared to those with low ABI. Time spent engaging in LPA was similar between the groups. MVPA, but not LPA, was inversely related to the 10-year risk of developing CVD in both normal and low ABI groups (p<0.001 and p=0.001, respectively).

**Discussion:** While on average, individuals with a low ABI did not accumulate much time in MVPA, CVD risk does appear to decrease linearly with increasing levels of activity of this intensity. Encouraging individuals with a low ABI to gradually increase their participation in MVPA may reduce future risk of cardiovascular events.

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1692 Board #100 May 30 2:00 PM - 3:30 PM

**Aerobic Exercise Training Induces Muscle Hypertrophy in Both Young and Old Men**

Adam R. Konopka, Matthew P. Harber, Miranda K. Udem, Leonard A. Kaminsky, FACSM, Todd A. Trappe, Scott W. Trappe, FACSM. *Human Performance Laboratory, Ball State University, Muncie, IN.*  
(No relationships reported)

We have previously reported that aerobic exercise training induces substantial (12±2%) muscle hypertrophy in older women (70±2 yr). However, it is unclear if this is an age and/or gender dependent response.

**PURPOSE:** Examine the influence of progressive aerobic exercise training on aerobic capacity, whole muscle size, and knee extensor muscle function in young and old men.

**METHODS:** Seven young (Y; 20±1 yr) and six old (O; 74±3 yr) men performed 12-weeks of exercise training on a cycle ergometer. Training workload was based on relative intensity (% heart rate reserve) and progressively increased throughout the training program. Aerobic capacity, quadriceps muscle volume (via magnetic resonance imaging), and knee extensor muscle function (peak isometric torque and power) were assessed before and after the training intervention.

**RESULTS:** The training program improved (P<0.05) aerobic capacity in both Y (14±4%) and O (17±3%), however the absolute increase was greater (P<0.05) in Y (0.5±0.1 L·min<sup>-1</sup>) compared to O (0.2±0.1 L·min<sup>-1</sup>). Quadriceps muscle volume was higher (P<0.05) after training in both Y (54±13 cm<sup>3</sup>; 5±1%) and O (49±11 cm<sup>3</sup>; 6±1%). Peak work output during the graded cycle exercise test was ~20% higher (P<0.05) in both Y and O after training while knee extensor isometric torque, peak power, and peak angular velocity were not influenced.

**CONCLUSIONS:** The potential for muscle hypertrophy in response to aerobic exercise training is preserved with aging in both men and women. These data further support the use of aerobic exercise as a successful countermeasure to the age-related loss of muscle mass and aerobic capacity.

Supported by NIH Grant AG032127

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1693 Board #101 May 30 2:00 PM - 3:30 PM

**Correlates of Exercise Capacity in Elderly Individuals with and without Coronary Artery Disease**

Sandra Mandic<sup>1</sup>, Rob Walker<sup>1</sup>, Emily Stevens<sup>1</sup>, Casey Brown<sup>1</sup>, Diana Giraldo Ocampo<sup>1</sup>, Edwin R. Nye<sup>1</sup>, Dianne Body<sup>2</sup>, Leanne Barclay<sup>1</sup>, Michael J A Williams<sup>1</sup>.  
<sup>1</sup>University of Otago, Dunedin, New Zealand. <sup>2</sup>Dunedin Public Hospital, Dunedin, New Zealand. (Sponsor: Jonathan Myers, FACSM)  
(No relationships reported)

Exercise capacity declines with aging and in the presence of coronary artery disease (CAD). However, mechanisms underlying reduced exercise capacity in elderly individuals with stable CAD compared to age-matched healthy individuals remain unclear.

**PURPOSE:** To compare correlates of peak oxygen consumption (VO<sub>2</sub>peak) in age- and gender-matched elderly individuals with stable CAD and without CAD (no-CAD).

**METHODS:** Seventy-six elderly individuals (age: 72±5 years (range: 61 to 82), 37% women) with CAD (n=38) and no-CAD (n=38) completed: 1) symptom-limited graded exercise test with expired gas analysis and bioimpedance assessment of cardiovascular response to exercise; 2) physical function testing (Short Physical Performance Battery); 3) bioimpedance assessment of body composition; 4) lower-extremity muscle strength (30-second chair stand test); and 5) 12-month physical activity recall.

**RESULTS:** The CAD group had significantly lower VO<sub>2</sub>peak (19.6±4.8 vs. 22.2±4.9 ml/kg/min; p=0.027), maximal heart rate (122±17 vs. 139±19 bpm; p<0.001), maximal cardiac output (12.5±2.2 vs. 14.4±3.1 L/min; p<0.002) and increased percentage of body fat (32.8 vs. 27.5%; p=0.026) compared to the no-CAD group. In both groups, VO<sub>2</sub>peak was positively related to maximal cardiac output (no-CAD: r=0.44; CAD: r=0.38), maximal heart rate (no-CAD: r=0.32; CAD: r=0.56), percentage of muscle mass (no-CAD: r=0.62; CAD: r=0.73) and last year physical activity (no-CAD: r=0.65; CAD: r=0.41) (all comparisons p<0.05) but not age (no-CAD: r=0.13, p=0.438; CAD: r=-0.01, p=0.959). In addition, in the CAD group VO<sub>2</sub>peak was positively related to muscle strength (r=0.54, p=0.001) and physical function (r=0.43, p=0.007) and negatively related to percentage of body fat (r=-0.73, p<0.001).

**CONCLUSIONS:** In addition to impaired cardiovascular function, reduced muscle strength and increased body fat contribute to reduced VO<sub>2</sub>peak in elderly individuals with stable CAD. Long-term cardiac rehabilitation programs should focus on improving these outcomes.

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## B-26 Free Communication/Poster - Clinical Exercise Physiology Spinal Cord/Neuro (Clinical Exercise Physiology Association)

MAY 30, 2012 1:00 PM - 6:00 PM  
ROOM: Exhibit Hall

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1694 Board #102 MAY 30 3:30 PM - 5:00 PM

### Vt2 Is A Valid Parameter To Determinate Anaerobic Threshold For People With Spinal Cord Injury

Roberto Aguado-Jimenez<sup>1</sup>, Beatriz Crespo<sup>2</sup>, Laura Mordillo<sup>2</sup>, Angel Gil<sup>2</sup>, Juan Reyes-Aguilar<sup>3</sup>, Antonio Oliviero<sup>3</sup>. <sup>1</sup>Public University of Navarra, Tudela (Navarra), Spain. <sup>2</sup>Fundacion Hospital Nacional De Paraplejicos, Toledo, Spain. <sup>3</sup>Fundacion Hospital Nacional De Paraplejicos, Toledo, Spain.  
(No relationships reported)

Anaerobic threshold determination has usually been employed in the training process. Anaerobic threshold can be calculated using ventilatory parameters (VT2, Beaver 1986) or acidity parameters in blood (Lactate, Coyle 1984). The purpose of this study was to determine if the anaerobic threshold, for people with spinal cord injury, can be calculated using ventilatory or blood lactate methods. Methods. Data were obtained from the project "Central fatigue in athletes: role of the cerebral cortex in relation to the effort in healthy and injured spinal cord". 18 subjects were recruited (Age: 34 ± 0.7 years; weight: 67.3 ± 4.5 kg; IMC: 22.8 ± 0.7; Aerobic Training: 3-6 h/week). Subjects were divided in 2 groups. SCI (people with spinal cord injury and accustomed to the wheelchair) and CON (control or healthy people and not accustomed to the wheelchair). They performed an incremental aerobic test to exhaustion on treadmill using an standard wheelchair. First velocity was 4 km•h<sup>-1</sup>, increasing 1 km•h<sup>-1</sup> every 3 minutes, with 1 minute recoveries after each stage. The test was maximal and finished considering ACSM criteria. During the test, VE, VO<sub>2</sub> y VCO<sub>2</sub> were analyzed. Anaerobic threshold was calculated at the time in which VE/VCO<sub>2</sub> increased nonlinearly (Beaver 1986). Blood lactate was analyzed to determine the anaerobic threshold (Coyle 1984). Results. In both groups, Anaerobic threshold velocity value was statistically higher (P<0.05) when it was obtained from ventilatory parameters (VT2). However, the difference did not exceed 0.4 km•h<sup>-1</sup>. When the anaerobic threshold velocity was compared between groups, it was observed that an habituation of exercise over the wheelchair, was reflected in a higher anaerobic threshold velocity. It was observed in the results from VT2 (SCI: 7.6 ± 1.9 km•h<sup>-1</sup> y CON: 5.0 ± 0.6 km•h<sup>-1</sup>, P<0.05.) or Blood Lactate (SCI: 8.0 ± 2.0 km•h<sup>-1</sup> y CON: 5.4 ± 1.6 km•h<sup>-1</sup>, P<0.05). Discussion. Results show that despite ventilatory differences in SCI, the methods based on ventilatory parameters (VT2), are valid in these populations. Los resultados ponen de manifiesto, que a pesar de las diferencias ventilatorias que pudieramos observar en PLM, las mediciones de umbral anaeróbico a partir de métodos ventilatorios son válidos para estas poblaciones, showing the same results as those found with lactate methods.

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1695 Board #103 MAY 30 3:30 PM - 5:00 PM

### Investigate The Needed Walking Ability Of Patients With Stroke For Training With Non-motorized Treadmill

Ya Ling Chang<sup>1</sup>, Hsing Yu Chen<sup>1</sup>, Wen Hsu Sung<sup>1</sup>, Tien Yow Chuang<sup>2</sup>. <sup>1</sup>National Yang-Ming University, Taipei, Taiwan. <sup>2</sup>Taipei Veterans General Hospital, Taipei, Taiwan.  
(No relationships reported)

**BACKGROUND:** Damage of walking ability on patients with stroke usually limited their activities of daily living. Non-motorized treadmill (NMT) can provide active walking training, but the tilted walking belt and high walking resistance of this device may keep patients with lower walking ability from training with it. So the needed ability for walking on NMT has to be determined.

**PURPOSE:** The purpose of the study is to investigate the needed walking ability of patients with stroke for training with NMT.

**METHOD:** Ten patients with stroke who could walk on the ground were recruited in the study. They were divided into group A (could not walk on NMT, n=4) and group B (can walk on NMT, n=6). All subjects were the first hemorrhagic or ischemic stroke (aged 30-81 y/o), and evaluated with functional walking tests and questionnaires. Functional walking tests included time up and go test (TUG), straight walking test (normal and fast speed). Questionnaires included the walking ability questionnaire, activities specific balance confidence scale (ABC) and Frenchay activities index (FAI). Measured data was analyzed by Kruskal-Wallis H test and Mann-Whitney U test. The level of .05 was set for statistical significance.

**RESULT:** The data including age, sex, body height, body weight and affected side has no significant difference between two groups. There are significant differences (p <0.05) found on straight walking test in normal speed (group A: 0.58 ± 0.23 m/sec; group B: 0.90 ± 0.28 m/sec) and straight walking test in fast speed (group A: 0.63 ± 0.27 m/sec; group B: 1.06 ± 0.32 m/sec). All the other tests found no significant difference, including TUG (group A: 23.55±13.53 sec; group B: 15.39±6.64 sec), walking ability questionnaire (group A: 53±10.80; group B: 58.17±12.32), ABC scale (group A: 67.34±23.74; group B: 60±17.91), and FAI (group A: 12.55±8.66; group B: 10.83±4.62).

**CONCLUSION:** The results showed that the needed walking ability of patients with stroke for walking on NMT was related with the performance of straight walking test. Although other tests found no significant difference, all scores of group B were better than scores of group A. The preliminary results may be a simple index for the minimum requirement for active walking training with NMT. Supported by TVGH Grant (IRB No: 201008022OB).

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1696 Board #104 MAY 30 3:30 PM - 5:00 PM

### Exercise Responses between Outdoor and Virtual Reality Indoor Arm+FES-leg Cycling in Individuals with Spinal Cord Injury

Nazirah Hasnan<sup>1</sup>, Che Fornusek<sup>2</sup>, Ruby Husain<sup>3</sup>, Glen M. Davis, FACSM<sup>2</sup>. <sup>1</sup>University of Sydney & University of Malaya, Sydney, Australia. <sup>2</sup>University of Sydney, Sydney, Australia. <sup>3</sup>University of Malaya, University of Malaya, Malaysia.  
(No relationships reported)

Functional electrical stimulation (FES) leg cycling has the potential to improve cardiorespiratory fitness after spinal cord injury (SCI). Combined arm and leg ('hybrid') exercise develops a higher oxygen uptake and greater cardiovascular demand compared to FES-leg cycling alone. Recent technologies have enabled outdoor hybrid cycling as well as virtual reality (VR) indoor hybrid exercise. VR-enhanced exercise enables the individual to interact within a virtual environment mimicking outdoor exercise, and provides a sense of participation and exercise motivation.

**PURPOSE:** This study compared submaximal exercise responses during outdoor hybrid cycling versus VR-enhanced indoor hybrid cycling.

**METHODS:** Eight individuals with chronic thoracic-lesion SCI were recruited. They performed voluntary arm and FES-assisted leg cycling on a commercially available hybrid recumbent tricycle. The experiments were conducted outdoors and indoors incorporating VR technology whereby the same outdoor environment was simulated on a large flat screen monitor. Four separate trials (2 outdoor, 2 VR) were conducted at least two days apart. Electrical stimulation was applied bilaterally to the quadriceps, hamstrings and glutei muscle groups and individuals modulated stimulation intensity according to preference and comfort. They were instructed to cycle to their best ability and safely. Oxygen consumption, heart rate and energy expenditures were measured over a 30-min outdoor and VR-simulated indoor test course.

**RESULTS:** During outdoor cycling, mean VO<sub>2</sub> was 15.95 ± 1.20 ml•kg<sup>-1</sup>•min<sup>-1</sup> compared to 16.60 ± 0.87 ml•kg<sup>-1</sup>•min<sup>-1</sup> for indoor VR exercise. Energy expenditures were 25.7 ± 1.4 kJ•min<sup>-1</sup> for outdoor cycling versus 26.8 ± 1.0 kJ•min<sup>-1</sup> indoors. The outdoor cycling heart rate was 128 ± 3 b•min<sup>-1</sup> compared to 125 ± 3 b•min<sup>-1</sup> during VR exercise. T-tests revealed that there is no significance difference (p>0.05) between indoor and outdoor test responses. There was also no significance differences in the highest VO<sub>2</sub> or heart rates observed over the 30-min test courses.

**CONCLUSION:** This study concluded that VR-enhanced hybrid cycling produces no different physiological responses than outdoor arm+leg cycling. Virtual reality technology may provide new opportunities for exercise rehabilitation in the SCI population.

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**1697** Board #105 MAY 30 3:30 PM - 5:00 PM  
**Lower Extremity Functional Electrical Stimulation Isometric Contractions Augment Arm Cycling Peak Oxygen Uptake In Spinal Cord Injured Individuals**

Berit Brurok. *Norwegian University of Science and technology, Trondheim, Norway.*  
(No relationships reported)

Functional electrical stimulation (FES) cycling augment arm cycling (ACE) peak oxygen uptake ( $VO_{2peak}$ ) in spinal cord injured (SCI) individuals, but high resource demands limits its access. Thus equally effective but less resource demanding training modalities are needed.

**PURPOSE:** To determine if FES lower extremity isometric muscle contractions augments ACE  $VO_{2peak}$  in individuals with SCI.

**METHODS:** Cross sectional single-subject design. Fifteen individuals with C<sub>4</sub> to T<sub>12</sub> SCI, and ASIA Impairment scale A, mean age of 40.2 (13.6) years were recruited and divided into two groups; injury above (SCI-high n=8) or below (SCI-low n=7) the T<sub>6</sub> level.  $VO_{2peak}$  was measured during and compared between; 1) ACE combined with FES isometric contractions (FES iso hybrid), 2) ACE combined with FES cycling (FES hybrid cycling), and 3) ACE alone.

**RESULTS:** In the SCI-high group, FES iso hybrid and FES hybrid cycling increased  $VO_{2peak}$  compared to ACE alone from 17.6 ( $\pm 5.0$ ) to 23.6 ( $\pm 3.6$ ) mL $\cdot$ kg<sup>-1</sup> $\cdot$ min<sup>-1</sup> and from 17.6 ( $\pm 5.0$ ) to 24.4 ( $\pm 4.1$ ) (P = 0.001) respectively.  $VO_{2peak}$  and related parameters were not different between the two FES hybrid modalities. In the SCI-low group, there was no difference in  $VO_{2peak}$  and related parameters between the three test modalities.

**CONCLUSIONS:** FES lower extremity isometric contractions and FES cycling augmented arm cycling  $VO_{2peak}$  in individuals with SCI high level injuries in the present study. However a portable FES apparatus may serve as a less resource demanding alternative to stationary FES cycling. These findings may have important implications for training compliance and exercise prescription for SCI

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**1698** Board #106 MAY 30 3:30 PM - 5:00 PM  
**Failure To Reproduce VO<sub>2</sub>max In Patients With Chronic Fatigue Syndrome As An Objective Indicator Of Disease**

Betsy A. Keller, FACSM, J. Luke Pryor, Sarah Simunovich, Kelsey Corrigan. *Ithaca College, Ithaca, NY.*  
(B.A. Keller: Contracted Research - Including Principle Investigator; NIH Grant A1090553-01, PI - Maureen Hanson.)

**PURPOSE:** To assess the reproducibility of  $VO_{2max}$  in subjects diagnosed with chronic fatigue syndrome (CFS) compared to healthy controls. Prior research demonstrates that  $VO_{2max}$  in healthy subjects is highly reproducible over days and even months ( $r > .95$ ), with a SEM of < 6-7% . :

**METHODS:** Subjects were 10 females and 2 males (41.3 $\pm$ 1.11 yrs) diagnosed with CFS by a physician experienced in the diagnosis of CFS, and 3 male and 4 female healthy controls (23.3 $\pm$ 1.11 yrs) . Each subject completed two maximum exercise tests on a cycle ergometer separated by 24 hrs to assess the reproducibility of  $VO_{2max}$  and associated measures.  $VO_{2max}$ , max heart rate (HRmax), anaerobic threshold (AT), max workload (Wmax), workload at AT (ATwork), and respiratory exchange ratio (RER) were measured. :

**RESULTS:** For CFS subjects, significant decreases from test 1 to test 2 were 13.5% for  $VO_{2max}$  (21.5 to 18.6 mL $\cdot$ kg<sup>-1</sup> $\cdot$ min<sup>-1</sup>; p<0.01), 8 bpm for HRmax (p<0.01), 18.8% for AT (12.0 to 9.7 mL $\cdot$ kg<sup>-1</sup> $\cdot$ min<sup>-1</sup>; p<0.05), 9.4% for Wmax (121 to 109 W, p<0.05), and 17.3% for ATwork (58.3 to 48.2 W; p<0.05). However, max RER did not change (1.11 to 1.12; p=0.23) indicating that CFS subject effort was consistently high for both tests. As expected for healthy controls, there were no significant differences in  $VO_{2max}$  (mean diff=1.5%; 47.5 to 48.2 mL $\cdot$ kg<sup>-1</sup> $\cdot$ min<sup>-1</sup>), HRmax (181.6 to 183.1 bpm), AT (26.4 to 25.9 mL $\cdot$ kg<sup>-1</sup> $\cdot$ min<sup>-1</sup>), Wmax (264 to 271 W), ATwork (150 to 143 W), and max RER (1.17 for both tests). :

**CONCLUSION:** Healthy controls were able to reproduce  $VO_{2max}$  as expected. In contrast, CFS subjects were unable to reproduce  $VO_{2max}$  and/or AT, despite evidence of maximum effort during both tests. A maximum graded exercise test-retest protocol with ventilatory gas exchange could provide CFS patients with an objective indicator of underlying physiologic dysfunction.:

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**1699** Board #107 MAY 30 3:30 PM - 5:00 PM  
**Forced And Voluntary Exercise Improve Vo<sub>2</sub>max In Parkinson's Patients**

Amanda L. Penko, Gordon Blackburn, Michael Crawford, Jay L. Alberts. *Cleveland Clinic, Cleveland, OH.*  
(No relationships reported)

High cadence exercise, or forced exercise, has been shown to be beneficial in symptom reduction in Parkinson's disease (PD) patients. With the increase in knowledge of the benefits of forced exercise to PD, it is important to examine the cardiovascular responses to forced and voluntary exercise interventions.

**PURPOSE:** To examine changes in  $VO_{2max}$  in PD patients who have completed an eight-week exercise intervention, either forced or voluntary.

**METHODS:** 60 males and females (58.62  $\pm$  8.47 yrs) with a clinical diagnosis of idiopathic PD completed two maximal progressive cycling exercise tests separated by eight weeks. Heart rate (HR) and  $VO_2$  was monitored throughout the test.

**RESULTS:** Both modes of exercise resulted in a significant (p=.003) improvement in  $VO_{2max}$ , however greater improvements were observed in the voluntary group. Neither group exhibited any change in peak exercise heart rate pre- to post-intervention (p=.705).

**CONCLUSION:**  $VO_2$  was significantly different pre-exercise to post exercise as determined during a progressive exercise test to maximal exertion for both the forced exercise group and the voluntary exercise group. These data support the efficacy of aerobic exercise for increasing aerobic capacity in PD patients.

This project supported by R01NS065198-01 and Lincy Foundation.

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**1700** Board #108 MAY 30 3:30 PM - 5:00 PM  
**Cardiopulmonary Exercise Testing and Reduced Work Efficiency in Chronic Fatigue Syndrome**

Chris Snell, Staci Stevens, Todd Davenport, J. Mark VanNess. *University of the Pacific, Stockton, CA.*  
(No relationships reported)

**PURPOSE:** Reduced functional capacity and post-exertional fatigue following physical activity are hallmark symptoms of Chronic Fatigue Syndrome (CFS). That these symptoms are often delayed may explain the equivocal results for clinical cardiopulmonary exercise testing among individuals with CFS. Test reproducibility in healthy subjects is well documented. This may not be the case with CFS due to delayed recovery symptoms. The objectives for this study were to compare results from repeated exercise tests as indicators of post-exertional fatigue and reduced work efficiency in CFS.

**METHODS:** Gas exchange data, workloads and related physiological parameters were compared between 51 individuals with CFS and 10 control subjects, all females, for two maximal exercise tests separated by 24 hours.

**RESULTS:** Multivariate analysis showed no significant differences between controls and CFS for test 1. However, for test 2 the individuals with CFS achieved significantly lower values for oxygen consumption and workload at peak exercise and at the ventilatory/anaerobic threshold. Follow-up classification analysis differentiated between groups with an overall accuracy of 86.9%.

**CONCLUSIONS:** The lack of any significant differences between groups for the first exercise test would appear to support a deconditioning hypothesis for CFS symptoms. However, results from the second test indicate the presence of a CFS related post-exertional fatigue. It might be concluded that a single exercise test is insufficient to reliably demonstrate functional impairment in individuals with CFS. A second test may be necessary to document the atypical recovery response and protracted fatigue possibly unique to CFS which can severely limit productivity in the home and workplace.



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1701 Board #109 MAY 30 3:30 PM - 5:00 PM

**Economy of Pedaling in Individuals With Down Syndrome**

Myriam Guerra<sup>1</sup>, Eduardo Garrido<sup>2</sup>, M<sup>a</sup> Carmen Martin-Borras<sup>1</sup>, Maria Gine-Garriga<sup>1</sup>, Guillermo Oviedo<sup>1</sup>, Bo Fernhall, FACSM<sup>3</sup>. <sup>1</sup>FPCEE Blanquerna (URL), Barcelona, Spain. <sup>2</sup>Hospital General de Catalunya, Sant Cugat del Valles, Spain. <sup>3</sup>University of Illinois at Chicago, Chicago, IL.  
(No relationships reported)

**INTRODUCTION:** Individuals with Down Syndrome (DS) have low aerobic capacity. Because of motor disabilities, cycling is difficult for them. Little is known about VO<sub>2</sub> economy when they perform tests over cycle ergometry.

**PURPOSE:** We investigated the relation between VO<sub>2</sub>peak and peak power during a maximal exercise test in persons with DS when cycling.

**METHODS:** 10 individuals with DS (age=20±2 years; BMI=24.5±4.1) and 7 without DS (age=20±2 years; BMI=23.3±2.7), all of them males, participated in this study. They completed a maximal cycle ergometer exercise test consisting of a 3-min warm up followed by an increase in load of 16 watts every minute until exhaustion. Metabolic data were continuously collected. Aerobic economy (peak VO<sub>2</sub> / peak power) was calculated in both groups and compared to predicted values.

**RESULTS:** Individuals with DS exhibited lower (p<.05) VO<sub>2</sub>peak (1.56±0.38 vs 3.22±0.46 L/min; 26.5±7.0 vs 44.1±4.7 ml/kg/min) and lower peak power (102.6±32.1 vs. 231.1±36.1W; 2.5±0.6 vs 3.2±0.3 W/kg). When comparing the actual economy (15.9±3.1 L/min/W) to the predicted value (10.3 L/min/W) it was significantly higher (p<.05) in DS group, meanwhile there were no significant differences in the control group (14.00±0.9 vs 10.3 L/min/W). When the actual economy between DS and control groups were compared (15.9±3.1 vs 14.0±0.9 L/min/W), there was no significant difference, even though the DS group had a higher mean.

**CONCLUSIONS:** Individual with DS exhibit poorer cycling economy than expected based on current formulas. However, there was no significant difference between persons with DS and controls, although this may have been influenced by a lack of statistical power. Thus, individuals with DS have low aerobic capacity and low exercise economy, which may partially explain their reduced ability to exercise. (Supported by MEC, reference DEP2005-00202-C04-01)

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1702 Board #110 MAY 30 3:30 PM - 5:00 PM

**Prediction Of METs From The Heart Rate Index In Persons With Down Syndrome**

Stamatis Agiovlasitis<sup>1</sup>, Bo Fernhall, FACSM<sup>2</sup>. <sup>1</sup>Mississippi State University, Mississippi State, MS. <sup>2</sup>University of Illinois at Chicago, Chicago, IL.  
(No relationships reported)

Persons with Down syndrome (DS) have problems with autonomic control of heart rate that may alter their relationship between metabolic equivalent units (METs) and the heart rate index (HR<sub>index</sub>). HR<sub>index</sub> may be a practical indirect method for estimating METs and assessing physical activity intensity in persons with DS.

**PURPOSE:** To examine whether the relationship between METs and HR<sub>index</sub> differs between persons with and without DS and whether predictability of METs differs between groups.

**METHODS:** Oxygen uptake and heart rate were measured in 18 persons with DS (25 ± 7 yrs; 10 women) and 18 persons without DS (26 ± 5 yrs; 10 women) at rest and during six over-ground walking trials, each lasting 6 minutes, at the preferred speed and at 0.5, 0.75, 1.0, 1.25, and 1.5 m/s. Each participant's METs and HR<sub>index</sub> at each speed were calculated by dividing oxygen uptake and heart rate during walking by resting oxygen uptake and resting heart rate, respectively. The relationship between METs and HR<sub>index</sub> in the two groups was analyzed using multi-level regression with random intercepts and slopes. Independent variables included HR<sub>index</sub>, group (DS vs. Non-DS), the group by HR<sub>index</sub> interaction, and body mass index (BMI). Prediction accuracy in each group was assessed with the mean absolute error and Bland-Altman plots.

**RESULTS:** The relationship between METs and HR<sub>index</sub> differed between persons with and without DS. HR<sub>index</sub> and group significantly predicted METs (p ≤ 0.025; R<sup>2</sup> = 0.66). Neither the group by HR<sub>index</sub> interaction nor BMI contributed significantly to the model. The prediction equation was METs = -4.736 + (6.375×HR<sub>index</sub>) - (0.433×Group [1=DS; 0=Non-DS]). The HR<sub>index</sub> cut-off for moderate-intensity activity was 1.15 and 1.21 for persons with and without DS, respectively. Mean absolute prediction error did not differ between groups (p > 0.05; DS: 22.8 ± 16.5%; Non-DS: 19.9 ± 13.0%). Bland-Altman plots showed somewhat greater variability in the difference between actual and predicted METs for persons with DS.

**CONCLUSION:** Persons with DS have altered METs to HR<sub>index</sub> relationship and lower cut-offs for moderate-intensity physical activity as estimated by the HR<sub>index</sub> than persons without DS. Predictability of METs from HR<sub>index</sub> is similar between persons with and without DS.

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**B-27 Free Communication/Poster - College Athletes**

MAY 30, 2012 1:00 PM - 6:00 PM  
ROOM: Exhibit Hall

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1703 Board #111 MAY 30 3:30 PM - 5:00 PM

**Pre-Participation Screening For College Athletes: The Role of Resting ECG**

Brian Hughes, Steve Burns, David Glover, Missy Briet, Casandra Davis, Heather D'Errico, Andrew Gai, Lindsey McFarland, Halie Thomas, William Miller.  
University of Central Missouri, Warrensburg, MO.  
(No relationships reported)

An unexpected death in athletes who most would consider to be in good health is particularly disconcerting and often visible to the public. Effective pre-participation screening is controversial and the addition of resting ECG has been suggested to be of limited value.

**PURPOSE:** The purpose of the current study was to determine the efficacy of adding a resting ECG as part of the pre-participation screening of Division 2 athletes.

**METHODS:** Resting ECG's were conducted on 326 male and female athletes to determine cardiac anomalies. ECG's were interpreted by a sports medicine physician experienced in the athlete ECG. All ECG's were also evaluated for mean QRS axis and rate corrected long QT syndrome (QTc).

**RESULTS:** Based on resting ECG's, 3 athletes were referred to the local hospital for further cardiac studies (echocardiogram and stress ECG) however all were cleared for activity due to negative results. Mean QRS axis Of the 326 ECG's was 85.5° with 15 athletes documenting right axis deviation @ 120-130 degrees and 1 athlete with left axis deviation @ -30°. Mean QTc was 414.4 ms with 19 athletes demonstrating QTc > 440ms.

**CONCLUSION:** Based on the data analyzed, resting ECG's for pre participation screening have little value in elucidating cardiovascular risk but may have great value as a baseline for future reference.

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1704 Board #112 MAY 30 3:30 PM - 5:00 PM

**Menstrual Irregularity Incidence and Body Composition in Korean Female University Athletes**

Namju Lee<sup>1</sup>, Jongkyu Kim<sup>1</sup>, Misook Lee<sup>1</sup>, Tae-sam Kim<sup>1</sup>, Sun-kyung Ki<sup>1</sup>, Hyun-chul Cho<sup>2</sup>. <sup>1</sup>Sports Science Institute, Korea National Sport University, Seoul, Korea, Republic of. <sup>2</sup>Yong-in University, GyeonGi-Do, Korea, Republic of.  
(No relationships reported)

**PURPOSE:** To investigate menstrual irregularity incidence in relation to training volume, bone mineral density, and body composition in Korean female university athletes based upon sports type.

**METHODS:** 108 female University athletes and 22 controls participated in this study. Menstrual history questionnaire was used and dual energy x-ray absorptiometry (DXA) total body scans were conducted.

**RESULTS:** Menstrual irregularity incidence was 57% in total, 27% in controls, and 63% in athletes ( $\chi^2(1)=9.494, p=0.002$ ). Menstrual irregularity incidence was 100% in Kendo, 100% in Judo, 91.7% in basketball, 67.7% in Taekwondo, and 33.3% in fencing athletes, which was higher than other sports type athletes ( $\chi^2(7)=61.798, p<0.0001$ ). Otherwise, menstrual irregularity incidence was 0% in gymnastics, 8.3% in field hockey, and 16.7% in badminton athletes, which was lower than controls. As total bone mineral density (TBMD) was increased, menstrual irregularity incidence was decreased in controls ( $\chi^2(2)=8.225, p=0.016$ ) and was increased in athletes ( $\chi^2(2)=4.025, p=0.13$ ). As percent body fat (%BF) was increased, menstrual irregularity incidence was increased in controls ( $\chi^2(2)=7.435, p=0.024$ ) and was decreased in athletes ( $\chi^2(2)=25.954, p<0.0001$ ). As muscle mass was increased, menstrual irregularity incidence was increased in athletes ( $\chi^2(2)=8.249, p=0.016$ ). As weekly training hours increased, menstrual irregularity incidence in athletes was significantly increased.

**CONCLUSIONS:** Regular over training might cause menstrual irregularity incidence in athletes even though they had higher BMD, and not lower %BF. It would be more needed to find out what body composition factors mainly affect health concerns of female athletes and what levels of each body composition factor they need to maintain.

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**1705** Board #113 MAY 30 3:30 PM - 5:00 PM

#### **Insulin Sensitivity Characteristics of College Athletes with Smoking Habit**

Sheng-Ju Chuang<sup>1</sup>, Szu-Hsien Yu<sup>1</sup>, Feng-Chih Hsu<sup>2</sup>, Mallikarjuna Korivi<sup>1</sup>. <sup>1</sup>Taipei Physical Education College, Taipei, Taiwan. <sup>2</sup>Physical Education Section, National Taoyuan Agricultural & Industrial Vocational High School, Taoyuan, Taiwan, Physical Education Section, Taiwan. (Sponsor: Chia-Hua Kuo, FACSM)  
(No relationships reported)

**PURPOSE:** Chronic inflammation and improper liver function play an important role in insulin sensitivity. The purpose of this study was to investigate the smoking habit on insulin sensitivity among young college athletes.

**METHODS:** In this study, total 552 nonsmokers and 98 current smokers (8.4±0.7 cigarette per day) athletes were recruited. Indices of glucose metabolism [glucose, insulin, glycated hemoglobin (HbA1c)], inflammation (white blood cells, WBC) and liver damage [(alanine aminotransferase (ALT), aspartate aminotransferase (AST)] were measured.

**RESULTS:** We found that gender-, alcohol consumption- and age-adjusted insulin, HOMA-IR (homeostasis model assessment of insulin resistance), HOMA-β (homeostasis model assessment β-cell func[Unsupported Character - Codename &shy;]tion) and white blood cell number in smokers were higher than nonsmokers. We also found that smoking habit is positively associated with serum insulin, HOMA-IR, HOMA-β, HbA1c and white blood cell numbers and negatively associated with QUICKI before and after adjusting the gender, alcohol consumption and age. Smoking was also negatively related to adjust AST. WBC is positively correlated to HOMA-IR and HOMA-β.

**CONCLUSIONS:** In conclusion, we suggested that smoking behavior can influence insulin sensitivity of athletes; the possible reason might be due to high systemic inflammation.

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**1706** Board #114 MAY 30 3:30 PM - 5:00 PM

#### **The Use Of Instrument Assisted Soft Tissue Mobilization To Change Perception Of Functional Ability In College-aged Students.**

John Vardiman, Matt Andre, Patrick Moodie, Justin Maresh, Zach Graham, Mike Lane, David Carr, Yayah Alayafi, Philip Gallagher. University of Kansas, Lawrence, KS.  
(No relationships reported)

Many manual therapy techniques and therapeutic modalities are utilized to return patients to functional activities or activities of daily living.

Assessing the change in a patients perception of their functional ability after receiving Instrument Assisted Soft Tissue Mobilization (IASTM) treatment has yet to be determined.

**PURPOSE:** The purpose of this project was to assess the efficacy of the Instrument Assisted Soft Tissue Mobilization (IASTM) technique at changing a patients functional ability as well as their perception of functional ability of the functional squat test.

**METHODS:** Twenty-seven college-aged students (21.29±1.89 years, 64.81±15.52 kg, 170.05±9.89cm) participated in this study. Thirteen subjects (8 female, 5 male) were randomly selected to receive the IASTM treatment (TG) and 14 subjects (11 female, 3 male) were selected for the control group (CG). All subjects completed the Perception of Functional Ability Questionnaire (PFAQ) and then performed a baseline functional squat test in a 3-D Marker-less Motion Capture System (Dynamic Athletics, Overland Park, KS). The TG received a bilateral IASTM treatment to the posterior lower leg and the CG rested in a prone position for 10 minutes and did not receive the treatment. After the IASTM or 10 minute rest period all subjects performed a follow-up functional squat test in the motion capture system and completed a follow-up PFAQ. All data was analyzed using a 2x2 repeated measures ANOVA (p<.05).

**RESULTS:** There was no significant difference in data from the PFAQ between the TG and CG. There was significantly more stability in body weight distribution found in the TG following the IASTM treatment compared to the CG. There was also significantly more posterior heel shift in the TG following IASTM compared to the CG.

**CONCLUSION:** Though not statistically significant, all components of perception of functional ability improved following IASTM with the healthy, college-aged subjects. IASTM treatment did significantly increase critical components of the functional squat test. These data indicate that IASTM is an effective modality for increasing functional ability with the functional squat test.

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**1707** Board #115 MAY 30 3:30 PM - 5:00 PM

#### **Skin Cancer Knowledge, Attitudes, And Behaviors In Collegiate Athletes**

Courtney Hobbs<sup>1</sup>, Martha Bass<sup>2</sup>, Jeffrey S. Hallam<sup>2</sup>, Allison Ford-Wade<sup>2</sup>. <sup>1</sup>Texas A&M Commerce, Commerce, TX. <sup>2</sup>The University of Mississippi, University, MS.  
(Sponsor: Mark Loftin, FACSM)  
(No relationships reported)

Skin cancer, specifically melanoma, is the deadliest and most preventable type of cancer in the world. Athletes have an increased risk for developing serious malignant growths due to unavoidable sun exposure during practice and competition times, and the lack of recommended sunscreen use.

**PURPOSE:** The purpose of this study was to assess skin cancer knowledge, attitudes, and behaviors among collegiate athletes. Behaviors that expose the athletes to UV rays, such as tanning bed use and sunlight exposure during peak hours, were of question. Strategies that athletes take to avoid overexposure to UV radiation when their practice/game times are scheduled outdoors during peak exposure hours were also examined.

**METHODS:** Three-hundred-forty-three athletes, from various intercollegiate sports at a mid-sized southern university, completed a modified version of the Melanoma Risk Behavior Survey.

**RESULTS:** The total mean score for knowledge was 8.88 ± 4.39, with a total possible score of zero - 24. A majority of the athletes were unable to identify basal cell carcinoma as the most common form of skin cancer. The mean score for attitude was 41.91 ± 6.22, with a total possible score of 11-55. A majority of the athletes felt a good tan was worth the increased risk of skin cancer. The mean score for behavior was 3.00 ± 2.70, with the total possible score of zero - 12. Less than 15% of the athletes attempted to avoid the sun during peak UV hours or wear protective clothing. Less than 25% regularly applied sunscreen before practice or during non-practice sun exposure.

**CONCLUSION:** Our results show that college athletes lack knowledge regarding skin cancer and sun protection, and engage in high-risk behaviors such as indoor tanning. There is a need to educate the collegiate athletic population about low-risk sun protection behaviors and skin cancer in general. Athletic directors, athletic trainers, coaches, and other individuals involved in the health and safety of college athletes need to include sun safety procedures in their discussions with the athletes during meetings and practice sessions.

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**1708** Board #116 MAY 30 3:30 PM - 5:00 PM

#### **Holistic Lifespan Health Outcomes Among Intercollegiate Student-Athletes: Data from the Trojan Lifetime Champions Study**

Shawn C. Sorenson, Russ Romano, Robin Scholefield, E. Todd Schroeder, FACSM, George J. Salem, FACSM. University of Southern California, Los Angeles, CA.  
(No relationships reported)

**PURPOSE:** Despite prominent attention, lifespan health data for elite athletes remain sparse. This investigation provides descriptive epidemiology on holistic lifetime health among Division I intercollegiate athletes.

**METHODS:** 488 university students and alumni, including varsity student-athletes (SA) and non-athletes (NA), completed anonymous questionnaires documenting lifetime physical, mental, & emotional health, health-related quality-of-life (HRQL), and exercise behaviors & attitudes. Age-stratified, cross-sectional analyses were used to evaluate relative risk (unadjusted odds ratios

with 95% confidence intervals) for professional treatment of joint, cardiopulmonary, and psychosocial health concerns, in SA compared to NA.

**RESULTS:** Older alumni SA (ages 43+) had nearly 8x the risk of treatment for joint concerns, compared to age-matched NA; odds ratio = 7.9 (1.5 - 4.3). Current and younger alumni SA had similar risk vs. NA. Collapsed across groups, older alumni were 9x as likely as current students to be treated for cardiopulmonary concerns, but risk was similar for SA and NA. Treatment for psychosocial concerns was similar, irrespective of age and athletic participation.

**CONCLUSIONS:** These data suggest that intercollegiate athletic participation increases risk for treatment of joint concerns later in life. Despite high levels of exercise as young adults, SA demonstrated no protective cardiopulmonary health effects, and no differences in psychosocial health. This may offer valuable guidance for interventions seeking to optimize lifespan outcomes in this population. Additional studies are necessary to evaluate exercise and HRQL outcomes, and generalize these results to larger & more diverse populations.

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**1709** Board #117 MAY 30 3:30 PM - 5:00 PM

**Differences on the Upper Quarter Y Balance Test Between High School and College Baseball Players**

Grant E. Garrigues<sup>1</sup>, Paul P. Gorman<sup>2</sup>, Phillip J. Plisky<sup>3</sup>, Kyle B. Kiesel<sup>3</sup>, Heather Myers<sup>1</sup>, Douglass Black<sup>1</sup>, Robin M. Queen<sup>1</sup>, Robert J. Butler<sup>1</sup>. <sup>1</sup>Duke University, Durham, NC. <sup>2</sup>ProRehab, Evansville, IN. <sup>3</sup>University of Evansville, Evansville, IN.  
(No relationships reported)

Athlete injury screening tests have received significant attention recently with the aim of reducing sport related injuries. Few tests have been developed to screen for upper extremity injury risk. The Upper Quarter Y Balance Test (YBT-UQ) was developed to provide a more fundamental upper extremity assessment. The YBT-UQ requires stance hand stability combined with reach hand mobility and coordination while maintaining a three point plank position.

**PURPOSE:** To examine how competition level affects performance on the YBT-UQ in baseball athletes.

**METHODS:** 37 male high school (HS) baseball players and 26 male college (COL) players were screened on the YBT-UQ prior to the spring season. Athletes with pain were excluded from the study. YBT-UQ performance was collected bilaterally in the medial, inferolateral, and superolateral directions. The maximum score for each direction was normalized to upper extremity length (C7 spinous process to tip of the middle finger) and used for analysis. The average of the normalized scores was used to develop a composite score. The bilateral normalized scores (%AL) were averaged and compared between groups. Reach symmetry was determined as the difference (cm) between the left and right side for each direction prior to normalization. Specific differences between the HS and COL players were statistically analyzed using independent samples t-tests ( $p < 0.05$ ).

**RESULTS:** HS baseball players had a significantly shorter average arm length ( $90.9 \pm 4.4$  cm) when compared to the COL players ( $93.9 \pm 3.9$  cm). No significant differences existed for the medial (HS:  $96.2 \pm 5.3$  %AL, COL:  $95.3 \pm 7.1$  %AL), inferolateral (HS:  $86.4 \pm 6.9$  %AL, COL:  $88.2 \pm 7.4$  %AL), superolateral (HS:  $69.3 \pm 9.6$  %AL, COL:  $69.2 \pm 7.1$  %AL) or composite (HS:  $84.0 \pm 5.7$  %AL, COL:  $84.2 \pm 5.9$  %AL) scores. Similarly no significant differences were observed for bilateral symmetry in the medial (HS:  $4.2 \pm 4.2$  cm, COL:  $4.9 \pm 4.1$  cm), inferolateral (HS:  $5.1 \pm 4.4$  cm, COL:  $4.3 \pm 3.6$  cm) or superolateral (HS:  $4.5 \pm 3.8$  cm, COL:  $5.5 \pm 6.0$  cm) directions.

**CONCLUSIONS:** Performance on the YBT-UQ does not appear to be dependent on the competition level in baseball players. Future studies should examine how athletes in other overhead sports perform on the test as well as examining if performance on the test is associated with an elevated injury risk.

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**1710** Board #118 MAY 30 3:30 PM - 5:00 PM

**Gender Differences on the Upper Quarter Y Balance Test in Collegiate Swimmers**

Michael P. Reiman. Duke University, Durham, NC. (Sponsor: Mitchell J. Rauh, FACSM)  
(No relationships reported)

Recently the Upper Quarter Y Balance Test (YBT-UQ) was developed to examine injury risk and provide a more fundamental assessment of upper extremity ability that minimizes the role of strength and power. Currently there is no reported research on YBT-UQ performance.

**PURPOSE:** To examine how gender affects performance on the YBT-UQ in athletes participating in swimming.

**MATERIALS/METHODS:** Twenty-four male and twenty-six female Division I college swimmers were recruited for the study prior to the pre-season. All athletes who reported pain or current injury at the time of testing or were currently under the sports medicine team's care for an injury were excluded from the study. YBT-UQ performance was collected for the left and right limb in the medial, inferior-lateral, and superior-lateral directions. The maximum score for each direction was utilized for analysis. The scores were normalized to upper extremity length (C7 spinous process to tip of the middle finger). The average of the normalized reach scores was used to develop a composite score. For analytical purposes, left and right side normalized scores (%AL) were averaged. To examine reach symmetry between genders, the difference (cm) between the left and right side was calculated for each direction prior to normalization. Statistical analysis was conducted using an independent samples t-tests ( $p < 0.05$ ).

**RESULTS:** Statistically significant differences were observed for the medial ( $p < 0.01$ , F:  $89.7.2 \pm 7.4$  %AL, M:  $97.4 \pm 7.3$  %AL) and composite ( $p < 0.04$ , F:  $80.6 \pm 7.3$  %AL, M:  $85.1 \pm 8.1$  %AL) scores. No statistically significant differences were observed for reach symmetry in the medial (F:  $3.8 \pm 3.3$  cm, M:  $3.2 \pm 1.9$  cm), inferior-lateral (F:  $5.5 \pm 5.4$  cm, M:  $3.2 \pm 2.8$  cm) or superior-lateral (F:  $5.1 \pm 4.2$  cm, M:  $5.6 \pm 4.5$  cm) directions.

**CONCLUSIONS:** Performance on several YBT-UQ indices appears to be lower for females than male collegiate swimmers. Future research should be conducted to assess if performance on the test has any validity as an assessment of injury risk.

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**1711** Board #119 MAY 30 3:30 PM - 5:00 PM

**Alcohol, Cigarette, Marijuana and Anabolic Steroid Consumption Among University Athletes in Bogota, Colombia**

Natalia Cano<sup>1</sup>, Laura Cárdenas<sup>1</sup>, Carolina Donado<sup>1</sup>, Olga Lucia Sarmiento<sup>1</sup>, John Duperly<sup>2</sup>. <sup>1</sup>Universidad de los Andes, Bogota, Colombia. <sup>2</sup>Fundacion Santa Fe de Bogota, Universidad de los Andes, Bogota, Colombia. (Sponsor: Michael Pratt, FACSM)  
(No relationships reported)

**PURPOSE:** University athletes (UA) are considered to have adequate academic performance, teamwork and health benefits from exercise, but there is evidence that UA in the US consume more alcohol (OH) and other illicit drugs than socially expected for athletes. In Colombia there are no studies on this topic, as well as no clear evidence concerning the use of anabolic steroids. We aimed to estimate the prevalence of OH, cigarettes (CC), marijuana (MJ) and anabolic steroids (AS) consumption amongst UA that competed in the Colombian University Association (ASCUN) tournament during 2011.

**METHODS:** In this cross sectional study, 801 males and females UA were randomly selected for a survey in an anonymous and voluntary way, as they participated in different competitions organized by ASCUN in the fall semester of 2011. The sample size was representative of all UA in Bogotá, Colombia. A translated and adapted version of the National Collegiate Athletic Association (NCAA) survey was used. The survey evaluated the patterns of OH, CC, MJ, and AS consumption. The life time prevalence of consumption of these substances was calculated by gender, sport (team vs. individual sports) and team captaincy.

**RESULTS:** Overall, of those surveyed 56.0% were male. The consumption of OH (85.0%) was the most prevalent, followed by CC (39.0%) and MJ (14.3%). The highest prevalence of consumption was among indoor soccer, volleyball and soccer players, for OH (14.9%, 13.5% and 11.4% respectively), CC (6.4%, 6.7% and 5.9% respectively), and MJ (2% for the three sports). In general for each substance the consumption was higher in males participating in a team sport (35.2% OH, 38.1% CC and 43.0% MJ). We didn't find a significant difference between team captains and other athletes, for OH (58.8% vs. 53.3%;  $p = 0.22$ ) or for consumption of other substances. The prevalence of AS use was 0.9% (85.7% males; 14.3% females), mostly among soccer athletes.

**CONCLUSIONS:** This study, the first on this topic in Latin America, shows a worrisome prevalence of OH, CC and MJ consumption among UA. Consumption was highest in men's team sports. This data should be taken into account for future interventions to reduce this burden in Colombia.

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**B-28 Free Communication/Poster - Concussion**

MAY 30, 2012 1:00 PM - 6:00 PM  
ROOM: Exhibit Hall

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**1713 Board #121 MAY 30 3:30 PM - 5:00 PM**

**Influence of Gender on Knowledge, Attitude, Perceived Social Pressures, and Perceived Behavioral Control Concerning Concussion among High School Athletes**

Johna K. Register-Mihalik<sup>1</sup>, Laura A. Linnan<sup>1</sup>, Tamara C. Valovich McLeod<sup>2</sup>, Stephen W. Marshall<sup>1</sup>, Frederick O. Mueller, FACSM<sup>1</sup>, Kevin M. Guskiewicz, FACSM<sup>1</sup>. <sup>1</sup>The University of North Carolina at Chapel Hill, Chapel Hill, NC. <sup>2</sup>A.T. Still University, Mesa, AZ.  
(No relationships reported)

Few studies have examined gender differences in health behavior concepts such as knowledge, attitude, perceived social pressures, and perceived behavioral control concerning concussion reporting among high school athletes.

**PURPOSE:** To examine the association between gender and knowledge, attitude, perceived social pressures, and perceived behavioral control concerning concussion.

**METHODS:** A pre-validated, cross-sectional survey was completed at home and returned via mail by a convenience sample of 162 high school athletes (98 males, 64 females; age=15.7±1.4 years). The main outcome measures were attitude total score (total of the 14 attitude Likert score answers), knowledge total score (number of questions correct out of 35), subjective norm average score (average of five separate question concerning social pressures, and norms), and perceived behavioral control average score (average of three questions concerning perceived control over concussion reporting). Higher scores indicate more favorable outcomes. Four separate regression models were used to examine the association between gender and these outcomes. Mean differences were examined as male scores minus female scores.

**RESULTS:** Gender was significantly associated with attitude (MD=-4.18; 95% CI:-7.99,-0.38; p=0.030), perceived social pressures (MD=-0.49, 95% CI:-0.91,-0.08; p=0.018), and perceived behavior control (MD=-0.43; 95% CI:-0.83,-0.03; p=0.018) with females having higher scores for each outcome. No association was observed between gender and knowledge scores (MD=0.77; 95% CI:-0.15,1.69; =0.10).

**CONCLUSIONS:** Although knowledge regarding concussion is similar between males and females, females may have a better attitude toward concussion reporting, a more favorable perception that important social referents (parents, teammates, and coaches) feel positively about concussion reporting, and more perceived control over concussion reporting. Clinicians should be mindful of these differences when educating males and females about concussion in an effort to improve attitudes and beliefs concerning concussion and concussion reporting in high school athletes. These findings may help direct the educational efforts mandated by recent statutes and legislation.

Funded by an NFL Charities Medical Research Grant

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**1714 Board #122 MAY 30 3:30 PM - 5:00 PM**

**“Association Of Genotype With Concussion Severity In Prospective Cohort Study Of College Athletes”**

Thomas R. Terrell<sup>1</sup>, Jeffrey Barth<sup>2</sup>, Doug McKeag, FACSM<sup>3</sup>, Robert C. Cantu, FACSM<sup>4</sup>, Ellen Bennett<sup>5</sup>, Rick Sloane<sup>6</sup>, Mark Lavallee, FACSM<sup>7</sup>, Dan Laskowitz<sup>5</sup>, Ken Bielak, FACSM<sup>8</sup>, David Petron<sup>9</sup>, Timothy J. Nobles<sup>8</sup>, Jamie Yeager<sup>8</sup>, Irfan Asif<sup>6</sup>. <sup>1</sup>University of Tennessee Graduate School of Medicine, UT Health Science Center, Sports Medicine Fellowship, Knoxville, TN. <sup>2</sup>University of Virginia School of Medicine, Charlottesville, VA. <sup>3</sup>Indiana University School of Medicine, Indianapolis, IN. <sup>4</sup>Boston University School of Medicine, Boston, MA. <sup>5</sup>Duke University Medical Center, Durham, NC. <sup>6</sup>Duke University, Durham, NC. <sup>7</sup>Memorial Medical Center, South Bend, IN. <sup>8</sup>University of Tennessee Graduate School of Medicine, UT Health Science Center, Knoxville, TN. <sup>9</sup>University of Utah School of Medicine, Salt Lake City, UT.  
(No relationships reported)

**INTRODUCTION :** The APOE e4 allele is significantly associated with poor outcome after severe TBI in non-athletic subjects. Previous prospective cohort studies (PCS) on athletes have studied the association of APOE e4 with acute concussion (conc) have been limited by small sample size. In addition, no other genetic polymorphisms (GPs) were included in prior studies. We report on the largest PCS involving college football and men’s/women’s soccer players in the literature and include the APOE G-219T promoter and two Tau gene exon 6 GPs in our analysis.

**PURPOSE:** To evaluate the association between sport related concussion and baseline neuropsychological (NP) test scores with several genetic polymorphisms (GPs) [GPs are APOE, APOE G-219T promoter (APOEProm), Tau exon 6 Ser53Pro (TauSer) and Tau Hist47Tyr (TauHis)] in college athletes.

**METHODS:** A multi-center PCS of 1186 college athletes from 15 institutions completed a conc/medical history (hx) questionnaire, genetic sampling (buccal swab, saliva, and blood), and baseline web-based NP testing (Headminder™). The overall population was 87% male, 59% white and mainly played football (67%) and soccer (24.4%).

**RESULTS:** Chi Square showed no significant association between experiencing an acute conc and the GPs. The Tau Ser TT genotype was associated with a trend towards reduced prospective concs (p<0.094). T tests showed that baseline NP test results such as Simple Reaction Time (SRT), Complex RT (CRT), CRT Errors, and Processing Speed (PS) had no significant association with any genotype from the GPs. The APOE e4 allele was associated with a significantly lower SRT Errors score (p=0.0131) and the TauSer TT genotype was associated with a significantly prolonged SRT (p=.017). The APOEProm TT genotype trended towards having a significant association with PS (TT having slower PS than GG/GT genotypes). The APOEProm TT/GT genotypes trended towards significantly prolonged CRT scores (p=0.088).

**CONCLUSION:** This large PCS of college athletes showed no significant association between APOE, APOEProm, Tau exon 6 Ser53Pro and Hist47Tyr and experiencing an acute conc. Future plans are to study the association between various GPs and post conc neurocognitive recovery.

**Acknowledgements:** NOCSAE and the AMSSM Foundation provided funding for this study.

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**1715 Board #123 MAY 30 3:30 PM - 5:00 PM**

**Balance Testing of Concussion Patients Using Dual-Task Interference**

Verle D. Valentine, Jason C. Dorman, Thayne A. Munce, Hannah K. Nelson, Ashley L. Miller, Paul A. Thompson, Michael F. Bergeron, FACSM. Sanford USD Medical Center, Sioux Falls, SD.  
(No relationships reported)

As proper medical care for sports concussions is increasingly emphasized, balance testing (BT) is emerging as a relatively new and promising method of concussion evaluation that warrants further investigation.

**PURPOSE:** To examine the diagnostic value of a novel BT protocol using dual-task interference from a cognitive challenge and compare longitudinal data from this and other concomitantly-used clinical concussion assessment tools.

**METHODS:** Clinically relevant data were collected from 68 concussed individuals (14-24 y) through standard symptom score evaluations, a computer-based neurocognitive test (ImPACT™), and the dual-task BT protocol. Additionally, 26 healthy, age- and sex-matched individuals performed identical BT on two separate occasions to provide normative data. Postural stability (AMTI force platform) was assessed during four BT conditions: eyes open (O), eyes open + cognitive task (OC), eyes closed (C), and eyes closed + cognitive task (CC). The cognitive task required subjects to recite the months of the year backwards.

**RESULTS:** Normative BT values for each condition were determined from the control data. An abnormal test was defined as 2.0 SD or more above the normative mean. Using these criteria, five distinct categories of concussion patients were identified: no balance deficits (ND), balance deficits only when vision was removed by closing the eyes (VD), balance deficits only during cognitive task (CD), balance deficits during both the VD and CD conditions (VCD), and non-specific balance deficits (BD). ANOVA analysis revealed higher symptom score reports by the BD vs. ND group in total symptom score ( $p = 0.014$ ), total physical symptoms ( $p = 0.005$ ), total cognitive symptoms ( $p = 0.018$ ), severity of complaint of balance problems ( $p < 0.001$ ), and severity of complaint of difficulty with attention and concentration ( $p = 0.003$ ).

**CONCLUSION:** Non-specific BT deficits in concussed patients are associated with greater reporting of symptoms. Dual-task interference BT with a cognitive challenge is a potentially valuable method of evaluation; yet, its clinical relevance is just now being established. Validation of this novel methodology may help to further establish BT as an effective tool in concussion treatment and research.

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**1716** Board #124 MAY 30 3:30 PM - 5:00 PM

**Incidence And Neurocognitive Effects Of Concussion In Youth (8-12 Yrs) American Football: A Prospective Study**

Anthony P. Kontos, R. J. Elbin, Scott Burkhart, Michael W. Collins. *University of Pittsburgh-School of Medicine, Pittsburgh, PA.* (Sponsor: Janet Buckworth, FACSM)

*(No relationships reported)*

As many as 5.5 million youth play American football each year, and recent reports indicate a two-fold increase in emergency department visits for sport-related concussions in youth (8-13 yrs) sport participants (Bakhos et al., 2008). Surprisingly, research on sport-related concussion in American football has been limited to high school, collegiate, and professional populations. There has been no research to date on concussion and its effects in youth American football.

**PURPOSE:** The purpose of the current study was to examine the incidence and neurocognitive effects of concussion in youth (8-12 yrs) American football using a newly developed, youth-specific computerized neurocognitive test.

**METHODS:** The study employed a prospective repeated measures design involving 453 youth football players aged 8-12 yrs. Participants completed the Pediatric Immediate Post-concussion Assessment and Cognitive Test (Pediatric ImPACT) and concussion symptom inventory at pre- and postseason. Concussed athletes also completed Pediatric ImPACT and reported symptoms at 1-3 days, 5-7 days, and 10-14 days post-injury. Additional injury information was obtained from parents using the Acute Concussion Evaluation (ACE). Player exposure and incidence rates for practices and games were recorded throughout the season. A series of correlations, reliable change estimates (RCE), and ANOVAs were conducted to analyze the data.

**RESULTS:** A total of 20 (4.4%) athletes incurred a concussion during the season. All concussions occurred during tackling and were the result of helmet to ground or helmet to helmet impacts. Clinical decreases (i.e., RCE) in neurocognitive performance were evident at 1-3 days and 5-7 days post-concussion, but returned to baseline levels by 10-14 days post-concussion. Pre- to post-season test-retest correlations for the Pediatric ImPACT individual test modules were moderate and ranged from .20 to .52.

**CONCLUSIONS:** The results suggest that youth American football has a relatively low rate of concussion compared to high school and college levels. The results also suggested that the Pediatric ImPACT test was effective in measuring neurocognitive deficits in youth following concussion. Most deficits resolved by 10-14 days. This research was supported by a grant from the National Football League Charities.

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**1717** Board #125 MAY 30 3:30 PM - 5:00 PM

**New Concussion Symptom Factors: Age and Sex Differences among High School and College Athletes**

R.J. Elbin<sup>1</sup>, Anthony P. Kontos<sup>1</sup>, Phil Schatz<sup>2</sup>, Tracey Covassin<sup>3</sup>, Jamie Pardini<sup>1</sup>, Michael W. Collins<sup>1</sup>. <sup>1</sup>*University of Pittsburgh, Pittsburgh, PA.* <sup>2</sup>*St. Joseph's University, Philadelphia, PA.* <sup>3</sup>*Michigan State University, East Lansing, MI.* (Sponsor: Janet Buckworth, FACSM)

*(No relationships reported)*

**PURPOSE:** The primary purpose of the current study was to examine using exploratory factor analyses (EFA) the factor structure of the 22-item Post-concussion Symptom Scale (PCSS) in independent samples of baseline and post-concussion high school and collegiate athletes. A secondary purpose of the study was to examine sex and age differences in the symptom factor scores.

**METHODS:** Baseline participants included 30,455 athletes (27,008 high school, 3,447 collegiate; 14,295 female, 16,160 male). Post-concussion participants included 1,438 athletes (944 high school, 494 collegiate; 477 females, 961 males) within 1-7 days of a concussion. Participants completed the PCSS. Two EFAs for baseline and post-concussion samples were conducted. A series of 2 (age) x 2 (sex) ANOVAs with Bonferroni correction for multiple comparisons were conducted for the baseline and post-concussion factors.

**RESULTS:** The baseline EFA supported a four factor solution (49.1% variance): 1) Cognitive-Migraine, 2) Sleep, 3) Vestibular-Headache, and 4) Emotional. The post-concussion EFA supported a four factor solution (58.3% variance): 1) Cognitive-Migraine, 2) Emotional, 3) Somatic, and 4) Sleep. High school athletes reported higher baseline Migraine (1.28:1.16) and Vestibular factors (.83:.61), but lower Sleep factor scores (1.86:1.99). Females reported higher Migraine (1.43:1.12), Sleep (2.13: 1.65), Vestibular (.95:.67), and Emotional factors scores (1.57:.85). High school athletes reported lower post-concussion Sleep factor scores (1.41:2.03). Females reported higher post-concussion Emotional factor scores (1.56:.90).

**CONCLUSIONS:** The results supported a four factor structure for both the baseline and post-concussion samples. However, several differences between baseline and post-concussion factor and age and sex differences were apparent and should be considered by clinicians and researchers.

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**1718** Board #126 MAY 30 3:30 PM - 5:00 PM

**Dual-task Assessment Of Concussion: Switch-task Stability Reliability Estimation**

Phillip D. Tomporowski, FACSM, Stephanie L. Cooper, Michelle S. Okumura, Michael S. Ferrara. *University of Georgia, Athens, GA.*

*(No relationships reported)*

The incidence of sport-related concussion is high, with 1.6 to 3.0 million sport-related concussions reported annually. Standardized, computer-based neurocognitive test batteries have been used in the assessment and management of sport-related concussion; however these tests are limited to cognitive functioning only. The dual-task methodology combines a physical and a mental task and closely replicates practice and game conditions, which can yield valuable information for return to play decisions.

**PURPOSE:** To examine the stability reliability of a dual-task test that combines stair stepping with an auditory detection task.

**METHODS:** 59 young adults (Mean age = 20.32 years; 40 female) performed a 5-min modified Harvard step test and an auditory switch test during two sessions separated by 7 days. The switch task measures the time required for an individual to inhibit an ongoing mental task and to initiate a different mental task, processes that are characteristic of executive function. Switch-task trials involved letter (vowel/consonant) or number (even/odd) discriminations to stimuli presented on headphones and recorded via two keys on a hand-held computer mouse. The stability reliability was assessed for switch-task tests consisting of 30, 40 and 60 items.

**RESULTS:** Intraclass correlations (ICC) estimated the stability of response time for switch and non-switch trials. The ICCs for the 30-item test were 0.60 (switch) and 0.61 (non-switch). The 40-item test yielded ICCs of 0.89 (switch) and 0.72 (non-switch). The 60-item test yielded ICCs of 0.85 (switch) and 0.75 (non-switch).

**CONCLUSION:** The auditory dual-task methodology shows acceptable reliability for both the 40 and 60 item tests. As part of a comprehensive concussion management plan, the dual task methodology may prove to be especially useful for making return-to-play decisions as it closely mimics physical activity and on-field performance by combining controlled motor movements and complex mental task performance.

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**1719** Board #127 MAY 30 3:30 PM - 5:00 PM  
**Baseline Concussion Scores are Influenced by Measured Levels of Effort**

Julianne D. Schmidt, Katrina J. Trinidad, Kevin M. Guskiewicz, FACSM. *The University of North Carolina at Chapel Hill, Chapel Hill, NC.*  
(No relationships reported)

Athletes are inherently less motivated when completing preseason concussion baseline testing than during post-concussion evaluations. When comparing back to baseline values during post-concussion evaluations, improved effort may mask deficits.

**PURPOSE:** To determine if baseline neurocognitive and postural control performance differ between athletes who demonstrate poor effort (PE) and those who demonstrate satisfactory effort (SE).

**METHODS:** 165 incoming student-athletes completed baseline testing including a computerized neurocognitive test (CNS Vital Signs), a postural control exam (SOT; Sensory Organization Test), and a measure of test-taking effort (DCT; Rey Dot Counting Test). PE was defined as a DCT combination score  $\geq 15$  and SE was defined as a DCT combination score  $< 15$ . We first identified 27 athletes (16%) that demonstrated PE at baseline. Each athlete in the PE group was matched based on gender, concussion history, learning disability diagnosis, and ADHD diagnosis to a single control who demonstrated SE at baseline (PE: n=27, SE: n=27). Separate one-way ANOVA models were used to compare the SE and PE groups on 8 CNS Vital Signs standard scores (composite memory, psychomotor speed, reaction time, complex attention, cognitive flexibility, processing speed, executive functioning, and reasoning) and a postural control score (SOT composite score) with an a priori alpha level of 0.05.

**RESULTS:** The PE group performed significantly worse than the SE group on composite memory (PE:89.6 $\pm$ 17.4 vs. SE:99.8 $\pm$ 14.6,  $F_{1,50}=5.3$ ,  $p=0.03$ ), psychomotor speed (PE:100.2 $\pm$ 11.3 vs. SE:106.1 $\pm$ 9.4,  $F_{1,52}=4.4$ ,  $p=0.04$ ), reaction time (PE:93.5 $\pm$ 18.6 vs. SE:102.2 $\pm$ 9.6,  $F_{1,52}=4.6$ ,  $p=0.04$ ), cognitive flexibility (PE:81.9 $\pm$ 26.9 vs. SE:95.4 $\pm$ 21.8,  $F_{1,52}=4.1$ ,  $p=0.05$ ), and processing speed (PE:88.6 $\pm$ 22.7 vs. SE:101.5 $\pm$ 14.5,  $F_{1,50}=6.2$ ,  $p=0.03$ ). No other significant differences were observed.

**CONCLUSION:** Athletes who demonstrated PE at baseline performed significantly worse on several neurocognitive domains. This supports the notion that baseline neurocognitive scores are only as good as the effort that an athlete extends. Sports medicine professionals administering baseline testing may consider incorporating this brief measure of effort at baseline and post-concussion to determine an appropriate evaluation plan.

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**1720** Board #128 MAY 30 3:30 PM - 5:00 PM  
**Normal Cognitive Function Following Self-reported "Dings" In A Cohort Of Collegiate Rugby Players.**

Tamerah N. Hunt, Donald LeMay. *The Ohio State University, Columbus, OH.* (Sponsor: Thomas Best, FACSM)  
(No relationships reported)

Previous concussion guidelines have suggested that adult athletes with mild concussions (dings) may be returned to play if asymptomatic for 15 minutes. The incidence of "dings" in rugby can be high and consequences of reporting may lead to stoppage of play. Athletes that continue to play while suffering from the physiological effects of concussion may increase their risk for further and potentially catastrophic injury.

**PURPOSE:** This study examined if self-reported "dings" result in decreases in cognitive function as measured by ImPACT.

**METHODS:** This study was a prospective cohort design. Collegiate rugby football athletes were observed on-field throughout their fall competitive season. Fourteen collegiate rugby players (age 21.5 + 1.34 years) participated in the study. All athletes completed ImPACT to establish a baseline prior to the competitive season. After the completion of their competitive season, all participants were re-tested utilizing ImPACT. Athletes were grouped by self-reported dings that continued to participate and those without dings "normals". Post-season ImPACT composite scores served as dependent variables.

**RESULTS:** Four athletes sustained a ding during the season (28.5%). No significant differences were observed on ImPACT composite scores between those with self-reported dings and "normals". Means + SD (CI) for Impulse control in "normals" 4.6 + 4.9 (CI 1.0-8.2) and dings 9.5 + 1.7 (CI 6.7-12.3) ( $F(1, 12) = 3.5$ ,  $p > .05$ ,  $\eta^2 = 0.23$ ). Verbal memory in "normals": 90.0 + 8.8 (87.7- 96.3) and dings 79.0 + 12.8 (58.6 -99.4) ( $F(1, 12) = 3.5$ ,  $p > .05$ ,  $\eta^2 = 0.27$ ); Visual motor in "normals" 41.9 + 6.2 (CI 37.4-46.4) and dings 45.7 + 7.9 (CI 32.9-58.3) ( $F(1, 12) = 0.89$ ,  $p > .05$ ,  $\eta^2 = 0.07$ ). The correlation between time in contact and self-reported dings (0.324) was not significant.

**CONCLUSIONS:** These findings suggest that deficits were not observed following one competitive season of rugby regardless of self-reported dings. A higher mean and confidence interval for impulse control existed which may indicate a long-term effect on impulse control following dings. These findings support the need for additional research to examine long-term effects of deficits following multiple low threshold impacts in rugby players.

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**1721** Board #129 MAY 30 3:30 PM - 5:00 PM  
**A Qualitative Exploration Of Concussion-related Medical Care Seeking Behavior Among Male Collegiate Ice Hockey Players**

Emily Kroshus<sup>1</sup>, Eric Kroshus<sup>2</sup>. <sup>1</sup>Harvard School of Public Health, Boston, MA. <sup>2</sup>Harvard University, Cambridge, MA.  
(No relationships reported)

**OBJECTIVE:** The objective of this study was to explore the subjective and contextualized experience of concussion recovery among male collegiate ice hockey players who sustained a concussion while participating in their sport, with particular attention paid to how their own subjectivity influenced their medical care seeking behaviors.

**METHODS:** A phenomenological qualitative approach was used, guided by the paradigm of social constructivism. Eleven semi-structured individual qualitative interviews were conducted with male collegiate ice hockey players who sustained concussions during their collegiate ice hockey career. Transcripts were coded in two cycles and were reviewed by an independent coder, achieving a minimum inter-coder agreement of 85%.

**RESULTS:** Three key themes emerged from the data: initial on ice self-assessment, player initiated medical care, and honesty of symptom reporting once care had been initiated. Initial on ice self-assessment often included a discounting of initial symptom severity, attributed one of three factors: a lack of knowledge about concussion symptoms, a comparison of symptoms to previous hits that were not diagnosed as concussions, and to a "tough it out" mentality characteristic of ice hockey players. After some duration of time, from minutes to days, these players recognized that symptoms were not going away and chose to initiate medical care by presenting themselves to either the team trainer or team physician. Despite the often self-initiated nature of this medical care, once initiated it became for many of the athletes a push to return to the ice as quickly as possible. Many of the athletes recognized the subjective nature of symptom reporting and the strong influence that their self-report had on their return to play. Some chose to distort their self-report to speed up the return to play process.

**CONCLUSIONS:** The assessment and treatment of concussions among male collegiate ice hockey players may be complicated by the patient's subjective role in both medical care seeking and symptom reporting once care has been initiated.

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**1722** Board #130 MAY 30 3:30 PM - 5:00 PM  
**Effect of Sport Related Concussion on Clinically Measured Reaction Time**

James T. Eckner, Jeffrey S. Kutcher, Steven P. Broglio, James K. Richardson. *University of Michigan, Ann Arbor, MI.*  
(No relationships reported)

Reaction time is a sensitive marker of concussion (mild traumatic brain injury). Until recently its measurement required specialized computer software which limited its availability to the clinician. To address this, we developed a simple, inexpensive clinical measure of reaction time (RTclin) that has been shown to be valid and reliable in athletes over multiple time periods. Preliminary results suggest that RTclin is sensitive to the known prolongation of reaction time following sport related concussion. However, these results were uncontrolled and included only 9 concussed athletes.

**PURPOSE:** To determine the effect of sport related concussion on RTclin in high school and collegiate athletes in a larger controlled study.

**METHODS:** Baseline RTclin was measured during pre-participation physical examinations in high school and collegiate athletes. RTclin is the average time over 8 trials required to catch a

suspended vertical shaft by hand closure after its release at random intervals by the examiner. Twenty-five athletes who subsequently sustained a concussion during the athletic season and 25 matched control athletes repeated RTclin testing within 48 hours of injury. Control athletes were members of the same team as the concussed athlete who presented to the training room for a non-concussive injury. A 2-way ANOVA with repeated measures was used to compare preseason and after-injury RTclin values in concussed versus control athletes.

**RESULTS:** Concussed and control athletes demonstrated similar baseline RTclin values during the preseason ( $202 \pm 23$  ms and  $203 \pm 17$  ms, respectively.  $P = 0.839$ ). After-injury RTclin values were significantly longer in the 25 concussed athletes as compared to their own baseline values ( $222 \pm 29$  ms;  $p = .001$ ), while there was a trend toward shorter RTclin values in the 25 control athletes ( $193 \pm 16$  ms,  $p = .054$ ).

**CONCLUSIONS:** RTclin is prolonged within 48 hours of injury in concussed athletes, both with respect to their own baseline RTclin results as well as to repeat RTclin results in uninjured control athletes. This study supports the application of RTclin as part of a multifaceted sport concussion assessment battery, particularly in venues where high technology concussion testing cannot be utilized due to cost or access.

**1723** Board #131 MAY 30 3:30 PM - 5:00 PM

**Knowledge Transfer and Exchange About Sport-related Concussion: A Survey of Family Physicians in Alberta, Canada**

Constance M. Lebrun, FACSM<sup>1</sup>, Martin Mrazik<sup>2</sup>, Abhaya Prasad<sup>2</sup>, Verle D. Valentine<sup>3</sup>. <sup>1</sup>Glen Sather Sports Medicine Clinic, University of Alberta, Edmonton, AB, Canada. <sup>2</sup>University of Alberta, Edmonton, AB, Canada. <sup>3</sup>Sanford USD Medical Center, Sioux Falls, SD.

(No relationships reported)

Ever-increasing involvement of individuals in athletic endeavors has resulted in sport-related concussion receiving major attention over the last decade. Concussion is frequently seen in recreational and competitive sports, and is a major public health concern worldwide. There have been considerable changes to the diagnosis, classification and management of concussion in recent years, causing confusion due to a lag in knowledge translation to the end users.

**PURPOSE:** This study sought to identify current knowledge, practice patterns, and optimal forums for fostering knowledge translation among family physicians in Alberta, Canada.

**METHODS:** Family physicians were mailed letters of recruitment through the Alberta Family Practice Research Network (AFPRN), and asked to reply with their willingness to participate in the on-line survey. Seventy-eight of 3154 family physicians responded (2.5% response rate).

**RESULTS:** While 96% of these physicians reported diagnosing and treating concussions in their work settings, only 54% consistently utilized current concussion guidelines. Sport-related activities constituted the majority (71%) of concussions seen. Physicians relied primarily on clinical examination (32%), and player self-report of symptoms (32%) to make return-to-play decisions. Only 2% reported using any form of neurocognitive testing, and (surprisingly) 5% were still using concussion grading scales. Physical rest was recommended as treatment by 96%, but only 71% also suggested cognitive rest. Seventy-one percent (71%) of physicians had taken continuing medical education (CME) credits to learn more about concussion. Physicians rated CME courses (14%), conferences (12%), training in medical school or residency (18%), consultation with colleagues (15%) or specialists (10%), and websites (14%) as their best sources of information regarding concussion. However, they rated CME courses and on-line courses with CME credits (total 46%) as their most preferred method to gain further knowledge.

**CONCLUSION:** Significant gaps still exist in knowledge transfer to family physicians about up-to-date practices for clinical diagnosis and treatment of sport-related concussion. More educational efforts and training opportunities are needed to optimize physician management of this common condition.

**1724** Board #132 MAY 30 3:30 PM - 5:00 PM

**No Evidence of Neuropsychological Performance Deficits in a Group of Male Collegiate Soccer Players from Purposeful Heading**

Thomas W. Kaminski, FACSM, Jenifer Halterman, Charles B. Swanik, Joseph J. Glutting. University of Delaware, Newark, DE.

(No relationships reported)

Purposeful heading is an inherent and strategic part of soccer, and has the potential to result in concussion if performed incorrectly. Some have questioned whether or not each episode of heading results in minor insults to the brain and if there are cumulative effects resulting in impaired neurocognitive functioning.

**PURPOSE:** This study examined the relationship between heading exposure, playing position, and neuropsychological test scores.

**METHODS:** The database consisted of collegiate male soccer athletes who completed yearly pre and post-participation ImPACT neuropsychological tests; however only 16 players had data from three consecutive playing seasons. The number and type of header were tracked for each player at both practices and games. Bivariate correlation coefficients were calculated between the three predictors: total practice (toheadpx), game (toheadg) and combined headers (tohead). The criteria included the six ImPACT composite scores. Additionally, differences between playing positions (midfield/offense vs. defenders) were examined using independent samples *t*-tests.

**RESULTS:** The total headers ranged from 160 to 422. Correlations table:

| Criteria     | Predictors |         |        |
|--------------|------------|---------|--------|
|              | Toheadpx   | Toheadg | Tohead |
| verbmam      | .083       | .301    | .267   |
| vismam       | .280       | -.023   | .083   |
| vismotpspeed | -.291      | .093    | -.032  |
| rxntime      | .030       | -.176   | -.128  |
| impulsecont  | -.189      | -.224   | -.245  |
| totalsxscore | .168       | .122    | -.036  |

None of the correlation coefficients were statistically significant; nor were there significant differences between any of the ImPACT scores and the position groups.

**CONCLUSIONS:** Despite many anecdotal reports suggesting links between purposeful heading and deficits in brain function, this study indicates that no relationship exists between the number of headers and neuropsychological test performance in male collegiate soccer players. Despite some player positions accumulating more total headers, there were no differences in ImPACT scores between groups.

**1725** Board #133 MAY 30 3:30 PM - 5:00 PM

**Sport Concussion Knowledge, Clinical Practices, and Needs for Continuing Education: A Survey of Family Physicians**

B. Joel Tjarks<sup>1</sup>, Verle D. Valentine<sup>2</sup>, Constance M. Lebrun, FACSM<sup>3</sup>, Jason C. Dorman<sup>2</sup>, Martin Mrazik<sup>3</sup>, Abhaya S. Prasad<sup>3</sup>, Thayne A. Munce<sup>2</sup>, Michael F. Bergeron, FACSM<sup>2</sup>. <sup>1</sup>University of South Dakota, Vermillion, SD. <sup>2</sup>Sanford USD Medical Center, Sioux Falls, SD. <sup>3</sup>University of Alberta, Edmonton, AB, Canada.

(No relationships reported)

Concussions are the most common form of head injury in recreational and competitive sports and have recently been identified as a major public health concern worldwide. With greater clinical and scientific appreciation of effects and recovery time, new research and discoveries, newly adopted legislation and revised management guidelines, sport-related concussion has received considerable attention recently from the media and healthcare organizations. Concomitantly, it is challenging for healthcare professionals to remain informed of the latest evidence-based concussion information.

**PURPOSE:** To identify current knowledge and practice patterns of family physicians in North Dakota and South Dakota regarding their clinical management of patients with sport-related concussion; and to examine their preferred delivery methods of knowledge transfer and exchange on this subject.

**METHODS:** A brief, internet-based survey (21 questions) was distributed to family physicians in North Dakota and South Dakota from a database provided by the American Academy of Family Physicians. One hundred nine (109) out of five hundred forty-five (545) family physicians completed the survey (20% response rate).

**RESULTS:** Only nine physicians (9.4%) said they are currently using the most up-to-date guidelines established at the 3rd International Conference on Concussion in Sport held in Zurich in

2008. Physical rest is recommended by 75% of physicians, while only 65% recommend cognitive rest. Outdated grading scales are still being used by physicians for their initial assessments (27%) and return-to-play decisions (12%). There were assorted answers regarding these physicians' current sources for learning about concussions, but the most preferable method (66.7%) was through a Continuing Medical Education (CME) course (online or otherwise). The majority of respondents (84%) indicated that they would like to receive additional education on concussions.

**CONCLUSIONS:** Myriad family physicians are managing sport-related concussions using clinical diagnoses and management practices that are inconsistent with current information and guidelines. Accordingly, a more deliberate and effective effort to re-educate and maintain knowledge in family physicians is critical to enhance patient care in this population.

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1726 Board #134 MAY 30 3:30 PM - 5:00 PM

**Concussion History and Exertional Heat Illness-Related Symptomatology Among Division-I Collegiate Athletes**

Michael L. Alosco<sup>1</sup>, Krysten Knecht<sup>1</sup>, Ellen Glickman, FACSM<sup>1</sup>, Michael F. Bergeron, FACSM<sup>2</sup>, John Gunstad<sup>1</sup>. <sup>1</sup>Kent State University, Kent, OH. <sup>2</sup>University of South Dakota, Sioux Falls, SD.

(No relationships reported)

Sports-related concussions are prevalent and increasingly recognized to be associated with a variety of adverse short- and long-term clinical outcomes. Recent findings indicate that traumatic brain injury is associated with disruption of the autonomic nervous system (ANS). However, while exertional heat illness (EHI) is also a familiar problem in many sports, the effect of concussion history on EHI risk has not been elucidated.

**PURPOSE:** This study examined the association between concussion and EHI symptomatology histories among a sample of NCAA division-I athletes.

**METHODS:** Analyses were conducted on 100 baseline assessments of NCAA division-I football, soccer, and field hockey athletes (58 males, 42 females; 19.8±1.4 years). All athletes completed baseline ImpACT™ testing and a brief questionnaire assessing history of EHI-related symptomatology.

**RESULTS:** Concussion history was common in the sample, with 28% reporting a history of at least one concussion. Chi-square statistics revealed a greater frequency of EHI symptoms in athletes with a history of concussion compared to those without such history, including getting tired faster than normal ( $\chi^2(1, N = 100) = 5.08, p = .02$ ), very fast heart rate ( $\chi^2(1, N = 100) = 6.86, p = .01$ ), muscle cramps ( $\chi^2(1, N = 100) = 5.90, p = .02$ ), and feeling light headed ( $\chi^2(1, N = 100) = 4.58, p = .03$ ). When restricting the sample to only football players, similar findings emerged, specifically for muscle cramps ( $\chi^2(1, N = 59) = 6.14, p = .01$ ), feeling like they might black out ( $\chi^2(1, N = 59) = 6.65, p = .05$ ), and fast heart rate ( $\chi^2(1, N = 59) = 4.59, p = .03$ ).

**CONCLUSIONS:** Athletes with a history of concussion may be at greater risk for EHI than those without such history and thus might warrant more deliberate EHI prevention measures and closer monitoring. Prospective studies of ANS function following concussion and concomitant effects on exertional heat strain will clarify potential changes in EHI risk.

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**B-29 Free Communication/Poster - Energy Balance**

MAY 30, 2012 1:00 PM - 6:00 PM  
ROOM: Exhibit Hall

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1727 Board #135 MAY 30 3:30 PM - 5:00 PM

**The Relation Between Bone Mineral Density And Cardiovascular Factors Among Iranian Female Athletes With Amenorrhea/oligomenorrhea**

Haleh Dadgostar<sup>1</sup>, Ghazaleh Soleimani, female<sup>2</sup>, Sara Lotfian, female<sup>3</sup>, Mazyar Moradi lakeh, male<sup>4</sup>, Elham Dadgostar, female<sup>5</sup>, Shafieh Movaseghi, female<sup>6</sup>, Talia Alenabi, female<sup>7</sup>. <sup>1</sup>Sports Medicine Research Center. Tehran University of Medical Sciences, Tehran, Iran, Islamic Republic of. <sup>2</sup>Rasoule akram hospital. Tehran University of medical sciences, Tehran, Iran, Islamic Republic of. <sup>3</sup>Sports Medicine Research Center. Tehran University of Medical Sciences, Tehran, Iran, Islamic Republic of. <sup>4</sup>Tehran University of medical sciences, Tehran, Iran, Islamic Republic of. <sup>5</sup>Sports Medicine Federation, Tehran, Iran, Islamic Republic of. <sup>6</sup>Eman Khomeini hospital. Tehran University of medical sciences, Tehran, Iran, Islamic Republic of. <sup>7</sup>Sports medicine Federation, Tehran, Iran, Islamic Republic of.

(No relationships reported)

**PURPOSE:** Oligo/amenorrhea, as a part of the Female Athletic Triad has adverse effects on the athlete's bone mineral density and cardiovascular system. Hypoestrogenism, due to suppression of PHO axis as a result of energy imbalance, is the possible cause of the Triad. This study was designed to clarify the effects of hormone therapy on bone mineral density and cardiovascular factors.

**METHODS:** The study is a 9-month clinical trial in the first part of which 22 female athletes with a history of at least 2 years of oligo/amenorrhea, bone mineral densitometry (BMD) and some of the cardiovascular factors were measured. In the second part of the study 18 athletes were randomized in two groups of OCP (n=10) and control (n=8). After 9 months densitometry and cardiovascular lab study were repeated.

**RESULTS:** In the first assessment, Mean of all cardiovascular factors was in the normal range except for HDL, however, most of the athletes had abnormalities in their lipid profile. Inverse relationship between the increase in the BMD of spine and total cholesterol, Apo A, and VLDL and also positive correlation between BMD of spine and HbA1C were significant. In the second part, VLDL and Apo B reduced significantly in the OCP group. Increase of Apo A was observed in control group. Changes in the ratio of Apo B to Apo A was significant in both groups.

**CONCLUSIONS:** There may be a common factor affecting both skeletal and cardiovascular systems, as with the increase of the BMD of spine, there is a decrease in the amount of serum total cholesterol, Apo A, and VLDL. Results of this study imply that although estrogen administration may not increase bone density, it could have positive effects cardiovascular system, especially lipid profile. In order to evaluate the long-term effect of estrogen administration in athletes suffering from menstrual irregularities, studies with larger sample size and longer duration is required.

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1728 Board #136 MAY 30 3:30 PM - 5:00 PM

**Need For A Tool: Handling Professional Soccer Players Biochemical Data**

Giulio Tempesti<sup>1</sup>, Alice Bartolini<sup>1</sup>, Niccolò Gori<sup>1</sup>, Giovanni Romagnoli<sup>2</sup>, Paola Pezzati<sup>3</sup>, Laura Stefani<sup>1</sup>, Giorgio Galanti<sup>1</sup>. <sup>1</sup>Sports Medicine, Florence, Italy. <sup>2</sup>Engineering Informatic Faculty, Florence, Italy. <sup>3</sup>General Laboratory Diagnostic Department, Florence, Italy.

(No relationships reported)

**PURPOSE:** According to Italian regulation, professional athletes undergo to a periodical biochemical parameters evaluation addressed to maintain health. A software toolkit analyzes biochemical parameters focused on monitoring of Least Significant Change (LSC) for hematological variables. **Method:** Since January 2008 to July 2011, 81 professional soccer players blood samples were collected. According to quality standard reference Clinical Laboratory, a dedicated software ("Victory") allows the user retrieving LSC in the team's athletes. LSC =  $2.77(CV_i^2 + CV_a^2)^{1/2}$  equation, including every athlete's data, derived from soccer seasonal training period. The software identifies hematological values exceeded the LSC values.

**RESULTS:** Standard hematological mean team values (2009/2010), examined considering ethnicity, age and role, were within the normal range (Hb  $15.2 \pm 0.6g/dL$ , min 13.9, max 16.6; HcT  $43.0 \pm 1.9\%$ , min 41.0, max 49.0; MCV  $87.3 \pm 3.0fL$ , min 82.0, max 93.5; reticulocytes  $0.0433 \pm 0.0128 \times 10^{12}/L$ , min 0.0186, max 0.0732). In parallel the LSC for Hb (5.80%), HT (8.20%) and MCV (2.41%) and reticulocytes count (17.96%) resulted to be normal, with the exclusion of soccer players data that exceed LSC value in consequence of the training period at the same work load. In the 6.2% of the all samples investigated for each athlete, the hematological variation was over the LSC.

**CONCLUSION:** The software retrieves epidemiological information based on the physiological changes of the hematological parameters occurring during the seasonal competitions. It can therefore be propose to clarify several clinical questions related to regular training or to risk factors particularly if in presence of different work load or recurrent injuries.



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1729 Board #137 MAY 30 3:30 PM - 5:00 PM

**A Long Term Sport Activity and Myocardial Performance In Breast Cancer Women**

Laura Stefani, Gabriele Innocenti, Valentina Di Tante, Ilaria Corsani, Gabriele Mascherini, Irene Scacciati, Alessio De Luca, Giorgio Galanti. *Sports Medicine, Florence, Italy.*  
(No relationships reported)

**PURPOSE:** The beneficial effects of the exercise as prescription in cancer is well known, however few information are now available on the cardiovascular performance when competitive sport is regularly practiced. The study was aimed to evaluate in a group of breast cancer women (BCW), the effects of dragon boat sport on the myocardial performance during a 4 years follow up study.

**METHODS:** Since 2006 to 2010, one year after breast cancer treatment, a group of 30 regularly trained (Dragon-Boat) women, without metastasis, has been followed at Sports Medicine Center in Florence -Italy. They were yearly submitted to a maximal cardio-pulmonary test and to a 2D echocardiographic exam evaluating morphological and functional cardiac parameters in addition to Heart Rate (HR) and Blood Pressure (BP) values, measured at rest and at the end of the effort. All data were compared (T-Student Test) to a group of competitive healthy women (HW).

**RESULTS:** At the end of the 4 follow-up years all the echo parameters were within the normal range in both groups. (Fig1) Despite CMI and BMI were significantly higher in HW than in BCW, the EF resulted to be similar. After 4 years of training in BC group the HR at rest was lower ( $78.12 \pm 13$ ) than at the beginning ( $80.7 \pm 11.7$ ) of the study. Systolic and Diastolic BP were comparable to the healthy athletes normal values.

**CONCLUSIONS:** The results obtained are suggestive for a beneficial effect of sports activity in breast cancer with an excellent exercise tolerance. A long term competitive sport activity does not seem to have any negative impact on the myocardial performance in them.

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1730 Board #138 MAY 30 3:30 PM - 5:00 PM

**Cardiovascular Performance And Prevalence Of Menstrual Disorders**

Silvia Lorini<sup>1</sup>, Laura Stefani<sup>1</sup>, Loira Toncelli<sup>1</sup>, Maria Concetta Robertina Vono<sup>1</sup>, Metella Dei<sup>2</sup>, Giorgio Galanti<sup>1</sup>. <sup>1</sup>*Sports Medicine, Florence, Italy.* <sup>2</sup>*Child and Women Health Department, Florence, Italy.*  
(No relationships reported)

**PURPOSE:** The incidence of amenorrhea is much greater observed among the athletes than in sedentary, however the implication of this feature with the cardiovascular performance remain less clear. The study is aimed to investigate this aspect in a larger group of athletes from sports at different static and dynamic component.

**METHODS:** Two groups of athletes 1Group (1G of 50 subjects) aged  $16 \pm 2$ , from swimming and dance at high dynamic and low static load and 2Group (2G of 50 subjects) from volleyball and gymnastic artistic at moderate/high dynamic and static load, were submitted to a questionnaire to evaluate the prevalence of menstrual disorders and also to an echocardiographic exam to verify the associated morphological and functional pattern.

**RESULTS:** the menstrual disorders result to be generally low (13%) with an exclusive presence in the 2G. All the echo parameter are within the normal range in both without any significant variation with the exclusion of the Cardiac Mass Index (CMI) value that results to be significantly lower in the 2G respect of the 1G (Fig1). Otherwise the nutrition parameters show a significant increase of the Fat Free Mass (FFM) in the 1G vs the 2G. An inverse behavior (Fig2) has been observed for the Fatty Mass (FM)

**CONCLUSIONS:** The results support the hypothesis that the prevalence of the irregular menstrual cycle are independent from the nutritional parameters in sports at high-moderate dynamic component. An opposite trend is evident for the CMI that seems to be associated to a superior and more equilibrate body composition.

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1731 Board #139 MAY 30 3:30 PM - 5:00 PM

**Ferritin, Hematocrit, And Hemoglobin As Biochemical Markers Of Iron Deficiency In Collegiate Runners**

Lindsey E. Eberman<sup>1</sup>, Leamoh Kahanov<sup>1</sup>, Nicholas Long<sup>1</sup>, Heather Adams<sup>1</sup>, Michelle L. Landis<sup>1</sup>, Janis Ingebretsen<sup>2</sup>. <sup>1</sup>*Indiana State University, Terre Haute, IN.* <sup>2</sup>*Union Hospital, Terre Haute, IN.*  
(No relationships reported)

Research suggests that endurance athletes experience lower than normal hematology levels during season, thought to be the result of overtraining. Serum ferritin has been identified as a biochemical indicator of iron deficiency and may also be a result of overtraining.

**PURPOSE:** We sought to observe serum ferritin, hemoglobin, and hematocrit levels of collegiate runners.

**METHODS:** As part of the pre-participation physical exam in an NCAA Division I Institution in the mid-western US, male ( $n=23$ ; age= $20 \pm 1$ ; height= $69.7 \pm 2.5$ in; weight= $147.4 \pm 16.3$ lb; in-season mileage= $60.2 \pm 19.6$ wk; off-season mileage= $75.4 \pm 13.0$ wk) and female ( $n=19$ ; age= $20 \pm 1$ ; height= $64.2 \pm 2.7$ in; weight= $126.0 \pm 14.5$ lb; in-season mileage= $40.1 \pm 7.9$ wk; off-season mileage= $39.3 \pm 5.9$ wk) cross country and track athletes underwent blood-draw and physical history examinations. Following the examinations, we acquired access to the anonymous data for further analysis. We collected age, height, weight, gender, ferritin, hematocrit, and hemoglobin levels from all participating athletes.

**RESULTS:** Overall, the collegiate runners demonstrated within normal limits ferritin (males= $63.4 \pm 29.38$ ng/mL, normal range= $30-400$ ng/mL; females= $44.1 \pm 50.8$ ng/mL, normal range= $13-150$ ng/mL), hematocrit (males= $41.7 \pm 2.2\%$ , low range= $<45\%$ ; females= $38.9 \pm 2.2\%$ , low range= $<40\%$ ), and hemoglobin levels (males= $14.6 \pm 0.8$ g/dL, normal range= $13.8-18.0$ g/dL; females= $13.7 \pm 0.7$ g/dL, normal range= $12.1-15.1$ g/dL). However, when determining athletes with low levels, we found differences in at-risk athletes based on the criteria. We identified lower than normal ferritin levels in 2 males and 1 female. We identified 22 males and 12 females with insufficient levels of hematocrit. Hemoglobin was lower than normal in 6 males.

**CONCLUSIONS:** The collected hematology levels may be an indication of over-training; however, such levels are expected of the body's response to stress and return to normal levels during periods of rest/off-season. The research suggests that observing ferritin levels alone may not be sufficient to determine iron deficiency. Hematocrit level is a more sensitive indicator of iron deficiency when triangulated with ferritin and training regime.

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1732 Board #140 MAY 30 3:30 PM - 5:00 PM

**Diet Versus Diet Plus Exercise On Weight And Depression In The Severely Obese**

Amy D. Rickman, Bret H. Goodpaster, John M. Jakicic, FACSM, The RENEW Study Research Group. *University of Pittsburgh, Pittsburgh, PA.*  
(No relationships reported)

Severe obesity (BMI  $\geq 35$  kg/m<sup>2</sup>) is associated with increased risk for depression compared to those at a lower BMI. Depressive symptomatology has been shown to improve with both weight loss and exercise. However, it is unclear if weight loss induced by dietary restriction compared to dietary restriction plus exercise have differential effects on depressive symptoms in individuals with severe obesity.

**PURPOSE:** To examine the effect of diet with delayed exercise (D) versus diet plus exercise (DE) on depressive symptoms and weight in individuals classified with Class II (BMI: 35.0-39.9 kg/m<sup>2</sup>) or III (BMI:  $\geq 40$  kg/m<sup>2</sup>) obesity.

**METHODS:** 118 obese individuals (age= $46.2 \pm 6.3$  years; BMI= $43.5 \pm 5.4$  kg/m<sup>2</sup>) were randomized to a D or DE intervention. Both D and DE received a reduced calorie diet (1200-2000 kcal/wk) through a behavioral modification program. DE was also prescribed exercise that progressively increased to 300 min/wk by month 6. Weight and the Beck Depression Inventory (BDI) were measured at baseline and 6 months.

**RESULTS:** Weight loss was significantly different between D ( $8.1 \pm 5.9$  kg) and DE ( $11.0 \pm 7.3$  kg) ( $p < 0.05$ ). Both D and DE significantly decreased BDI score with no difference between groups. Subjects were grouped as having lower (BDI  $\leq 13$ , N=89) and higher baseline BDI scores ( $>13$ , N=29). There was no significant difference in weight loss or improvement in BDI score between D and DE for those a lower baseline BDI. However, weight loss was significantly different in D ( $6.5 \pm 6.3$  kg) vs. DE ( $12.3 \pm 8.6$  kg) for those with a higher baseline BDI, but no difference for improvement in BDI.

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**CONCLUSIONS:** Results suggest severely obese adults lose significantly more weight with DE compared to D; however, both result in similar improvements in depressive symptoms. DE and D were equally effective for weight loss in individuals with less depressive symptoms. Of importance is that for those with more severe depressive symptoms, DE was more effective for weight loss than D, suggesting the clinical implication of prescribing DE for weight loss in these individuals. Strategies to maximize adherence to both diet and exercise are recommended.

Supported by the Pennsylvania State Department of Health

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**1733** Board #141 MAY 30 3:30 PM - 5:00 PM

**Web-Based Questionnaire to Identify Low Energy Availability in Endurance Trained Women: A Cluster Analysis.**

Maria Bentley<sup>1</sup>, Nick Garrett<sup>1</sup>, Mary Jane De Souza, FACSM<sup>2</sup>, Andrew Kilding<sup>1</sup>. <sup>1</sup>AUT University, Auckland, New Zealand. <sup>2</sup>The Pennsylvania State University, University Park, PA.

(No relationships reported)

**PURPOSE:** Low energy availability (EA) in endurance-trained women may develop by intentional or unintentional means in the presence of diverse eating attitudes and behaviours. This study investigated the ability of an on-line web-based survey to identify the clustering and prevalence of at-risk factors for low EA in endurance-trained.

**METHODS:** Women registered for endurance running events in New Zealand completed an anonymous web-based questionnaire comprising questions pertaining to eating attitudes and behaviours, medical, menstrual and injury history. Descriptive information (e.g. self reported age, height, body weight and training load) was also sought.

**RESULTS:** Sufficient data was completed by 698 respondents (29.6±7.1y). Cluster analysis encompassing at-risk factors for low EA identified three distinct subgroups. One cluster classified 57.6% of the sample 'not-at-risk' for low EA as defined by normal Eating Disorders Inventory drive for thinness (DFT, 1.5±2.0), Three Factor Eating dietary restraint (TFE-R, 5.0±3.0) and Eating Disorder Examination restraint (EDE-R, 0.6±0.8) scores. Elevated DFT (7.0±3.9) and TFE-R scores (13.3±2.5) classified 29.8% of respondents in a second cluster 'at-risk' for low EA. High DFT (18.1±2.7), TFE-R (15.3±3.0) and EDE-R (3.3±1.2) scores classified 13.3% of respondents in a third cluster 'at-high-risk' for low EA. The frequency of answering yes to "do you think you may have an eating disorder?" and weight loss attempts for sport and social reasons was also high (36.4%, 31.8% and 46.6% respectively) in this cluster. A high number of respondents (38.8%, 45.7% and 69.3% in clusters 1, 2 and 3 respectively) did not attempt to increase energy intake when exercise energy expenditure was increased.

**CONCLUSION:** A web-based questionnaire identified diverse subgroups of eating attitudes and behaviours and a high prevalence of at-risk factors for low EA in a large sample of endurance-trained women. Online tools that consider the complexity of eating attitudes and behaviours and other currently established at-risk factors (e.g. BMI, menstrual irregularity) may be useful for wide-spread screening for low EA in endurance-trained women.

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**1734** Board #142 MAY 30 3:30 PM - 5:00 PM

**Supplement, Prescribed And OTC Medication Use Among Participants In A High-altitude Ultra-endurance Mountain Bike Race**

Morteza Khodaei, Matthew Leiszler, John C. Hill, FACSM. University of Colorado Denver, Denver, CO.

(No relationships reported)

The Leadville100 Mountain Bike Race is an ultra-endurance high altitude race in Colorado. The course ranges in altitude from 2804m to 3840m.

**PURPOSE:** To determine the frequency of supplement, prescribed and OTC medication use during the race and whether their usage is associated with successfully finishing this ultra-endurance race.

**METHODS:** All participants were asked to complete an electronic medical questionnaire and also an electronic survey. Information regarding cyclists' age, gender, and race time is also available to the public on-line.

**RESULTS:** Out of 1604 competitors who started the race, 1140 (71.1%) completed the medical questionnaire and the survey online. Average age was 41.9 (range 18-78) years. Most participants (87.2%) were male. The majority (n=1168, 72.8%) finished the race under the cut-off time of 12 hours. Only 106 (9.3%) of responders reported having an ongoing medical condition and 190 (16.7%) were taking prescribed medications. Respiratory/allergy medications were the most commonly used medications (28.4%), followed by thyroid (24.2%), and cardiac (22.6%) medications. Regular use of supplement and OTC medication was not very common (n=176, 15.4%) among respondents. Vitamins were the most commonly used supplements/OTC medications (38.6%), followed by NSAIDs (28.4%), respiratory/allergy (15.9%), and other sports supplements (15.3%). More than a quarter (n=317; 27.8%) of the respondents was planning to take supplements/medications during the race. Interestingly, 240 cyclists (21.1% of respondents) were planning to take NSAIDs during the race. Only 7 cyclists (0.6%) planned to take Acetazolamide for preventing altitude sickness. Participants who reported having ongoing medical conditions, taking prescribed medications, or OTC medications were less likely to complete the race ( $p < 0.005$ ,  $p < 0.005$ , and  $p < 0.001$  respectively). Interestingly, cyclists who planned to take supplements/medications during the race were also less likely to complete the race ( $p < 0.001$ ).

**CONCLUSION:** In this high altitude event, significant numbers of participants still plan to take NSAID's despite discouragement by race medical team. Cyclists who reported having ongoing medical conditions or the ones who took prescribed/OTC medications were less likely to successfully complete the race.

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**1735** Board #143 MAY 30 3:30 PM - 5:00 PM

**Age and Gender Differences Pertaining to Modes of Locomotion in Triathlons**

Jada L. Stevenson<sup>1</sup>, Huaxin Song<sup>2</sup>, Jamie A. Cooper<sup>1</sup>. <sup>1</sup>Texas Tech University, Lubbock, TX. <sup>2</sup>Texas Tech University Medical Science Center, Lubbock, TX.

(No relationships reported)

The magnitude of change in gender differences across age groups in triathlon performance for the Ironman distance has been established. However, the influence of age on gender differences at shorter distance triathlons is yet to be determined.

**PURPOSE:** The purpose of this study was to compare gender differences across age groups for the different modes of locomotion among varying triathlon distances (Sprint, Olympic, and Ironman 70.3) in amateur triathletes from the 2008-2010 World Championship triathlons.

**METHODS:** Data for the top ten male and female amateur triathletes for the age groups between 18-64 yrs was collected from the 2008, 2009, and 2010 World Championships for the Sprint distance triathlon, Olympic distance triathlon, and the Ironman 70.3 or "half Ironman" triathlon. Gender differences across age groups were compared using time performances for different methods of locomotion (swimming, cycling, and running), overall race time, and estimated power output.

**RESULTS:** Total time difference between genders were largest in the age groups 18-24 and 50-64 for Sprint distance, 18-24 and 60-64 for Olympic distance, and 18-24 and 55-64 for Ironman 70.3 distance. In comparing the modes of locomotion, mean gender difference in performance time was smallest for cycling in the Sprint distance (12.4±0.71%,  $p < 0.05$ ) and in the Ironman 70.3 distance (10.5±0.9%,  $p < 0.05$ ), whereas running showed the smallest gender difference in the Olympic distance (7.5±0.64%,  $p < 0.05$ ). Mean gender differences in estimated power output were significantly greater for swimming versus cycling and running in the Sprint distance (44.6±3.14%, 36.4±2.21%, 33.1±0.70%,  $p < 0.05$ ), Olympic distance (39.8±2.43%, 33.6±0.97%, 26.9±0.51%,  $p < 0.05$ ), and Ironman 70.3 distance (40.4±3.04%, 32.8±1.96%, 33.1±0.88%,  $p < 0.05$ ), respectively.

**CONCLUSION:** The magnitude of change for total performance time between genders was greatest in the youngest age groups and older age groups for Sprint, Olympic and Ironman 70.3 distances. Gender differences varied among the modes of locomotion for the three distances of triathlons; however, for short to mid distance triathlons both performance time and estimated power output seem to indicate that the largest gender differences exist for swimming.

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**1736** Board #144 MAY 30 3:30 PM - 5:00 PM

**Influence Of Self-reporting Ongoing Medical Conditions On Successfully Completing A High-altitude Ultra-marathon Race**

John Spittler, Morteza Khodaei, John Hill, FACSM. University of Colorado, Denver, CO.

(No relationships reported)

The Leadville 100 is a high altitude ultra-marathon in Colorado. The course ranges in altitude from 2804m to 3840m.

**PURPOSE:** To determine whether having an ongoing medical condition has any influence on successfully finishing this ultra-marathon and to determine the frequency of NSAID use during the race.

**METHODS:** All participants completed either electronic or paper surveys before the race. Information regarding runners' age, gender, and race time is also available to the public online.

**RESULTS:** Out of 625 competitors who started the race, 616 (98.6%) completed the medical questionnaire and the survey. Average age was 40.9 (range 17-85) years. Most participants (84%) were male. More than half (n = 346, 55.4%) finished the race under the cut-off time of 30 hours. Only 53 (8.6%) runners reported having an ongoing medical condition and 46 (7.4%) were taking prescribed medications. Less than one third of the runners (28.2%) reported wearing OTC or custom-fit orthotics. Interestingly, 169 runners (27.61%) were planning to take NSAIDs during the race. There was no statistical correlation (p > 0.05) between successfully finishing the race and whether or not the runners reported having ongoing medical conditions, taking prescribed/OTC medications, and wearing orthotics.

**CONCLUSION:** It seems that having an ongoing medical condition, taking prescribed/OTC medications, or wearing orthotics have no significant influence on successfully completing this high-altitude ultra-marathon. Significant numbers of participants still planned to take NSAIDs despite discouragement by race medical team.

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**1737 Board #145 MAY 30 3:30 PM - 5:00 PM**  
**Changes In Serum Sodium Before And After A 10 Kilometer Race**

Mark Troxler, FACSM. *USA Track & Field, Allen, TX.*

(No relationships reported)

**PURPOSE:** To demonstrate that a clinically significant change in serum sodium occurs before and after a 10 Kilometer race.

**METHODS:** A randomized controlled trial with each subject acting as their own control. 35 randomized volunteer participants of a 10K run. Two hours before the race each study athlete was taken for a post-urine/bowel void weight measurement and 5cc of blood was drawn. After the race each athlete reported how many 8oz cups of water they drank and 5cc of additional blood was drawn as well as each athlete was weighed. The change in the serum sodium was the primary outcome and the body weight change and fluid consumption was the secondary outcomes. Change in serum sodium versus change in body weight and fluid consumption was analyzed.

**RESULTS:** 55 run participants volunteered for the study. After randomization 35 randomized volunteer participants of the 10K run entered the study. 24 were male and 11 were female. Of the 35 runners, zero had a serum sodium level above 145mmol/L, three had a serum sodium level below 135mmol/L, and thirty two had a serum sodium of 135-143mmol/L. Of the hyponatremic (sodium <135mmol/L) participants two runners (Premenopausal Females) were low before the race and one runner (Postmenopausal Female) was low after the race. Only three runners, all men, drink a greater total amount of water than the female post-race hyponatremic runner. Only 6 runners, all men, drink more water before the race than the two pre-race hyponatremic female runners. Ten runners had a reduction in serum sodium during the race.

**CONCLUSIONS:** Premenopausal women should limit their fluid intake before the race regardless of the distance. Postmenopausal women should limit their fluid intake during the 10K race.

| Serum Sodium Level of 35 10K Runners |                       |
|--------------------------------------|-----------------------|
| Number of Runners                    | Serum Sodium (mmol/L) |
| 0                                    | >145 mmol/L           |
| 3                                    | <135 mmol/L           |
| 32                                   | 135-144 mmol/L        |

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**B-30 Free Communication/Poster - Exercise Training Effects on Muscle**

MAY 30, 2012 1:00 PM - 6:00 PM

ROOM: Exhibit Hall

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**1738 Board #146 MAY 30 2:00 PM - 3:30 PM**  
**Resistance Training Induces Similar Hypertrophy in the Arm and Thigh Musculature of Young Women.**

William J. Booth<sup>1</sup>, Adam N. Upshaw<sup>1</sup>, Sarah B. Wilkinson<sup>2</sup>, Peter W. R. Lemon, FACSM<sup>1</sup>, Charles L. Rice, FACSM<sup>1</sup>, Greg D. Marsh<sup>1</sup>. <sup>1</sup>The University of Western Ontario, London, ON, Canada. <sup>2</sup>University of Guelph-Humber, Toronto, ON, Canada.

(No relationships reported)

Muscle strength is strongly related to muscle cross-sectional area (CSA). Resistance training can increase muscle CSA and this hypertrophy can be optimized by combining resistance training with post exercise dietary supplementation. Previous research has shown that following resistance training young men hypertrophy to a greater extent in the arm (~16.0%) than in the thigh (~8.5%). This differential hypertrophy has been less well studied in women.

**PURPOSE:** To compare hypertrophy of the thigh to the arm in young women following a 10 week resistance training program with post-workout supplementation.

**METHODS:** Forty untrained females (23±4y) engaged in supervised resistance training three times per week targeting both the upper and lower body for 10 weeks. Participants performed 1-RM testing at pre-, week 3, week 6 and week 9 to ensure that the resistance remained between 80-85% of their 1-RM. All participants refrained from any food intake for at least 1 h prior to their workouts. Immediately after each session, participants ingested a protein, carbohydrate drink containing at least 21g of protein. All participants were assessed with 3T magnetic resonance (MR) imaging on their non-dominant side prior to the 10 week program and again at least 5 days (no more than 8 days) after their final session. The largest CSA (averaged over 5 slices) pre-training was analysed using computer software and compared to the same CSA post-training.

**RESULTS:** Post-training both arm and thigh musculature CSA significantly increased (1.6cm<sup>2</sup> and 6.8cm<sup>2</sup>, respectively) (p<0.05). However, the increase in the thigh (7.3%) was not significantly different than the increase in the arm (8.0%).

**CONCLUSIONS:** Although CSA significantly increased in both the thigh and arm musculature, the change for these women was not significantly different between upper and lower limbs. Further, the % increase in arm CSA was similar to that previously reported in men while the thigh hypertrophy was less than that found in men. Differences between male and female hypertrophy may be explained by fibre type differences, hormonal influences, or body mass distribution differences.

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**1739 Board #147 MAY 30 2:00 PM - 3:30 PM**  
**The Effects of Low Intensity Resistance Training and Detraining on Isokinetic Strength in Postmenopausal Women**

Meng-yu Chen<sup>1</sup>, Chiao-Hsin Chen<sup>2</sup>, Linda Lin<sup>1</sup>. <sup>1</sup>National Cheng Kung University, Tainan, Taiwan. <sup>2</sup>Chi-Mei Medical Center, Tainan, Taiwan.

(No relationships reported)

**PURPOSE:** To examine the effects in isokinetic strength and body composition's factors after one year of low intensity resistance training, and 24 weeks of detraining in postmenopausal women.

**METHODS:** There were 15 healthy volunteers matched for strength were assigned to a control (n=7, age: 55.26±3.09 years, BMI: 23.89±5.02 kg/m<sup>2</sup>) or exercise group (n=8, age: 55.63±5.03 years, BMI: 21.3±3.41 kg/m<sup>2</sup>). The exercise group exercised one year by using the elastic bands or body weight for resistance. The training program consisted of 2 sessions per week of a supervised progressive high repetition and low resistance training. The measurement was performed by Biodex System to collect data of muscle strength of upper and lower limb. Body composition was estimated by dual energy X-ray absorptiometry (DEXA). The body fat and lean body mass were assessed at baseline, after training and detraining. Pearson product-moment correlation and Mann-Whitney U test were used for data analysis.

**RESULTS:** The exercise group demonstrated significant improvements in peak torque divided by weight of biceps (2.01%) after one year training. And the fat percentage of legs were significantly greater in exercise group (-7.5 %) than the control groups (+2.0 %) (p<.05). The muscular isokinetic strength was positively correlated with lean body mass in the upper limb

( $p < .05$ ). In addition, the peak torque of biceps (3.9%), and fat mass of the leg (-5.17%) in the exercise group were still greater than the baseline after 24 weeks of detraining. However, there was no significant difference in lean mass, and no significant changes were observed in muscle strength of lower limb.

**CONCLUSIONS:** The results of the present study provide evidence that low intensity resistance training program has beneficial effects on body composition and muscular isokinetic strength. The low intensity resistance training still could maintain the gains in strength and body composition for more prolonged periods after training ceased in postmenopausal women.

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**1740** Board #148 MAY 30 2:00 PM - 3:30 PM

**The Effects of Short-Term Training on Isometric and Concentric Torque Production of the Forearm Flexors**

Daniel A. Traylor, Terry J. Housh, FACSM, Glen O. Johnson, Richard J. Schmidt, Clayton L. Camic, Jorge M. Zuniga, Haley C. Bergstrom, Robert W. Lewis.

University of Nebraska-Lincoln, Lincoln, NE. (Sponsor: Terry Housh, FACSM)

(No relationships reported)

**PURPOSE:** The purpose of the present study was to examine the effects of 3 days of concentric isokinetic training of the forearm flexors on peak torque (PT) at maximal isometric voluntary contraction (MVIC), 60, 180, and 300°·s<sup>-1</sup>.

**METHODS:** Ten adult male (mean age  $\pm$  SD = 21.8  $\pm$  1.2 years; body weight = 87.8  $\pm$  18.4 kg; height = 182.0  $\pm$  9.5 cm) subjects completed two pretests (pretest 1 and 2) that included maximal unilateral isometric and concentric isokinetic forearm flexion (non-dominant arm) muscle actions at MVIC, 60, 180, and 300°·s<sup>-1</sup>. These pretests served as the within subjects control phase of the study. During the training phase, the subjects performed five sets of ten maximal isokinetic concentric forearm flexion (non-dominant arm) repetitions at 60°·s<sup>-1</sup>. The final visit involved the same testing procedures as pretests 1 and 2 and served as the posttest.

**RESULTS:** The results indicated that there was no significant ( $p > 0.05$ ) time  $\times$  velocity interaction, but significant main effects for time and velocity. The follow-up t-tests for the marginal means for time (collapsed across velocity) indicated that there was no significant difference between pretest 1 and pretest 2, but the posttest was greater than both pretest 1 and pretest 2 ( $p < 0.05$ ). Thus, the short-term training resulted in increases in PT at all velocities. The follow-up t-tests for the marginal means for velocity (collapsed across time) indicated that PT decreased significantly with velocity.

**CONCLUSIONS:** Thus, unlike a previous short-term training study that found no increases in PT for the forearm flexors after 2 days of isokinetic training, these findings indicated that 3 days of concentric isokinetic training for the forearm flexors was sufficient to elicit increases in PT. These findings provide specific information for use by allied health professionals, such as physical therapists and athletic trainers, who are responsible for developing resistance training programs to prepare injured athletes to return to practice and competition. In addition, the results of the present study may be useful for physical and occupational therapists in prescribing rehabilitation programs to help patients return to work.

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**1741** Board #149 MAY 30 2:00 PM - 3:30 PM

**Skeletal Muscle Architectural Adaptations to Endurance Run Training**

Kevin Murach, Leslie Fey, Seth Wineland, Katelyn Guerriere, Nick Luden. James Madison University, Harrisonburg, VA.

(No relationships reported)

Skeletal muscle architectural plasticity resulting from resistance and power training is well-documented, yet adaptations to endurance run training have not been examined. Existing cross-sectional data indicates that thickness and pennation angle are greater and fascicle length shorter in running-specific musculature of competitive runners versus sprinters, suggesting the potential for run training adaptations.

**PURPOSE:** To determine whether a 15-week marathon training program alters skeletal muscle architectural parameters (thickness [ $T$ ], pennation angle [ $\theta$ ], and fascicle length [ $FL$ ]) in the vastus lateralis (VL) and lateral gastrocnemius (LG) of 10 recreationally active but untrained college-aged subjects.

**METHODS:** Before and after training, VL and LG architecture was imaged using B-mode ultrasonography in addition to maximal voluntary contraction (MVC) and treadmill cardiovascular testing.  $T$  and  $\theta$  was measured offline using NIH imaging software and  $FL$  was formulated using a prediction equation. Dependent t-tests were used to compare pre-post values for each parameter.

**RESULTS:** LG  $T$  and  $\theta$  increased (3.8  $\pm$  6.7% and 19.3  $\pm$  2.2%, respectively [ $p < 0.05$ ]) and LG  $FL$  decreased (14.5  $\pm$  44.6%,  $p < 0.07$ ) while only VL  $T$  increased (and 6.6  $\pm$  11.1%,  $p < 0.05$ ). Fractional oxygen utilization at 11.1  $\pm$  0.5 km/hr improved (70.3  $\pm$  2.4% vs 65.9  $\pm$  2.1%,  $p < 0.05$ ) while other cardiovascular parameters and MVC were unchanged.

**CONCLUSION:** 15 weeks of endurance run training modifies LG architecture and fractional oxygen utilization. These muscle-specific architectural adaptations reflect single muscle fiber observations from the same training program in that the LG seems to be more sensitive to run training than the VL. Further, LG alterations substantiate previous cross-sectional data gathered in distance runners (higher pennation angle and shorter fascicles), implying that the distance runners' architectural profile can at least partially be attributed to training. The functional implications of these adaptations warrant further investigation.

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**1742** Board #150 MAY 30 2:00 PM - 3:30 PM

**The Effect of Preparation Period Training on Aerobic Power and Muscle Oxygenation in Rowers**

Kazuki Esaki<sup>1</sup>, Koutarou Yamakawa<sup>1</sup>, Toshiyuki Kurihara<sup>2</sup>, Takafumi Hamaoka, FACSM<sup>2</sup>. <sup>1</sup>Shiga University, Shiga, Japan. <sup>2</sup>Ritsumeikan University, Shiga, Japan.

(Sponsor: Takafumi Hamaoka, FACSM)

(No relationships reported)

The aim of preparation period training is to increase the aerobic power and muscle strength in rowing. However, the effect of training on muscle oxygenation during preparation period is unclear.

**PURPOSE:** The purpose of this study was to examine whether the preparation period training improved the aerobic power and the thigh muscle reoxygenation recovery during and following a rowing exercise.

**METHODS:** Fourteen male collegiate rowers participated (age: 20  $\pm$  1 yrs, height: 178.4  $\pm$  7.9 cm, weight: 75.8  $\pm$  7.9 kg) in this study. Subjects were tested before and after a 3-month preparation period training. We evaluated the performance time and the peak pulmonary oxygen uptake (VO<sub>2peak</sub>) during a 2000 m rowing ergometer test and the half-recovery time of muscle reoxygenation (1/2reoxy time) using near-infrared spectroscopy in the vastus lateralis (VL) and rectus femoris (RF) during the recovery phase following the 2000 m rowing ergometer test.

**RESULTS:** The 2000 m performance time and VO<sub>2peak</sub> were significantly improved (415  $\pm$  9  $\rightarrow$  411  $\pm$  11 sec and 62.1  $\pm$  5.6  $\rightarrow$  63.7  $\pm$  6.1 ml/kg/min, respectively,  $p < 0.05$ ). The 1/2reoxy time of the VL was not significantly different between pre- and post-training. On the other hand, 1/2reoxy time of the RF was significantly increased post-training. The value of change in 1/2reoxy time of the VL was significantly correlated with both the 2000 m performance time ( $r = 0.545$ ,  $p < 0.05$ ) and VO<sub>2peak</sub> ( $r = -0.573$ ,  $p < 0.05$ ). The value of change in 1/2reoxy time of the RF was not correlated with the performance time or VO<sub>2peak</sub>.

**CONCLUSION:** The result suggested that the improvement of performance in the preparation period rowing training was correlated not only with VO<sub>2peak</sub>, but also with the muscle oxidative capacity.

Supported by JSPS KAKENHI 23500780.

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1743 Board #151 MAY 30 2:00 PM - 3:30 PM

**Effect of Different Frequency Of Endurance And Strength Training on Muscle Functional Deterioration During Immobilization**

Masako Fujioka<sup>1</sup>, Takafumi Hamaoka, FACSM<sup>1</sup>, Takuya Osada<sup>2</sup>, Norio Murase<sup>2</sup>, Ryotaro Kime<sup>2</sup>, Yuko Kurosawa<sup>1</sup>, Shiro Ichimura<sup>3</sup>, Toshiyuki Homma<sup>4</sup>, Kazuki Esaki<sup>5</sup>, Fumiko Nakamura<sup>6</sup>, Toshihito Katsumura<sup>2</sup>. <sup>1</sup>*Ritsumeikan University, Shiga, Japan.* <sup>2</sup>*Tokyo Medical University, Tokyo, Japan.* <sup>3</sup>*Tokyo University of Science, Tokyo, Japan.* <sup>4</sup>*Japan Institute of Sports Sciences, Tokyo, Japan.* <sup>5</sup>*Shiga University, Shiga, Japan.* <sup>6</sup>*Kokugakuin University, Tokyo, Japan.* (Sponsor: Hamaoka Takafumi, FACSM)

(No relationships reported)

In our previous research, muscle functions declined after a 3-week forearm immobilization (3W-IMM) (Kitahara et al., 2003), and endurance and strength handgrip exercise training twice weekly during 3W-IMM prevented the decrease in muscle oxidative capacity and strength (Matsumura et al., 2008). However, the effect of lower amount of exercise training on muscle functions has never been examined.

**PURPOSE:** To investigate the effects of different training volume (once weekly and twice weekly) on muscle functions, particularly, on muscle energy metabolism during exercise pre- and post-3W-IMM.

**METHODS:** Twenty healthy male subjects participated in this study and the non-dominant arm was immobilized for 3 weeks with a cast. The subjects were assigned to an immobilization-only group (IMM-group), endurance [30% of maximum voluntary contraction (MVC), 1 contraction every second until exhaustion] and strength (70% MVC, 10 repetitions) grip exercise training once weekly (EST1-group, n=6) or twice weekly (EST2-group, n=7) during the 3W-IMM period. The MVC and the endurance performance evaluated as maximal workload achieved during handgrip exercise test (30% MVC, 1 Hz, until exhaustion) were examined both pre- and post-3W-IMM. Muscle phosphocreatine (PCr) and muscle pH were evaluated using <sup>31</sup>-phosphorus magnetic resonance spectroscopy.

**RESULTS:** The difference in maximal workload during endurance test between pre- and post-3W-IMM decreased more markedly in IMM-group than in EST2-group (p=0.074). Muscle PCr and muscle pH were not significantly different between three groups during endurance exercise test and between pre- and post-3W-IMM. The difference in MVC between pre- and post-3W-IMM was significantly greater in IMM-group than both in EST1-group and EST2-group (p<0.05).

**CONCLUSIONS:** The endurance and strength training, not only twice weekly but also once weekly, was effective for preventing the decrease in muscle strength during 3W-IMM. The training twice weekly was effective, but not for the training once weekly, to maintain endurance performance. Muscle PCr and muscle pH kinetics during endurance test were unchanged with 3W-IMM.

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1744 Board #152 MAY 30 2:00 PM - 3:30 PM

**Improvements with Electrical Stimulation Resistance Training in Men and Women with Complete Spinal Cord Injury**

Jared T. Brizendine, Terence E. Ryan, Melissa L. Erickson, Kevin K. McCully, FACSM. *University of Georgia, Athens, GA.*

(No relationships reported)

Eighty percent of the individuals with spinal cord injury (SCI) in the United States are male consequently little research exists concerning females with SCI. Electrically induced resistance training has been shown to improve muscle mass and muscle strength in males with spinal cord injury. The current hypothesis is that resistance training will result in less changes and slower gains.

**PURPOSE:** To compare training improvements with electrical resistance training in males and females with SCI.

**METHODS:** Ten male and three female subjects with complete spinal cord injury gave informed consent prior to inclusion in this study. A training session consisted of four sets of leg extensions on each leg with up to 10 repetitions per set. Two sessions were performed per week for four months. Stimulation current was recorded and maintained constant after the first week, weight was increased after two successful sessions. Performance adaptations were measured as change in weight pre and post training, change in repetitions pre and post training, and time to 16 pounds lifted.

**RESULTS:** Two out of ten males and two out of three females reached the goal weight of 20 pounds by conclusion of training. Seven men who reached 10 pounds did so in 49, 55, 65, 80, 103, 111, and 124 days. The two women who reached ten pounds reached so in 34 and 63 days. One male and one female were much weaker than the other participants prior start of training. The man went from no lifts to completing at least one lift at the end of training and the woman went from six lifts to forty lifts at the end of training. The average gains in quadriceps muscle mass were similar between males and females as measured with MRI.

**CONCLUSIONS:** There was no evidence that females with SCI improve less rapidly than males with SCI in response to electrical induced training. More females need to be tested to confirm this finding, though females are certainly not limited in their response to training. Supported by NIH R01 HD039676.

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1745 Board #153 MAY 30 2:00 PM - 3:30 PM

**Peak Power Training Reduces SDH Activity In Type Iib Fibers Of Rat Medial Gastrocnemius Muscle**

Regula Furrer, Arnold de Haan, Bauke J. van Dijk, Nathalie Bravenboer, Paul Lips, Richard T. Jaspers. *Research Institute MOVE, VU University and VU Medical Center, Amsterdam, Netherlands.*

(No relationships reported)

Muscle fibers are limited in increasing size and oxidative capacity simultaneously. The combination of resistance training to increase muscle size and peak power and endurance training to increase oxidative capacity can cause conflicting situations at the molecular level. Since several sports require both, high peak power and oxidative capacity, strategies may have been adopted to deal with this problem. Using specific recruitment of different muscle fibers during resistance and endurance training may allow increasing both. The rat medial gastrocnemius muscle (GM) is composed of a high and a low oxidative compartment which are recruited task specifically (the latter only being recruited during high intensity activities).

**PURPOSE:** To investigate whether task specific recruitment of the rat GM allows the muscle to increase in size and oxidative capacity simultaneously in response to combined peak power and endurance training.

**METHODS:** 39 rats were assigned to peak power training (PT, n = 10), resembling resistance exercise, endurance training (ET, n = 10), both peak power and endurance training (PET, n = 10), or controls (n = 9). Trainings were progressive and performed on a treadmill 5 days per week for 6 weeks (PET performed both training sessions each day with 8 hours rest in between). After 6 weeks, fiber cross-sectional area (CSA<sub>f</sub>) and succinate dehydrogenase (SDH) activity (representing mitochondrial activity) were assessed for all fiber types in both compartments. SDH mRNA levels in both compartments were quantified by RT-PCR.

**RESULTS:** None of the training modalities induced a change in CSA<sub>f</sub> in either compartment. In the high oxidative compartment, SDH activity was not significantly different between the groups, although SDH mRNA levels were increased after ET (p < 0.05). In the low oxidative compartment, for PT and PET groups, SDH activity of type Iib fibers was ~30% lower than in the ET and control groups (p < 0.05), whereas SDH mRNA levels remained constant.

**CONCLUSIONS:** Peak power training induced a substantial decrease in SDH activity in the type Iib fibers of the low oxidative compartment without a decrease in SDH mRNA levels, indicating that peak power training reduced the rate of translation of mitochondrial proteins and/or enhanced mitochondrial degradation.

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1746 Board #154 MAY 30 2:00 PM - 3:30 PM

**TNF- $\alpha$  Induced Loss Of Force In The Diaphragm Of Mice Is Prevented By Exercise Training**

Norman Mangner<sup>1</sup>, Axel Linke<sup>1</sup>, Andreas Oberbach<sup>2</sup>, Stephan Gielen<sup>1</sup>, Marcus Sandri<sup>1</sup>, Robert Höllriegel<sup>1</sup>, Yasuharu Matsumoto<sup>3</sup>, Gerhard Schuler<sup>1</sup>, Volker Adams<sup>1</sup>.  
<sup>1</sup>University of Leipzig - Heart Center, Leipzig, Germany. <sup>2</sup>University of Leipzig, Leipzig, Germany. <sup>3</sup>Tohoku University Graduate School of Medicine, Sendai, Japan.  
(No relationships reported)

**PURPOSE:** Inflammatory cytokines are known to impair respiratory muscle function, e.g. in congestive heart failure. Further, TNF- $\alpha$  produces reactive oxygen species (ROS) and leads to irreparable damage of muscle proteins. Exercise training (E) is characterized by a distinct antioxidative capacity. Therefore, we tested the hypothesis if exercise training is capable to prevent the TNF- $\alpha$  induced loss of force in the diaphragm of mice.

**METHODS:** C57Bl6 were assigned to 4 weeks of treadmill E or sedentary behaviour (S). After 4 weeks mice were randomly injected intraperitoneally with TNF- $\alpha$  or saline. Force was determined in diaphragm bundles using an electrostimulation protocol. Expression and activity of glutathione peroxidase (GPX) and of the NAD(P)H oxidase and protein carbonylation were measured using standard methods.

**RESULTS:** TNF- $\alpha$  reduced force at 125 Hz in sedentary animals. E prevented this force reduction (S NaCl: 11.6 $\pm$ 1.0, S TNF: 6.8 $\pm$ 0.9, E NaCl: 11.2 $\pm$ 0.8, E TNF: 10.8 $\pm$ 1.2 N/cm<sup>2</sup>, p<0.01). TNF- $\alpha$  led to an increased activity of NAD(P)H oxidase in both sedentary and exercised animals (S NaCl: 1.0 $\pm$ 0.1, S TNF: 1.8 $\pm$ 0.2, E NaCl: 1.1 $\pm$ 0.2, E TNF: 1.5 $\pm$ 0.3 mU/mg, p=0.01). Carbonylated proteins as a marker of oxidative stress were only elevated under the influence of TNF- $\alpha$  in sedentary animals, whereas E prevented the TNF- $\alpha$  induced increase in carbonylated proteins. TNF- $\alpha$  induced loss in muscle force correlated with the total amount of carbonylated proteins (r=-0.62, p<0.05). TNF- $\alpha$  led to an increased carbonylation of alpha-actin (by ~400%) and creatine kinase (by ~500%), whereas E again prevented the TNF- $\alpha$  induced increase

The mRNA expression and activity of GPX were enhanced by E (mRNA: S NaCl: 42.5 $\pm$ 17.5, S TNF: 63.4 $\pm$ 15.4, E NaCl: 179 $\pm$ 39.2, E TNF: 190 $\pm$ 55.6 arb. units, p<0.01; activity: S NaCl: 19.8 $\pm$ 0.7, S TNF: 23.3 $\pm$ 2.0, E NaCl: 33.1 $\pm$ 2.39, E TNF: 33.6 $\pm$ 1.2 mU/mg, p=0.01).

**CONCLUSION:** TNF- $\alpha$  administration leads to reduced force development in the diaphragm of mice. This effect is attenuated by preconditional exercise training. This may be, at least in part, a result of reduced carbonylation of alpha-actin and creatine kinase due to an increased expression in radical scavenger enzymes resulting in a reduced ROS concentration.

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1747 Board #155 MAY 30 2:00 PM - 3:30 PM

**The Effect of Exercise Training on Muscle Energy Status in IL-6 Induced Cachexia**

Melissa Puppa, Aditi Narsale, Kandy Velazquez, Shu Sato, James White, James Carson, FACSM. University of South Carolina, Columbia, SC.  
(No relationships reported)

Cachexia is a condition involved with the loss of bodyweight, muscle mass, and adipose tissue mass. The ApcMin/+ mouse develops an IL-6 dependent cachexia which can be accelerated with IL-6 overexpression.

**PURPOSE:** The purpose of this study was to determine the effect of moderate intensity treadmill exercise training on skeletal muscle energy status in cachectic mice.

**METHODS:** Mice were randomly assigned to exercise training (Ex) or cage control (CC) groups. Starting at 6wks of age, exercised mice ran on a treadmill at a moderate intensity (18 m/min, 1h, 6 days/wk, 5% grade) until 14wks of age. At 12wks of age, the mice were electroporated with either a vector (V) or IL-6 over-expression plasmid (IL-6) in the right quadriceps muscle and at 14wks of age were sacrificed

**RESULTS:** Cachexia induced a 12% decrease in quadriceps weight and moderate aerobic exercise training attenuated muscle mass loss. Cachexia induced a 3 fold increase in the activation of the energy sensor AMPK, p<0.05, and exercise training attenuated this induction; however, the combination of exercise and cachexia still stimulated a 2 fold increase in AMPK activation compared to control animals, p<0.05. Neither exercise nor cachexia had an effect on total AMPK levels. Activation of a downstream target of AMPK, ACC, was also increased with cachexia and exercise was able to attenuate this increase.

**CONCLUSIONS:** Our data demonstrated that the decrease in skeletal muscle mass with cachexia is associated with an altered energy state of the muscle. Exercise needs to be explored further as potential a therapy to alleviate muscle energy imbalance with cachexia. Funded by ROICA121249-01

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1748 Board #156 MAY 30 2:00 PM - 3:30 PM

**Myogenin, MyoD and IGF-I Regulate Muscle Mass But Not Fiber-Type Conversion During Resistance Training In Rats**

Andreo Fernando Aguiar<sup>1</sup>, Ivan José Vechetti-Júnior<sup>2</sup>, Rodrigo Wagner Alves de Souza<sup>2</sup>, Eduardo Paulino Castan<sup>2</sup>, Rachel Colauto Milanezi Aguiar<sup>2</sup>, Robson Francisco Carvalho<sup>2</sup>, Cosme Franklim Buzzachera<sup>3</sup>, Maéli Dal-Pai-Silva<sup>2</sup>. <sup>1</sup>North University of Parana, Londrina, Brazil. <sup>2</sup>Univ Estadual Paulista (UNESP), Botucatu, Brazil. <sup>3</sup>North University of Parana, Londrina, Brazil. (Sponsor: Carlo Baldari, FACSM)  
(No relationships reported)

**PURPOSE:** To determine whether skeletal muscle hypertrophy and fiber-type conversion induced by long-term resistance training (RT) are associated with increased myogenin, MyoD and IGF-I mRNA expression.

**METHODS:** Male *Wistar* rats (80 days old, 250-300 g) were randomly divided into two groups (n=8 per group): 8-week control (C8) and 8-week trained (T8). T8 group was submitted to progressive RT program (four sets of 10-12 repetitions at 65-75% of the 1RM, 3 day/week) for 8 weeks. At the end of the experiment, the animals were euthanized by decapitation and the plantaris muscle was collected for morphometrical (muscle fiber area), histochemical (fiber-type frequency by myofibrillar ATPase histochemistry) and molecular (myogenin, MyoD and IGF-I mRNA expression by RT-qPCR) analysis. Fiber-type frequency data were analyzed using the Goodman Test for contrasts between intermultinomial and intramultinomial populations. Muscle fiber area, and myogenin, MyoD and IGF-I mRNA expression data were analyzed by an unpaired *t* test. Differences were considered significant at p < 0.05.

**RESULTS:** RT promoted an increase in muscle fibers area (T8 vs. C8: 29.0% increase, p < 0.05) that was accompanied by the increases in myogenin (T8 vs. C8: 44.8% increase, p < 0.05), MyoD (T8 vs. C8: 22.9% increase, p < 0.05) and IGF-I (T8 vs. C8: 30.1% increase, p < 0.05) mRNA expression. Additionally, there was a significant positive correlation between the muscle fiber area and mRNA expression for myogenin (r=0.87), MyoD (r=0.85) and IGF-I (r=0.88), as analyzed by individual data points of the trained group. On the other hand, the increase in myogenin, MyoD and IGF-I mRNA expression was not associated with changes in the fiber-type frequency.

**CONCLUSIONS:** These results indicate a possible interaction between myogenin, MyoD and IGF-I in the control of muscle hypertrophy during long-term RT and suggest that these factors are involved more in the regulation of muscle mass than in fiber-type conversion.

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1749 Board #157 MAY 30 2:00 PM - 3:30 PM

**Prior Exercise Training Prevents Statin-Associated Skeletal Muscle Dysfunction in Mice**

Kimberly Huey, Michelle Godar, Carissa Chamney, Rachel Bump. Drake University, Des Moines, IA. (Sponsor: Roland R Roy, FACSM)  
(No relationships reported)

The most common side effect of statin treatment, skeletal muscle myopathy, is more likely in exercisers. We previously reported that 2 weeks of running wheel exercise prior to statin treatment protected against muscle dysfunction, rather than exacerbated it, as seen with novel exercise. However, the minimal amount of prior exercise necessary to protect against statin-associated muscle dysfunction remains unclear.

**PURPOSE:** We investigated the interaction of statin treatment with novel vs. 3 days of prior exercise on muscle function and heat shock protein (Hsp) expression and hypothesized that exacerbation of statin-induced myopathy by exercise is specific to untrained muscle, while some prior training is protective against dysfunction. Within the Hsp family, Hsp25 and  $\alpha$ B-crystallin are both up-regulated with exercise training and are associated with maintenance of muscle integrity after damaging contractions.

**METHODS:** Mice received daily atorvastatin (15 mg/kg) or placebo for 2 wks, with/without voluntary wheel running (RW) (Novel & Sedentary groups) and the accustomed group completed 3 days of RW prior to beginning placebo or statin treatment (n= 6-7/group). In vivo plantarflexor isometric force and fatigability were measured with a dual mode lever system and Hsp25 and  $\alpha$ B-crystallin muscle protein levels were quantified with Western blot.

**RESULTS:** Statin treatment significantly reduced RW activity on days 1-3 in novel compared to accustomed groups. Statin treatment reduced force in sedentary and novel-exercise groups compared to placebo (21 and 35%, respectively,  $p < 0.05$ ), while accustomedization prevented statin-associated force loss. Fatigability was not different among groups. Hsp25 and  $\alpha$ B-crystallin levels were increased 2- to 9-fold with novel and accustomed RW compared to sedentary, independent of statin treatment ( $p < 0.05$ ).

**CONCLUSIONS:** These results suggest that as little as 3 days of exercise prior to statin treatment can protect against statin-associated losses in muscle force production observed under sedentary or novel exercise conditions and exercise-induced Hsp up-regulation may contribute to this protective effect.

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1750 Board #158 MAY 30 2:00 PM - 3:30 PM

**Skeletal Myofiber-expressed Veg Is Required For Adaptation To Exercise Training**

Hamid Delavar, Leonardo Nogueira, Kechun Tang, Michael C. Hogan, Peter D. Wagner, Ellen C. Breen. *University of California, San Diego, La Jolla, CA.*

(No relationships reported)

Increased muscle capillarization is a normal adaptation to exercise training. We hypothesized that VEGF expression in mature skeletal myofibers is necessary for this angiogenic response and contributes to an improvement in locomotor muscle function and exercise capacity.

**PURPOSE:** To determine whether a reduction in myofiber-expressed VEGF limits the adaptive response to exercise training.

**METHODS:** Using a tamoxifen-inducible skeletal myofiber-specific VEGF gene deletion mouse model (HSA-Cre-ER<sup>T2</sup> X VEGF<sup>LoxP</sup>), VEGF levels are reduced by >80% in skeletal muscle of adult myofiber VEGF gene-deleted mice (myoVEGF<sup>-/-</sup>) compared to control littermates (WT). Exercise capacity was evaluated by measuring maximal treadmill speed and endurance running time before tamoxifen-induced gene deletion, 3 weeks after tamoxifen treatment, and after an additional 8 weeks of progressive exercise training (1 hr/d, 5 d/wk). The capillary/fiber ratio was measured in the soleus, plantaris and gastrocnemius after training. Maximal tension in the EDL and soleus was measured *in vitro*.

**RESULTS:** Exercise endurance was impaired in myoVEGF<sup>-/-</sup> mice 3 weeks after VEGF deletion (WT, 97 min  $\pm$  26, myoVEGF<sup>-/-</sup>, 54 min  $\pm$  34,  $p < 0.05$ ), but maximal speed was unaffected (WT, 62 cm/s  $\pm$  4.5, myoVEGF<sup>-/-</sup>, 59 cm/s  $\pm$  6). Post-training, exercise endurance (WT, 161  $\pm$  16 min, myoVEGF<sup>-/-</sup> 57 minutes  $\pm$  29,  $p < 0.001$ ) and maximal speed (WT, 72 cm/s  $\pm$  3.4, myoVEGF<sup>-/-</sup>, 54 cm/s  $\pm$  12,  $p < 0.001$ ) were improved only in the WT mice. Capillary/fiber ratio post-training was less in myoVEGF<sup>-/-</sup> (Gastroc. WT, 1.75  $\pm$  0.20, myoVEGF<sup>-/-</sup>, 1.03  $\pm$  0.11. Soleus, WT 1.85  $\pm$  0.21, myoVEGF<sup>-/-</sup>, 1.65  $\pm$  0.18. Plantaris, WT, 1.66  $\pm$  0.35, myoVEGF<sup>-/-</sup>, 1.39  $\pm$  0.21). Post-training maximal tetanic tension (N/cm<sup>2</sup>) produced by the EDL and soleus was not different between groups.

**CONCLUSION:** Mice deficient in skeletal myofiber VEGF were unable to improve exercise capacity in response to training. This is accompanied by a lower skeletal muscle capillary/fiber ratio in locomotor skeletal muscle. These data suggest myofiber VEGF is required to regulate the adaptive response to exercise training.

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1751 Board #159 MAY 30 2:00 PM - 3:30 PM

**Diabetic Patients With Different Training Status Show Different Levels Of Muscle Weakness And Electrophysiological Impairment.**

Jonida Haxhi<sup>1</sup>, Stefano Balducci<sup>2</sup>, Ilenia Bazzucchi<sup>1</sup>, Alessandro Scotto di Palumbo<sup>1</sup>, Flaminia Carlucci<sup>1</sup>, Giuseppe Pugliese<sup>2</sup>, Massimo Sacchetti<sup>1</sup>. <sup>1</sup>University of Rome "Foro Italico", Rome, Italy. <sup>2</sup>Second Medical School, "La Sapienza" University, Rome, Italy. (Sponsor: Carl Foster, FACSM)

(No relationships reported)

**PURPOSE:** Diabetes is associated to muscle weakness and disability. We investigated neuromuscular function, in the upper and lower limb, in 31 T2D patients and 12 Controls.

**METHODS:** Subjects comprised 4 groups: sedentary diabetic patients with lower (1st quartile-D1) and higher (4th quartile-D2) motor nerve conduction velocity (MNCV), trained diabetic patients (TD) and non-diabetic sedentary control subjects (C). Isokinetic and Maximal isometric strength (MVC) for a wide angular-velocity range (0°/s to 240°/s) were assessed for the knee extensors (KE) and elbow flexors (EF). Muscle fiber conduction velocity (MFCV) was estimated from sEMG recordings of the vastus lateralis (VL) and biceps brachii (BB) activity.

**RESULTS:** EF and KE MVC were similar between groups. Sedentary diabetics showed significantly decreased dynamic strength of KE at all velocities, when compared to Controls and TD (% decrease M $\pm$ SD, 15°/s to 240°/s,  $p < .05$ : D1 = 58.6% $\pm$ 3.0; D2 = 61% $\pm$ 3.3 vs. C = 43.9% $\pm$ 4.0; TD = 58.0% $\pm$ 2.6), with C and TD being similar to each other, especially at low angular velocities. D2 showed higher KE strength than D1, but differences reached statistical significance only at 90°/s. Strength in the elbow flexors was affected at higher contraction speeds, with the untrained diabetics showing significantly lower strength at 180°/s (Nm M $\pm$ SD: D1=34.1 $\pm$ 3.0; D2=28.8 $\pm$ 2.4 vs. C=42.1 $\pm$ 2.8;  $p < .05$ ) and 240°/s (Nm M $\pm$ SD: D1=28.0 $\pm$ 2.7; D2=24.1 $\pm$ 1.9 vs. C=36.4 $\pm$ 2.4). No strength differences resulted between D1 and D2 for the arm. There were significant within-group differences in the ratio between leg torque and arm torque for the D1 (-35%), D2 (-31%) and TD (-31%), but not for the control group. Groups showed differences in isometric MFCV for the VL, but not for the BB. MFCV was significantly lower in D1 (-24%,  $p = .01$ ) and D2 (-23%,  $p = .02$ ) compared to the control group. TD was not different from C, in terms of MFCV.

**CONCLUSIONS:** Muscle weakness in diabetes is dependent on contraction velocity, especially in the lower limbs, whereas MNCV has only a marginal effect. The different neuromuscular impairment is confirmed by differences in MFCV. Training status is associated with better neuromuscular function. Finally, MFCV could represent a sensitive marker for monitoring neuromuscular function impairment and training-induced reconditioning.

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1752 Board #160 MAY 30 2:00 PM - 3:30 PM

**Exercise Training-induced Improvement Of Impaired Muscle Glucose Metabolism Is Associated With Muscular Sex Steroid Hormone Level In Zucker Fatty Diabetic Rats**

Koji Sato<sup>1</sup>, Kumiko Minato<sup>2</sup>, Satoshi Fujita<sup>1</sup>, Hideki Yamauchi<sup>3</sup>, Noboru Mesaki<sup>4</sup>, Motoyuki Iemitsu<sup>1</sup>. <sup>1</sup>Ritsumeikan University, Kusatsu, Shiga, Japan. <sup>2</sup>Wayo Women's University, Ichikawa, Chiba, Japan. <sup>3</sup>The Jikei University School of Medicine, Tokyo, Japan. <sup>4</sup>Teikyo Heisei University, Ichihara, Chiba, Japan. (Sponsor: Takafumi Hamaoka, FACSM)

(No relationships reported)

Effect of exercise training in type 2 diabetes patients to improve hyperglycemia via enhancement of muscle glucose metabolism signaling is well known. We have recently reported that sex steroid hormones can be synthesized locally in the skeletal muscle which improves fasting blood glucose level in obese rats.

**PURPOSE:** To determine whether exercise training-induced secretion of muscular sex steroid hormone may improve insulin resistance in Zucker obese fatty rats.

**METHODS:** Thirty Zucker fatty diabetic rats (6-week old) were randomly assigned to either control, exercise training or exercise training with continuous infusion of 5 $\alpha$ -reductase inhibitor groups. Exercise training was conducted by voluntary wheel running for 6 weeks, with average running distance of 2,752 m per day.

**RESULTS:** The results indicate that 6 weeks of exercise training significantly attenuated serum insulin and fasting glucose levels compared with the control group. Muscle concentrations of DHEA and DHT, and protein expression levels of 5 $\alpha$ -reductase were all significantly higher in the exercise-training group. Moreover, exercise training upregulated GLUT4 translocation with concomitant increases in protein kinase B and protein kinase C- $\zeta/\lambda$  phosphorylations. Furthermore, significant correlations were observed between fasting glucose levels and muscular DHEA ( $r = -0.87$ ,  $P < 0.001$ ) and DHT levels ( $r = -0.80$ ,  $P < 0.001$ ). Interestingly, exercise training-induced improvements in serum insulin and fasting glucose levels concomitant with GLUT4-regulated signaling were all suppressed with 5 $\alpha$ -reductase inhibitor.

**CONCLUSIONS:** These results indicated that exercise-induced improvements in muscle glucose metabolism signaling and fasting glucose level may be attributed to the increased muscular levels of sex steroid hormones.

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1753 Board #161 MAY 30 2:00 PM - 3:30 PM

**Effect Of Aerobic Training On Three-dimensional Capillary Architecture In Soleus Muscle**

Shinichiro Murakami<sup>1</sup>, Naoto Fujita<sup>2</sup>, Takashi Morifuji<sup>2</sup>, Hiroyo Kondo<sup>3</sup>, Hidemi Fujino Fujino<sup>2</sup>. <sup>1</sup>Himeji Dokkyo University, Himeji, Japan. <sup>2</sup>Kobe University Graduate School of Health Sciences, Kobe, Japan. <sup>3</sup>Nagoya Women's University, Nagoya, Japan.  
(No relationships reported)

Aerobic exercise has been known an effective therapy against the muscle endurance fitness.

**PURPOSE:** To clarify the effect of aerobic training on three-dimensional (3-D) capillary architecture in slow muscle has been investigated in the present study.

**METHODS:** Twelve male Wistar rats (9 weeks old) were used and divided into exercise training (EX) and control (Con) groups. The rats in EX group were performed aerobic exercise training on a treadmill (speed = 15 m/min, duration = 60 min) for 3 weeks. The contrast medium-injected capillary in the soleus muscle was visualized using a confocal laser microscope. The succinate dehydrogenase (SDH) activity and vascular endothelial growth factor (VEGF) expression were measured.

**RESULTS:** The SDH activity and VEGF expression in EX were significantly higher than those in Con ( $p < 0.05$ ). The number of capillaries and the number of the anastomoses in the EX were increased than those of Con ( $p < 0.05$ ). The capillary diameter in the soleus of EX rat was thicker than that of Con rat ( $p < 0.05$ ). In addition, the mean capillary volume in EX was significantly higher than that in Con ( $p < 0.05$ ). Whereas the anastomoses diameter was not different in the soleus muscle between EX and Con rat.

**CONCLUSIONS:** These data show that aerobic training builds 3-D capillary architecture in soleus muscle. These results of the present study indicate endurance training creates a powerful stimulus for structural remodeling of the vasculature.

This study was supported by Grants-in-Aid for Scientific Research from the Japanese Ministry of Education, Culture, Sports, Science and Technology no. 23650340, 23650324, 23700600, 23700932 and 22300189.

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1754 Board #162 MAY 30 2:00 PM - 3:30 PM

**Physical Activity During Adolescence Is Associated With Greater Estimated Strength At The Proximal Femur In Adulthood**

Stefan A. Jackowski, Saija A. Kontulainen, David ML Cooper, Joel L. Lanovaz, Adam DG Baxter-Jones. University of Saskatchewan, Saskatoon, SK, Canada.  
(No relationships reported)

**PURPOSE:** Physical activity can enhance bone structure and estimated strength at the proximal femur in children and adolescents, but whether these benefits are maintained into early adulthood remains controversial. The purpose of this study was to investigate whether males and females, described as active (ACT), moderately active (MOD) and inactivate (INACT) during adolescence, display differences in estimated bone structure and strength at the proximal femur in early adulthood.

**METHODS:** One hundred and four participants (55 males, 49 females) from the Pediatric Bone Mineral Accrual Study (PBMA) were tertiled into adolescent physical activity groupings (ACT, MOD, INACT) using the Physical Activity Questionnaire for Adolescents (PAQ-A). Cross sectional area (CSA) and section modulus (Z) at the narrow neck (NN) and femoral shaft (S) sites of the proximal femur were assessed using hip structural analysis (HSA) in adulthood. Group differences were assessed using an analysis of covariance (ANCOVA), controlling for adult height (Ht), total body lean tissue (LTM) and fat mass (FM) and adult physical activity levels (PA).

**RESULTS:** Once controlling for Ht, LTM, FM, and adult PA, the ACT females had significantly greater adult NN CSA ( $2.5 \pm 0.1$  vs.  $2.2 \pm 0.1$  cm<sup>2</sup>,  $p = 0.01$ ) and NN Z ( $1.11 \pm 0.04$  vs.  $0.96 \pm 0.03$  cm<sup>3</sup>,  $p = 0.004$ ) than INACT females. Additionally, ACT females had significantly greater adult NN Z than the MOD group ( $1.11 \pm 0.04$  vs.  $1.00 \pm 0.03$  cm<sup>3</sup>,  $p = 0.02$ ). In males, the ACT ( $2.19 \pm 0.06$  cm<sup>3</sup>) and MOD ( $2.20 \pm 0.06$  cm<sup>3</sup>) groups had significantly greater adult S Z than their INACT peers ( $1.95 \pm 0.07$  cm<sup>3</sup>,  $p > 0.001$ ).

**CONCLUSIONS:** There may be sex and site specific effects of adolescent physical active on bone structure and strength at the proximal femur. Despite these differences, being highly physically active during adolescence may provide site specific benefits to proximal femur structure and estimated strength in adulthood.

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1755 Board #163 MAY 30 2:00 PM - 3:30 PM

**Augmented TLR4-CD14 Expression in Response to Lengthening Muscle Actions Are Blunted by Eccentric Training**

Rodrigo Fernandez-Gonzalo<sup>1</sup>, José A. de Paz<sup>2</sup>, Paula Rodriguez-Miguelez<sup>2</sup>, María J. Cuevas<sup>2</sup>, Per A. Tesch<sup>1</sup>, Javier Gonzalez-Gallego<sup>2</sup>. <sup>1</sup>Karolinska Institutet, Stockholm, Sweden. <sup>2</sup>University of León, León, Spain.  
(No relationships reported)

Chronic eccentric training reduces strength and power losses and inflammatory response to an eccentric exercise challenge. While the mechanisms involved are not fully understood, the toll-like receptor 4 (TLR4) signaling pathway has been proposed to control inflammation and may also be responsible for the decreased inflammation noted after chronic eccentric training.

**PURPOSE:** This study aimed at investigating TLR4 and associated molecule cluster differentiation14 (CD14) responses to an acute bout of eccentric exercise in healthy subjects, and to assess whether the repeated bout effect and chronic training modified the responses.

**METHODS:** Twenty recreationally active women ( $22 \pm 2$  yrs) were randomly assigned to either a control (CG,  $n = 8$ ) or a training group (TG,  $n = 12$ ). Both groups performed two exercise bouts consisting of 120 eccentric actions at 60% of maximal voluntary isometric strength (MVIC) using a squat machine, 9-wks apart. Between these two exercise bouts, TG was subjected to a 6-wk eccentric training program (3 sessions/wk). CG maintained their habitual activities. Lower limb MVIC and power were measured before and 24 hrs after each bout. Quadriceps muscle soreness was assessed before and over 4 consecutive days following each bout. CD14 and TLR4 protein concentration and the inflammatory marker tumor necrosis factor  $\alpha$  (TNF $\alpha$ ), were measured in peripheral blood mononuclear cells, before, immediately after and 2 hrs after each eccentric bout.

**RESULTS:** After the first bout, MVIC (-19%) and power (-14%) were reduced, and soreness increased in both TG and CG ( $P < 0.05$ ). CD14 (26%), TLR4 (32%) and TNF $\alpha$  (30%) protein concentration increased ( $P < 0.05$ ) in both groups. TG showed increased ( $P < 0.05$ ) MVIC (2200 N to 2600 N) and power (1024 to 1180 W) after 6-wk training. There were no changes in CG. Following the second bout, strength and power losses showed greater attenuation in TG compared with CG ( $P < 0.05$ ). CD14, TLR4 and TNF $\alpha$  decreased ( $P < 0.05$ ) after the second bout compared with the first one in TG, but not in CG.

**CONCLUSION:** The inflammation associated with an acute bout of lengthening exercise is reduced by eccentric training through down-regulation of the TLR4 signaling pathway. These results support the use of eccentric training as a therapeutic exercise aid.

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1756 Board #164 MAY 30 2:00 PM - 3:30 PM

**Functional Adaptations to Voluntary Wheel Running in Young and Elderly Mice**

Lisa Ferguson-Stegall, Ted G. Graber, LaDora V. Thompson. University of Minnesota, Minneapolis, MN. (Sponsor: Donald R. Dengel, FACSM)  
(No relationships reported)

Sarcopenia and frailty are major causes of disability in the elderly. Resistance training (RT) studies have demonstrated that significant muscle specific functional adaptations can occur in the elderly, although the hypertrophic response is blunted compared to that of the young. It has also been demonstrated that the old require a greater training volume to maintain muscle adaptations following a period of RT compared to the young. In contrast to RT, the amount of endurance exercise necessary to elicit muscle-specific and functional improvements in the old are not well understood.

**PURPOSE:** We compared the effects of 4 wk of voluntary wheel running (VWR) or no exercise (control) on measures of physiological function in young (6-8 mo,  $n = 10$ ) and elderly (28-30 mo,  $n = 13$ ) C57BL/6 male mice.

**METHODS:** 5 young (XY) and 4 elderly (XO) mice were housed individually in cages outfitted with running wheels for 4 wk. Control animals (CY,  $n = 5$ , and CO,  $n = 9$ ) were housed without a wheel for 4 wk. An inverted cling test for grip time and Rota-Rod test were performed prior to the 4-wk intervention and at the end. Animals were sacrificed and the soleus (SOL) and extensor digitorum longus (EDL) muscles harvested for physiological contractility.

**RESULTS:** Daily VWR was significantly higher in the young (XY) than the old (XO) mice ( $5.04 \pm 0.64$  vs  $2.72 \pm 0.27$  km,  $P < 0.05$ ). Change from baseline in grip time was significantly higher in CY and XY than CO and XO ( $97.4 \pm 37.3$  and  $96.6 \pm 36.6$  vs  $-12.1 \pm 11.2$  and  $19.0 \pm 26.2$  s, respectively,  $P < 0.05$ ). Change from baseline in Rota-Rod time increased in the young



VWR group (XY) compared to the other 3 groups (XY,  $53.5 \pm 8.6$  vs XO,  $15.2 \pm 7.3$  s; CY,  $-32.0 \pm 16.0$ ; CO,  $-7.8 \pm 9.0$  s, respectively,  $P < 0.05$ ). No differences were found between groups for SOL or EDL muscle contractility (maximal power, specific peak tension, and specific peak twitch). EDL mass was significantly higher in XO compared to CO ( $0.01545$  vs  $0.01122$  g,  $P < 0.05$ ). **CONCLUSION:** While 5 km/d is associated with improved physiological performance in the young as determined by Rota-Rod testing, the mechanism for this improvement is not linked to changes in muscle strength. The lower amount of VWR performed by the old mice is not associated with improvements in physiological performance or muscle contractility, although the exercise may stimulate some muscle hypertrophy in the old.

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**1757** Board #165 **MAY 30** **2:00 PM - 3:30 PM**  
**Body Composition Changes Over A One Year Period**

Simon Smith<sup>1</sup>, Blake Hamill<sup>1</sup>, Tyler Karnes<sup>1</sup>, Taniqua Ward<sup>1</sup>, Dalton Delaney<sup>1</sup>, Kelsey Hubble<sup>1</sup>, Zac Geary<sup>1</sup>, Pam Farris<sup>1</sup>, Justin Steffy<sup>1</sup>, Kayla Garver<sup>1</sup>, Melissa Powers<sup>1</sup>, Michelle Gray<sup>2</sup>. <sup>1</sup>University of Central Oklahoma, Edmond, OK. <sup>2</sup>University of Arkansas, Fayetteville, AR.  
(No relationships reported)

The amounts of lean tissue mass (LTM), fat mass (FM), and bone mineral density (BMD) all play a key role in the health and functioning of older adults. In order to combat age-related changes, it is often advised that individuals participate in resistance training. Understanding the body composition changes in senior adults during one year of resistance training programs at different intensities and velocities could provide the needed knowledge about optimal training protocol for this population.

**PURPOSE:** The purpose of this study was to examine the changes of body composition in older adults over one year of resistance training at either high intensity/low velocity (LV) or low intensity/high velocity (HV).

**METHODS:** Seventeen adults over the age of 75 were randomly assigned to the LV group which performed resistance training at 80% of their one-repetition maximum (IRM) and the HV group which lifted at 50% of their IRM as quickly as possible. All participants started in the LV group for 24 weeks then seven randomly chosen participants transitioned to the HV group. An iDXA was used to measure total body LTM, FM, and BMD at baseline, 24 weeks, and after one year of training. Repeated measures ANOVA were used to analyze interaction and main effects for each outcome ( $\alpha = .001$ ).

**RESULTS:** No significant interaction or main effects were observed for FM, LTM, and BMD. Due to non-significance, univariate effect sizes (d) were calculated for each group. The HV group exhibited a small decrease in LTM ( $d = 0.102$ ), while LTM was maintained in the LV group ( $d = -0.007$ ).

**CONCLUSION:** Although no significant differences were found in LTM, FM, or BMD over the one year, meaningful changes are illustrated by the effect sizes. These results suggest that senior adults who participated in high intensity resistance training can maintain their lean tissue while those who train at a lower intensity are less likely to successfully mitigate the negative age related changes despite moving the weight at a greater velocity. To our knowledge, this is the first study to examine the impact of velocity on body composition over this length of time. This research is important for helping health professionals to understand proper resistance training interventions when attempting to address age related body composition changes.

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**B-31** Free Communication/Poster - Exergaming

MAY 30, 2012 1:00 PM - 6:00 PM  
ROOM: Exhibit Hall

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**1758** Board #166 **MAY 30** **3:30 PM - 5:00 PM**  
**The Training Effects of an Active Video Game on Reaction Time and Power**

Hsuan Su, Yuh-Jen Lin, I-Hua Chu. Kaohsiung Medical University, Kaohsiung, Taiwan.  
(No relationships reported)

An active video game combines with exercise training, thus has a potential to improve health-related fitness, as well as train skill-related fitness in the general population. Reaction time and power are skill-related fitness components that can help individuals maintain their quality of life and deal with unexpected life events. Whether an active video game can be used as a training tool to improve one's reaction time and power is unknown.

**PURPOSE:** The purpose of this pilot study was to examine the training effects of an active video game on reaction time and power in a group of healthy college students.

**METHODS:** Fourteen subjects (mean age  $21.6 \pm 9$  yr, 4 males and 10 females) were recruited from university campus. Subjects were excluded from the study if they answered "YES" to one or more questions in the Physical Activity Readiness Questionnaire (PAR-Q). All eligible subjects completed measures of reaction time and power (Side Step) at study entry and every two weeks during the 4-week training program. When playing the active video game, subjects would encounter different obstacles and must immediately respond to the game with vertical jumping, left and right side stepping, and squatting. The training program was 3 times per week, 20 minutes per session, for 4 weeks. Two separate Repeated Measures Analysis of Variance (ANOVA) and post hoc comparisons were conducted to compare changes in reaction time and power over the 4 weeks.

**RESULTS:** For reaction time, the results showed no significant change after 4 weeks of training ( $277.9 \pm 93$  vs.  $230.0 \pm 53$  ms,  $p = 0.147$ ). For power, the results showed significant improvements in subjects' power after the training program ( $22.7 \pm 9$  vs.  $27.0 \pm 9$  times,  $p < 0.001$ ). In addition, the subjects' power began to improve in as early as 2 weeks ( $22.7 \pm 9$  vs.  $25.3 \pm 9$  times,  $p = 0.001$ ) and continue to improve from 2 to 4 weeks ( $25.3 \pm 9$  vs.  $27.0 \pm 9$  times,  $p = 0.017$ ).

**CONCLUSIONS:** The results of this pilot study indicate that a 4-week active video game training program appears to be effective in improving power in healthy college students. On the other hand, it may require a longer training duration to show any improvements in reaction time in this population. It is suggested that an active video game can be used as a training tool for improving power in young healthy adults.

Supported by NSC Grant NSC100-2815-C-037-003-H.

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**1759** Board #167 **MAY 30** **3:30 PM - 5:00 PM**  
**The Training Effects of an Active Video Game on Balance**

Yuh-Jen Lin, Hsuan Su, I-Hua Chu. Kaohsiung Medical University, Kaohsiung, Taiwan.  
(No relationships reported)

An active video game combined with exercise training may have a potential to improve skill-related fitness in the general population. Both static and dynamic balance play important roles in reducing risk of falls and enhancing exercise performance. Whether an active video game can be used as a training tool to improve one's static and dynamic balance is unknown.

**PURPOSE:** The purpose of this pilot study was to examine the training effects of an active video game on static and dynamic balance in healthy college students.

**METHODS:** Fourteen subjects (mean age  $21.6 \pm 9$  yr, 4 males) were recruited from university campus. Subjects were excluded from the study if they answered "YES" to one or more questions in the Physical Activity Readiness Questionnaire (PAR-Q). All eligible subjects completed measures of static balance (Close-Eyes Single Limb Balance) and dynamic balance (Star Excursion Balance Test, SEBT) at study entry and every two weeks during the 4-week training program. The SEBT tests subjects' dynamic balance in 8 directions: anterior (A), anteromedial (AM), medial (M), posteromedial (PM), posterior (P), posterolateral (PL), lateral (L), and anterolateral (AL). When playing the video game, subjects would encounter different obstacles and must immediately respond to the game with vertical jumping, side stepping, and squatting. The training program was 3 times per week, 20 minutes per session, for 4 weeks. Two Repeated Measures Analysis of Variance and post hoc comparisons were conducted to compare changes in static and dynamic balance over the 4 weeks.

**RESULTS:** The results showed significant improvement in static balance after the 4-week training program ( $35.2 \pm 32$  vs.  $63.7 \pm 42$  s,  $p = 0.015$ ). For dynamic balance, there was no significant improvement in three directions, including A, AL, and AM. Dynamic balance in all other directions have improved significantly for both legs after training (L,  $0.80 \pm 0.2$  vs.  $0.96 \pm 0.1$ ,  $p < 0.001$ ; PL,  $1.04 \pm 0.1$  vs.  $1.12 \pm 0.1$ ,  $p = 0.003$ ; P,  $1.06 \pm 0.1$  vs.  $1.14 \pm 0.1$ ,  $p = 0.002$ ; PM,  $1.08 \pm 0.1$  vs.  $1.14 \pm 0.1$ ,  $p = 0.012$ ; M,  $1.05 \pm 0.1$  vs.  $1.10 \pm 0.1$ ,  $p = 0.007$ ) (data for right leg).

**CONCLUSIONS:** The results of this pilot study suggested that an active video game might be used as a training tool for improving static and dynamic balance in young healthy adults.

Supported by NSC Grant NSC100-2815-C-037-003-H.

1760 Board #168 MAY 30 3:30 PM - 5:00 PM

**The X-box Exergaming System Requires More Physical Activity Than The Wii Or Playstation Platforms**

Ellis B. Jensen<sup>1</sup>, Enrique A. Becwar<sup>2</sup>. <sup>1</sup>Utah Valley University, Orem, UT. <sup>2</sup>Viterbo University, La Crosse, WI. (Sponsor: Tim Gavin, FACSM)  
(No relationships reported)

Exergaming couples exercise with gaming and may increase physical activity, fitness, and health in its players. While all exergaming systems require physical activity, differences in motion detection capability between the gaming platforms may cause some systems to less accurately measure activity in players.

**PURPOSE:** To determine whether the superior motion tracking of the Xbox Kinect (Xbox) system requires players to expend more energy than players of the Wii Fit (Wii) and PlayStation Move (PS3) platforms.

**METHODS:** Subjects played each of the three exergaming systems at high intensity (High) and tried to earn the highest possible score. They also played with the lowest effort possible (Low) that still allowed them to reach the same high score as during the High trial. Energy expenditure was estimated during game play by SenseWear activity monitors and by the exergaming systems.

**RESULTS:** As measured by the SenseWear device, the Wii and PS3 allowed less vigorous activity in the Low trial than in the High trial. However, the Wii and PS3 gaming systems did not recognize decreased activity in the Low compared to the High trial. The Xbox tracked player movement very well and required players in the Low trial to expend relatively the same amount of calories as players in the High group.

| Platform | Trial | System (cal) | $\delta$ =High-Low (cal) | p-value | SenseWear (cal) | $\delta$ =High-Low (cal) | p-value |
|----------|-------|--------------|--------------------------|---------|-----------------|--------------------------|---------|
| Wii      | High  | 74           | 19                       | .114    | 90              | 44                       | .049*   |
|          | Low   | 55           |                          |         | 46              |                          |         |
| PS3      | High  | 107          | 6                        | .57     | 118             | 52                       | .023*   |
|          | Low   | 101          |                          |         | 66              |                          |         |
| Xbox     | High  | 59           | 5                        | .602    | 72              | 3                        | .766    |
|          | Low   | 54           |                          |         | 69              |                          |         |

**CONCLUSION:** Both the Wii and PS3 platforms allowed players to perform well in games while exerting very little effort in the Low trial. The Xbox exergaming platform only rewards high physical activity levels with high gaming scores. This study suggests that the Xbox platform is a better option than the Wii and the PS3 systems for players trying to increase their physical activity through exergaming.

1761 Board #169 MAY 30 3:30 PM - 5:00 PM

**Influence of Wii Fit Plus Exercises on Lower Extremity Strength and Balance in Middle-Aged Adults**

Renee M. DeSalvo, Brandon S. Pollock, Nicholas T. Potenzini, Ronald Otterstetter, Judi A. Juvancic-Heltzel, Carrie Fister. *The University of Akron, Akron, OH.*  
(Sponsor: Gary H. Kamimori, FACSM)  
(No relationships reported)

**BACKGROUND:** Regular exercise can decrease the risk of falls, fractures, low back pain, and joint injuries by improving balance and strength. The WiiFit Plus incorporates programs such as yoga, strength training, aerobics, and balance games which are intended to improve balance, strength, flexibility, fitness, and general well-being.

**PURPOSE:** The purpose of this study was to examine the effect of WiiFit Plus exercises on lower leg muscular strength and balance in middle-aged adults.

**METHODS:** Three (3) healthy males (age  $53.3 \pm 2.3$  yrs) and 22 healthy females (age  $51.4 \pm 6.2$  yrs) were randomized into a control group ( $n=12$ ) and experimental group ( $n=13$ ) based on Godin Leisure Time Exercise Questionnaire results. Baseline strength (quadriceps, hamstrings, peroneals and tibialis anterior) using a computerized dynamometer and balance (overall stability index, anterior/posterior index and medial/lateral index) were assessed. The experimental group attended 40 minute WiiFit Plus exercise sessions on 2 non-consecutive days for eight weeks. Workload was modified on a biweekly basis based on heart rate and rate of perceived exertion (RPE). The control group continued normal activities of daily living. After eight weeks, post-intervention strength and balance measurements were assessed for both groups.

**RESULTS:** The experimental group demonstrated greater ( $p=0.02$ ) gains in quadriceps strength at  $90^\circ$  ( $8.28 \pm 15.8$  ft-lbs) than the control group ( $-11.57 \pm 22.0$  ft-lbs). No significant gains were observed ( $p \geq 0.08$ ) in all other dependent variables for lower extremity strength and balance.

**CONCLUSION:** Based on the results achieved, positive trends comparing the mean differences of the experimental population to the control group indicate that the Wii Fit Plus may be an effective supplement to exercise and a useful tool in preventing and/or improving functional deficiencies in the knee or ankle.

1762 Board #170 MAY 30 3:30 PM - 5:00 PM

**The Effects of Using a Gaming System to Improve Balance Parameters in Phase III Cardiac Rehabilitation Patients**

Peter Ellison<sup>1</sup>, Kent D. Johnson, FACSM<sup>1</sup>, Denny Pon<sup>2</sup>, Mary Beth Riley<sup>2</sup>. <sup>1</sup>Lipscomb University, Nashville, TN. <sup>2</sup>Saint Thomas Hospital, Nashville, TN.  
(No relationships reported)

Falls are a primary concern in geriatric populations and can result in critical injuries or even death. Fall prevention programs and balance exercises should be included in any exercise program developed specifically for individuals whose balance is compromised due to age or compromised health.

**PURPOSE:** The purpose of this project was to test the effectiveness of the Nintendo® Wii Fit Plus gaming system for improving balance in Phase III Cardiac Rehabilitation patients.

**METHODS:** Twenty-three Phase III Cardiac Rehabilitation patients from a local Cardiac Rehabilitation Program volunteered for the study. Subjects were initially pre-tested for balance equilibrium using The Berg Balance Scale and for lower body strength using the 30-second sit-stand test from the Senior Fitness Test. Following initial testing, subjects were required to participate in a total of 20 balance class sessions (three days per week) over a 12-week period. After the 12-week training period, subjects were retested for balance equilibrium (Berg Balance Scale) and lower body strength (30-second sit-stand test).

**RESULTS:** Results from The Berg Balance Scale test demonstrated a significantly improved balance score ( $42 \pm 4.06$  to  $50 \pm 3.65$ ;  $p < 0.05$ ) in these Phase III Cardiac Rehabilitation subjects. There were no significant changes ( $p > 0.05$ ) in the lower body strength scores (pre-test to post-test).

**CONCLUSION:** These data demonstrate the potential for using the Nintendo® Wii Fit Plus as an effective program to improve balance equilibrium in Phase III Cardiac Rehabilitation patients.

1763 Board #171 MAY 30 3:30 PM - 5:00 PM

**Heart Rate, Oxygen Consumption, and Ventilation due to Different Physically Active Video Game Systems**

Krista Scheer<sup>1</sup>, Sarah Siebrandt<sup>1</sup>, Gregory A. Brown, FACSM<sup>1</sup>, Brandon S. Shaw<sup>2</sup>, Ina Shaw<sup>3</sup>. <sup>1</sup>University of Nebraska Kearney, Kearney, NE. <sup>2</sup>Tshwane University of Technology, Johannesburg, South Africa. <sup>3</sup>Monash South Africa, Johannesburg, South Africa.  
(No relationships reported)

Several years ago, the Nintendo Wii ushered in the era of “physically active” home video game systems. Since then, the Sony Move and XBOX Kinect have been introduced as alternate “physically active” home video game systems. All of these gaming systems involve movement of the player to control on-screen game play, rather than simply pushing buttons.

**PURPOSE:** The purpose of this study was to compare heart rate, oxygen consumption, and ventilation while playing three similar hand to hand combat style games when playing Nintendo Wii Boxing, XBOX Kinect Boxing, and Sony Move Gladiatorial Combat.

**METHODS:** Twelve college aged participants (19.7 ± 1.0 y, 175.2 ± 6.8 cm, 76.0 ± 20.7 kg, 25.9 ± 9.9 % Body Fat) were assessed for resting heart rate, oxygen consumption, and ventilation. The participants then engaged in a maximal exercise test evaluating heart rate, oxygen consumption, and ventilation. On another day, in a randomly assigned manner, the participants played Nintendo Wii Boxing, XBOX Kinect Boxing, and Sony Move Gladiatorial Combat against either a computer or human opponent for 8 minutes in each condition.

Table 1. Heart rate, oxygen consumption, and ventilation (Data are means ± sd).

|                                | Wii Boxing<br>(Computer<br>Opponent) | Wii Boxing<br>(Human<br>Opponent) | Kinect<br>Boxing<br>(Computer<br>Opponent) | Kinect<br>Boxing<br>(Human<br>Opponent) | Move<br>Gladiatorial<br>Combat<br>(Computer<br>Opponent) | Move<br>Gladiatorial<br>Combat<br>(Human<br>Opponent) |
|--------------------------------|--------------------------------------|-----------------------------------|--|---|--|---|
| Heart Rate<br>(beats/min)      | 104.1 ± 14.0                         | 108.0 ± 12.1                      | 108.4 ± 12.3                               | 110.0 ± 13.5                            | 110.9 ± 15.5   | 109.6 ± 9.2   |
| VO <sub>2</sub><br>(ml/kg/min) | 8.9 ± 3.8                            | 9.1 ± 2.5                         | 9.7 ± 2.0                                  | 10.5 ± 2.2                              | 9.4 ± 3.3  | 9.0 ± 1.9   |
| VO <sub>2</sub><br>(L/min)     | 0.7 ± 0.3                            | 0.7 ± 0.2                         | 0.8 ± 0.4                                  | 0.8 ± 0.2                               | 0.7 ± 0.3  | 0.7 ± 0.3   |
| VE(L/min)                      | 19.5 ± 7.0                           | 19.5 ± 5.4                        | 20.4 ± 9.9                                 | 21.0 ± 4.7                              | 20.0 ± 7.9   | 19.5 ± 6.1  |

**CONCLUSIONS.** Playing Nintendo Wii Boxing, XBOX Kinect Boxing, and Sony Move Gladiatorial Combat all increase heart rate, oxygen consumption, and ventilation above resting levels. However, the magnitude of increase in heart rate, oxygen consumption, and ventilation is not influenced by gaming system, or playing against another person. Overall, playing a “physically active” home video game system meets only the minimal threshold for moderate intensity physical activity.

1764 Board #172 MAY 30 3:30 PM - 5:00 PM

**Is Exergaming Appropriate For At-Home Physical Therapy?**

Enrique A. Becwar<sup>1</sup>, Ellis B. Jensen<sup>2</sup>. <sup>1</sup>Viterbo University, La Crosse, WI. <sup>2</sup>Utah Valley University, Orem, UT. (Sponsor: Tim Gavin, FACSM)  
(No relationships reported)

**INTRODUCTION:** Today’s sedentary American lifestyle has led to decreased health and greater rates of obesity in recent years. Some physical therapy clinics have begun to use exergaming (video games that include an exercise component) to help patients complete at-home exercises prescribed to improve patient recovery. Key to this function is the exergaming system’s ability to accurately track specific body motion.

**PURPOSE:** To assess the ability of the Wii Fit (Wii), PlayStation Move (PS3), and Xbox Kinect (Xbox) to track body motion.

**METHODS:** Volunteer subjects played the Wii, PS3, and Xbox systems at two intensities: high intensity (Full) and low intensity (Relaxed). During Full trials, subjects tried to obtain the highest score possible. During Relaxed trials, subjects used as little energy as possible while earning the same scores they had during Full trials. Total energy expenditure was estimated using SenseWear activity bands and the exergaming systems. Paired t-tests identified systems that were not able to detect motion differences in subjects during Full and Relaxed trials.

**RESULTS:** The PS3 and the Wii were both unable to detect motion differences in subjects exercising at high or low intensity. The Xbox differentiated high from low-intensity movements and required subjects to expend similar energy during Full and Relaxed trials.

|      | Level | Activity band<br>(cal) | Difference<br>(cal) | P-Value Full<br>vs. Relaxed | Exergame<br>(cal) | Difference<br>(cal) | P-value Full vs.<br>Relaxed |
|------|-------|------------------------|---------------------|-----------------------------|-------------------|---------------------|-----------------------------|
| Wii  | High  | 90                     | 44                  | 0.049                       | 74                | 19                  | 0.114                       |
|      | Low   | 46                     |                     |                             | 55                |                     |                             |
| PS3  | High  | 118                    | 52                  | 0.023                       | 107               | 6                   | 0.57                        |
|      | Low   | 66                     |                     |                             | 101               |                     |                             |
| Xbox | High  | 72                     | 3                   | 0.766                       | 59                | 5                   | 0.602                       |
|      | Low   | 69                     |                     |                             | 54                |                     |                             |

**CONCLUSION:** The Wii and PS3 are unable to differentiate between vigorous and relaxed body movement while the Xbox was able to differentiate body movements and hold the user to higher movement standards. This ability may allow the Xbox to play a role in at-home physical therapy.

1765 Board #173 MAY 30 3:30 PM - 5:00 PM

**Assessment of the Aerobic and Muscular Demands of Playstation Move’s Table Tennis and Gladiator Games.**

Randi Lite, Dana Griffin, Natalie Moy. Simmons College, Boston, MA.  
(No relationships reported)

**PURPOSE:** to determine central demand (HR, METS) and local demand (EMG) while playing Playstation Move’s Table Tennis and Gladiator Games. Muscle activity while gaming is compared with muscle activity while performing a muscle endurance test specific for each of the four muscles assessed.

**METHODS:** Eight healthy, college-aged volunteers had EMG recordings of the dominant side of rectus femoris, rectus abdominus, lattisimus dorsi, and pectoralis major made during a 1-minute curlup test, a 1 minute pushup test, a 1 minute modified pullup test, and the Forestry Step Test. The subjects completed a 20-minute tutorial, then played each game for 3 minutes in randomized order with 2-3 minutes rest between games. EMG activity, heart rate, RPE, and VO<sub>2</sub> were recorded. RMS values for each muscle were calculated, both while playing the games and while performing the muscle endurance tests.

**RESULTS:** Gladiator produced a HR of  $67.0 \pm 7.65\%$  of predicted HRmax and an intensity of  $2.87 \pm 1.21$  METs. The mean RPE was  $10.2 \pm 3.0$ . There was no significant difference in RMS for any muscle compared with its corresponding 1-minute muscle endurance test. Table Tennis produced a HR of  $57.3 \pm 7.83\%$  of predicted HRmax and an intensity of  $2.13 \pm 0.39$  METs. The mean RPE was  $7.5 \pm 1.6$ . The RMS for the rectus femoris during table tennis was significantly less than the RMS during the Step Test. Gladiator had a significantly greater RPE ( $p=.02$ ) and HR ( $p=.01$ ) compared with Table Tennis.

| Muscle           | Muscle Endurance Test RMS | Gladiator RMS  | Table Tennis RMS |
|------------------|---------------------------|----------------|------------------|
| Pectoralis major | $0.47 \pm .18$            | $0.65 \pm .56$ | $0.41 \pm .32$   |
| Rectus abdominis | $0.42 \pm .56$            | $0.94 \pm .87$ | $0.78 \pm .86$   |
| Latissimus dorsi | $0.38 \pm .23$            | $.61 \pm .51$  | $0.40 \pm .37$   |
| Rectus femoris   | $2.07 \pm .79$            | $1.13 \pm .70$ | $0.81 \pm .57^*$ |

\* $p=.02$

**CONCLUSION:** ACSM Guidelines suggest 30 minutes of moderate activity (3-6 METS) for 5-7 days/week. Both games were below the 3 MET level. The RMS for four muscles were not different from standard muscle endurance activities, suggesting that the games may develop muscle endurance at least on the dominant side.

## B-32 Free Communication/Poster - Fitness and Performance Testing I

MAY 30, 2012 1:00 PM - 6:00 PM

ROOM: Exhibit Hall

### 1766 Board #174 MAY 30 3:30 PM - 5:00 PM

#### Anaerobic Power Output in College Division 2 Athletes

Steve Burns, Brian Hughes, Andrew Gai, Aryn Lessmeier, Curtis Sartin, Trevor Swaine, Halie Thomas, Casandra Davis. *University of Central Missouri, Warrensburg, MO.*

(No relationships reported)

The Wingate anaerobic test is considered to be an accurate measure of anaerobic capacity of an individual.

**PURPOSE:** The purpose of this study was to begin development of updated norms of division 2 college athletes for peak power (PP) mean power (MP), and fatigue index (FI) on the Wingate anaerobic test using advanced technology (RacerMate® Velotron).

**METHODS:** A total of 337 athletes participated in their respective preseason weeks. After signing IRB approved informed consent, subject's height and weight was measured (Inbody520, Biospace Inc, CA). Subjects were guided through the Wingate procedures, after a 5 minute warm-up including 2-3, 10 sec sprints. Wingate 30 second test consisted of a 5 second sprint before the calculated resistance was applied ( $.075 \text{ kg} \cdot \text{kg}^{-1}$ ). Peak Power (PP) and Mean Power (MP) in both watts and watts/kg were recorded in addition to fatigue index.

**RESULTS:** The data indicate that football athletes have the highest PP ( $1604.9 \pm 289.0\text{W}$ ), MP ( $787.7 \pm 95.6\text{W}$ ) and FI ( $41.6 \pm 9.9\text{W} \cdot \text{sec}^{-1}$ ). Men's track and cross country produced the highest MP relative to body weight ( $8.4 \pm 7.0\text{W} \cdot \text{kg}^{-1}$ ) and women's track and cross country produced the lowest FI ( $10.7 \pm 2.8\text{W} \cdot \text{sec}^{-1}$ ) (See table below).

**CONCLUSION:** Based on the current data, these results provide norms for comparison of peak anaerobic power and mean anaerobic power in division 2 college athletes. Additionally Football players exhibit higher power output than other sports represented.

| Anaerobic Power      |    |         |        |           |        |           |            |
|----------------------|----|---------|--------|-----------|--------|-----------|------------|
| Sport                | N  | Wt (kg) | PP (W) | PP (W/kg) | MP (W) | MP (W/kg) | FI (W/sec) |
| Volleyball           | 27 | 72.6    | 776.6  | 10.7      | 503.1  | 7.0       | 14.7       |
| Baseball             | 42 | 87.7    | 1158.9 | 13.3      | 682.6  | 7.8       | 23.9       |
| Women's Basketball   | 12 | 72.8    | 816.6  | 11.0      | 545.5  | 7.3       | 14.8       |
| Men's Basketball     | 16 | 89.6    | 1133.9 | 12.6      | 719.7  | 8.0       | 23.0       |
| Softball             | 17 | 72.7    | 634.9  | 9.5       | 400.4  | 6.0       | 12.5       |
| Wrestling            | 53 | 83.1    | 981.7  | 12.2      | 617.2  | 7.7       | 19.2       |
| Women's Track and CC | 11 | 58.7    | 637.2  | 10.9      | 412.5  | 7.0       | 10.7       |
| Men's Track and CC   | 17 | 71.1    | 896.2  | 12.7      | 597.3  | 8.4       | 15.8       |
| Golf                 | 15 | 77.7    | 981.0  | 11.8      | 612.6  | 8.3       | 20.5       |
| Soccer               | 38 | 61.7    | 670.9  | 11.0      | 422.6  | 7.0       | 12.6       |
| Football             | 75 | 102.6   | 1604.9 | 15.8      | 787.7  | 8.0       | 41.6       |
| Bowling              | 14 | 75.8    | 962.0  | 12.4      | 575.0  | 7.7       | 20.1       |

### 1767 Board #175 MAY 30 3:30 PM - 5:00 PM

#### Assessment Of Leg Power Using Stairs With A Low Step Height In Elderly

Yutaka Yoshitake<sup>1</sup>, Yoshiki Kawano<sup>2</sup>, Akiyo Higashionna<sup>1</sup>, Goichiro Yoshida<sup>1</sup>, Xiang Fan<sup>1</sup>, Takafumi Hamaoka, FACSM<sup>3</sup>. <sup>1</sup>National Institute of Fitness and Sports in Kanoya, Kanoya, Japan. <sup>2</sup>Laboratory of Physical Science Inc, Fukuoka, Japan. <sup>3</sup>Ritsumeikan University, Kusatsu, Japan.

(No relationships reported)

A stair-climbing power test using ordinary stairs is an inexpensive test that is simple to perform. This test can also be completed in less than 1 minute. However, there has so far been no report on the usefulness of using stairs with a lower step height to assess the leg muscle power in elderly people as a field test.

**PURPOSE:** To determine the usefulness of the low height step stair-climbing power (LSSCP) test by comparing the results obtained from the LSSCP test with those from a knee extension torque (KET), leg extensor power (LEP), Time Up & Go (TUG) test and 10 m maximal walking speed (MWS) in elderly people.

**METHODS:** The subjects of this study consisted of healthy elderly men (N=65, aged 71.1+/-5.6 yrs) and women (N=146 aged 70.3+/-5.9 yrs). The LSSCP was measured using stairs with a lower height step (9 cm step height, 10-stair flights, 72 cm total height). The time spent in stair climbing was measured by a contact mat connected to an electronic timer. The circuit automatically opens at take off and closes when the subjects touch the mat. The subjects were instructed to ascend the stairs as fast as they could. The stair-climbing power was then calculated with the body mass, the time spent in stair climbing, the vertical height travelled, and the gravitational acceleration. The bilateral LEP was measured using an isotonic leg power measuring system in a sitting position. The KET was measured on each side of the knee using a specially designed dynamometer. The test-test reliability of LSSCP was determined in the participants by using an intraclass correlation coefficient (ICC) model.

**RESULTS:** The LSSCP was 201.2±/30.6 watts (mean +/- SD) for men and 179.7±/24.4 watts for women. The LSSCP significantly correlated with KET (p<0.001), LEP (p<0.05), MWS (p<0.05) and TUGT (p<0.05) in elderly men and women, respectively. The ICC value of LSSCP was 0.73 for men and 0.84 for women, thus indicating a good reliability. A significantly negative correlation was found between LSSCP and age in both genders (p<0.05).

**CONCLUSION:** From a practical viewpoint for use as a field test, the LSSCP test was found to be useful for assessing the functional leg power levels in community-dwelling elderly people.

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**1768** Board #176 MAY 30 3:30 PM - 5:00 PM

**Leg Power in Elite Male Fencers: A Comparative Study among the Three Competitive Disciplines**

Gustavo D. Aquilino, Aldo F. Longo, Néstor A. Lentini. *Exercise Physiology Laboratory, National Sport High Performance Center (CeNARD), Buenos Aires, Argentina.*

(No relationships reported)

The motor response of a fencer is required to be fast and explosive. Leg power plays a key role in the competitive fencing disciplines.

**PURPOSE:** To compare leg power performance of elite male fencers by competitive discipline.

**METHODS:** Data of 18 fencers who took part in the Argentine national team were considered in the study (Age = 24.38 ± 5.26 yr, Weight = 74.82 ± 8.16 kg, Height = 1.81 ± 0.06 m; mean ± SD). Three groups of 6 subjects each were defined according to the competitive disciplines of the sport: Épée, Foil and Sabre. Leg Power was indirectly measured through the assessment of height jumped following three well-known protocols: Abalakov Jump, Counter Movement Jump and Squat Jump. A contact platform was used to assess height jumped. Lewis formula was employed for calculation of Average Power (AP). Based on data gathered over several years, the best performance of each subject was selected for the analyses. ANCOVAs were conducted on AP for Abalakov, Counter Movement and Squat Jumps; Weapon was the independent factor in the analyses and Weight was introduced as a covariable. Linear associations among the three vertical jumps were evaluated on the whole sample by means of Pearson correlation tests; height jumped was used for these analyses.

**RESULTS:** Sample means of height jumped in cm for Épée, Foil and Sabre were, respectively, 51.77, 51.52 and 53.42 in Abalakov Jump; 44.83, 45.43 and 46.95 in Counter Movement Jump; and 38.97, 39.80 and 41.02 in Squat Jump. ANCOVAs on AP were not statistically significant (p>0.05) for Weapon for any of the tests: Abalakov Jump (1159.7, 1168.0 and 1182.1 W; F = 0.14), Counter Movement Jump (1080.6, 1096.1 and 1109.8 W; F = 0.41) and Squat Jump (1011.2, 1024.8 and 1037.1 W; F = 0.24). As predictable, there were found high correlations among vertical jumps ( $r_{A,C} = 0.92$ ,  $r_{A,S} = 0.83$ ,  $r_{C,S} = 0.91$ ; p<0.05).

**CONCLUSIONS:** The results obtained showed negligible differences in AP among the three disciplines of the sport. It would be desirable to obtain further statistical evidence from a larger sample size.

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**1769** Board #177 MAY 30 3:30 PM - 5:00 PM

**Effects of Self Myofascial Release & Static Stretching on Anaerobic Power Output**

Jeffrey M. Janot, Brittany Malin, Ryan Cook, Jacob Hagenbucher, Andrew Draeger, Melissa Jordan, Gary Van Guilder. *University of Wisconsin-Eau Claire, Eau Claire, WI.* (Sponsor: Mark Blegen, FACSM)

(No relationships reported)

The application of pre-exercise self-myofascial release (MFR) techniques to enhance exercise performance is an understudied topic. In contrast, the effects of pre-exercise static stretching (SS) are well-known, especially in regards to changes in anaerobic performance variables such as sprinting speed and vertical jump. Less is known specific to the effects of SS on cycling performance.

**PURPOSE:** The aim of this study was to determine the effects of SS and MFR on anaerobic power output.

**METHODS:** Cycling (30-sec Wingate) tests were used to assess power output in 9 male and 14 female subjects. Peak power output (PPO) and percent power drop (PPD) were examined among subjects to determine the differences between interventions.

**RESULTS:** In female subjects, PPO was significantly reduced following SS, in comparison to control (Control: 536.29 ± 69.11 W; SS: 508.30 ± 67.10 W). PPD was significantly decreased in the SS and MFR treatments compared to the control (Control: 44.95 ± 5.29%; SS: 40.45 ± 6.69%; MFR: 41.53 ± 5.97%). In male subjects, PPO was significantly increased following SS, in comparison to control (Control 850.62 ± 165.41 W; SS: 881.14 ± 169.33 W). PPD was significantly increased in MFR compared to the control group (Control: 44.69 ± 7.75%; MFR: 48.91 ± 8.27%).

**CONCLUSIONS:** The effects of MFR on anaerobic power output appear to be gender specific with evidence of a positive effect on performance in women. Given that there is very little scientific inquiry with respect to the influence of MFR on maximal anaerobic power performance, it can only be speculated on the possible mechanisms for the gender disparity.

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**1770** Board #178 MAY 30 3:30 PM - 5:00 PM

**Effects Of Temperature And Prior Sprint Efforts On Maximum Cycling Power And Optimal Pedaling Rate**

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(No relationships reported)

Warm up protocols are commonly used prior to exercise, particularly before maximal power performance. Specifically, these protocols may serve to increase muscle temperature and to provide potentiation of muscle force production. However, warm-ups must balance increasing muscle temperature and inducing muscle fatigue.

**PURPOSE:** To determine the effects of passive warm-up, active warm-up, passive cooling, and prior maximal cycling on maximum cycling power ( $P_{max}$ ) and optimal pedaling rate ( $RPM_{opt}$ ).

**METHODS:** Twelve participants (mass 69 ± 13 kg, height 173 ± 7 cm, age 25 ± 5 yrs) performed two maximal cycling trials on an inertial load ergometer before and after three different experimental treatments: passive warm-up, active warm-up, and passive cooling. For the passive warm-up and cooling treatments, participants were immersed up to iliac crest for 30 min in 40° C and 18° C water, respectively. For the active warm-up, participants rested at room temperature for 25 min, then performed a 5 min cycling warm-up at 100-120 rpm.

**RESULTS:**  $P_{max}$  increased by 6 ± 5% (906 ± 214 vs. 961 ± 216 W, p < 0.001) and 8 ± 4% (908 ± 230 vs. 983 ± 249 W, p < 0.001) following the passive and active warm-ups, respectively, and decreased by 23 ± 6% (955 ± 238 vs. 738 ± 187 W, p < 0.001) following passive cooling. Compared to baseline, passive and active warm-up increased  $RPM_{opt}$  (114 ± 13 vs. 122 ± 15 rpm and 114 ± 9 vs. 127 ± 11 rpm, respectively, p < 0.05), whereas passive cooling decreased  $RPM_{opt}$  (116 ± 7 vs. 101 ± 11 rpm, p < 0.01). Following passive and active warm-ups, there was no additional increase in  $P_{max}$  between the first and second maximal cycling trials.

**CONCLUSION:** These results indicate that passive and active warm-ups increased  $P_{max}$  by similar magnitudes whereas passive cooling substantially compromised  $P_{max}$ . Temperature also influenced  $RPM_{opt}$ , likely reflecting effects on muscle shortening velocity. Although  $P_{max}$  increased following passive and active warm-ups, there was no further increase following the first maximal trial, suggesting that no additional potentiation occurred. Finally, these results may have implications for athletes who warm-up before performing short duration maximal effort tasks. That is, passive warm-up may provide an alternative strategy for increasing temperature while minimizing fatigue.

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**1771** Board #179 MAY 30 3:30 PM - 5:00 PM

**Comparison of Peak Power for Cycling on Ergometer and Trainer**

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(No relationships reported)

The ability of a cyclist to produce peak power may be related to the apparatus that is used for testing. Laboratory research has an advantage of tighter control compared to field studies; however, ecological validity is important for application to the target population and environment. A stationary cycle ergometer is often the default instrumentation for lab data collections, but results may not generalize well because a cycle ergometer may differ substantially from a cyclist's own bicycle. A stationary trainer equipped with the cyclist's own bicycle compared to an ergometer can be used to address this concern.

**PURPOSE:** To compare peak power during cycling on an ergometer and a stationary trainer.

**METHODS:** Highlytrained cyclists ( $n = 5$ , age =  $37.6 \pm 4.5$  yr,  $VO_2$  peak =  $63.3 \pm 5.3$  ml/kg-1/min-1) performed a peak power test, in randomized order, on an modified Monark ergometer and CycleOps Supermagneto trainer. After adequate warm-up, subjects ramped up by self-selecting gear and cadence on the trainer until self-determined peak power was achieved. On the ergometer, subjects increased to peak cadence just prior to application of a resistance equal to  $6.7 \pm 1.0\%$  of body weight. For the ergometer, cadence was determined by video analysis (Vicon motion analysis system).

**RESULTS:** Peak power was significantly ( $p = .026$ ) greater on the trainer ( $925.0 \pm 162.5$  W) compared to the ergometer ( $840.0 \pm 154.7$  W).

**CONCLUSION:** Subjects were able to produce 10% higher power on the trainer compared to the ergometer. The increased ability to produce power on the trainer is likely due to subjects being more familiar and better fitted to their own bicycles.

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**1772** Board #180 MAY 30 3:30 PM - 5:00 PM

**Revisiting The Relationship Between Power And Time To Fatigue**

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(No relationships reported)

A well-established model, Critical Power, has been extensively used in numerous endurance sports to characterize an individual's work performance; anaerobic work capacity and critical power. A linear relationship between the work and time to fatigue, given by  $Work = AWC + CP \cdot t$ , was initially proposed by Monod and Scherrer in 1965 in small muscle groups and was extended to whole-body exercise by Moritani et al. in 1981. This linear relationship was determined from plotting the limit work expressed in the product of force and limit time against the limit time. Since limit time is indirectly plotted against each other, the relationship will inevitably be linear.

**PURPOSE:** To revisit the relationship between power and time to fatigue in rowing exercise using a mathematically equivalent critical power model,  $Power = AWC/t^n + CP$ .

**METHODS:** Ergometer testing results (power outputs for 1 minute, 1000m, 2000m, and 6000m) were obtained from 55 male ( $19.48$  yrs  $\pm 3.34$ ) and 35 female ( $20.63$  yrs  $\pm 3.16$ ) athletes. Power output for 1 minute, 1000m, and 6000m were used to determine the relationship (exponent  $n$  in the above equation) between power and time to fatigue. This relationship is then used to construct a critical power model for each individual athlete. Together with the theoretical 2000m power output curve, a predicted 2000m power output can be calculated through numerical methods. Power output comparisons were made using two-sample independent t-tests for the traditional model relationship and the new model relationship.

**RESULTS:** The exponent  $n$  of the critical power model was determined to be  $0.3998$  ( $p < 0.001$ ). The predicted 2000m power outputs from the traditional relationship ( $n=1$ ) showed a significant difference from the actual 2000m power outputs ( $t=2.14$   $p=0.0337$ ), while the 2000m power outputs from the new relationship ( $n=0.5$ ) showed no significant difference from the actual 2000m power output result ( $t=1.03$   $p=0.3045$ ).

**CONCLUSION:** The new relationship ( $n=0.5$ ) between power and time to fatigue appears to predict the actual 2000m power output better than the traditional relationship ( $n=1$ ) between power and time to fatigue.

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**1773** Board #181 MAY 30 3:30 PM - 5:00 PM

**Effects of Football Equipment on Power in High School Players**

Stefan L. Bergeron, Brian J. Campbell, Torie M. Guidry, Cole M. Thompson. *University of Louisiana at Lafayette, Lafayette, LA.*

(No relationships reported)

Traditional speed testing of football players has normally been done in the absence of game equipment. Research in the area of football equipment's impact on strength and conditioning assessments is limited. Determining power from 40-yard dash times in the use and absence of football equipment can give coaches valuable insight on athletes' potential. Changes to functional power (FP) in the presence of game equipment have yet to be investigated in the 40-yard dash.

**PURPOSE:** To assess changes in FP during the 40-yard dash with football equipment (EQ) and with no football equipment (NEQ).

**METHODS:** Sixty-four high school football players (weight:  $78.28 \pm 15.45$  kg) were timed in the 40-yard dash on a natural grass field using an automatic timing system with a high speed video camera (30 frames/sec), starter pistol, receiver, and timing software. Players performed two trials with nylon shorts and a t-shirt, then two trials with standard issued football game equipment. The fastest times of the two trials for each condition were used for analysis. A paired samples t-Test was utilized to assess the significance between 40-yard dash EQ and NEQ at an alpha level of 0.05.

**RESULTS:** There was a significant increase in power with EQ condition ( $t = 11.040$ ,  $p < .001$ ).

**CONCLUSION:** Literature suggested that speed decreased with the addition of football equipment, but measuring and understanding power increase can be beneficial to coaches and trainers. Certain players may be capable of handling increased overall lean muscle mass while still having quality on-field performance. Poor FP with equipment can be identified in order for coaches to implement a specific conditioning program.

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**1774** Board #182 MAY 30 3:30 PM - 5:00 PM

**Football Equipment Effects on 20-yard Agility Power in High School Football Players**

Brittany S. Richard, Lauren E. Miller, Brian J. Campbell, Katie C. Morgan, Stefan L. Bergeron, Cole M. Thompson, Torie M. Guidry. *University of Louisiana at Lafayette, Lafayette, LA.*

(No relationships reported)

Traditional sports performance test does not incorporate (game like) conditions when determining the speed or agility of an athlete. Agility power testing with equipment (APE) gives more evidence on how the players will perform in game like situations than testing without equipment (APW). This also gives coaches valuable insight on the players potential and further allows them to implement effective conditioning programs specific to the individual.

**PURPOSE:** To assess the effects of football equipment on agility power in High School Football players. **Method:** 64 high school football players (weight:  $78.28 \pm 15.45$  kg) were timed in the 20 yard agility run on a natural grass field. Each player was tested in two trials of both APE and APW conditions. Agility time was administered by experienced, hand held timers with the best trial being used for analysis. Power scores were then calculated and compared using a paired samples t-test.

**RESULTS:** A significant difference was noted between APE and APW ( $t = 5.679$ ,  $p < .001$ ).

**DISCUSSION:** The results suggest that players significantly increase their agility power with equipment. Coaches can use this information to target players with higher power output in presence of added equipment. This implies that players with higher power output may transition more lean muscle mass to the football field. Participants who demonstrate less power than average should be targeted for improvement through specific strength and conditioning.

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**1775** Board #183 MAY 30 3:30 PM - 5:00 PM

**Cross Training Program Induces Specific Changes on Anthropometric Profile and Leg Power in Women Dancer**

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(No relationships reported)

Cross training is a fitness method which incorporates various activities in a work session; it reduces the risk of overload injury, increases the quality of movement and improves technique. Scientific literature about the results of morphological evaluation of physical performance or administration of dancers training programs is currently limited, therefore, knowledge of the morphology of the dancers will provide training tools to develop the basic and specialized skills in dance activity.

**PURPOSE:** To evaluate the effect of a specific fitness program based on "cross training" technique on anthropometric and physical performance profile of a semi-professional dancers group.

**METHOD:** The participants were nine women dancers 20 to 24 years of age. The evaluation of anthropometric profile, the proportional sum of six skinfolds (PS6S), the feeding and physical

performance (aerobic capacity, muscular strength, leg power and others), was performed before and after to apply the cross training program (12 weeks). Descriptive statistics, Student t test and ANOVA were used and statistical significance was set at  $p < 0.05$ .

**RESULTS:** Only five dancers,  $22.4 \pm 1.4$  years old,  $51.3 \pm 7.0$  kg of weight and  $161.1 \pm 2.0$  cm of height, with  $8.0 \pm 2.8$  years of experience in the discipline completed the program. Iliac crest skinfold decreased from  $14.5 \pm 6.3$  to  $11.4 \pm 4.8$  mm,  $p=0.011$ , abdominal ( $19.3 \pm 7.3$  to  $15.8 \pm 6.5$  mm,  $p=0.014$ ), front thigh from  $24.9 \pm 6.9$  to  $17.9 \pm 3.6$  mm ( $p=0.013$ ), medial calf ( $13.6 \pm 6.6$  to  $10.9 \pm 4.7$  mm,  $p=0.045$ ). The forearm circumference increased ( $p=0.009$ ), while the hip ( $p=0.003$ ), ankle ( $p=0.034$ ) and PS6S ( $101.3 \pm 32.0$  to  $78.8 \pm 25.6$  mm) decreased significantly. Energy intake, aerobic capacity and muscular endurance remained unchanged. The results indicated an increased potency (jump Grand Jete) of  $124.7 \pm 11.2$  to  $152.4 \pm 11.5$  cm ( $p = 0.028$ ).

**CONCLUSIONS:** Cross training program showed effectiveness to improve some of the skills required in the performance of contemporary dance, however it will be interesting to search an increase in aerobic capacity, a basic characteristic for physical training as well as to adapt the diet in this group.

**1776 Board #184 MAY 30 3:30 PM - 5:00 PM**

**Attenuated Wingate Test Power Outcomes from "All-Out" Pre-Test Pedaling Cadence Compared to Moderate Cadence**

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(No relationships reported)

Published research employing the Wingate Anaerobic Test for muscular power (WAnT) describes instructing the participant to either pedal as fast as possible or maintain a constant, moderate cadence in the seconds before test start. It is unclear whether non-standardized, pre-test pedal cadences can influence power data.

**PURPOSE:** The aim was to determine the effect of different pre-test pedaling cadences on power outcomes obtained during the WAnT.

**METHODS:** Vigorously-exercising adult males ( $n = 14$ ,  $24.9 \pm 1.2$  y,  $80.1 \pm 2.7$  kg, BMI =  $24.4 \pm 0.6$ , body fat =  $11.0 \pm 1.0\%$ ) and females ( $n = 14$ ,  $20.4 \pm 0.6$  y,  $61.4 \pm 2.6$  kg, BMI =  $22.2 \pm 0.5$ , body fat =  $21.4 \pm 1.3\%$ ) participated in a randomized study during which they performed the 30-s WAnT on a cycle ergometer on two occasions. Each WAnT was separated by at least 48 h for adequate recovery. Flywheel load was standard at  $0.075$  kg/kg body weight. In one trial, the participant was instructed to pedal as fast as possible with an unloaded flywheel during the 5 s before resistance was applied and the test began (FAST). In the second trial, the participant was instructed to maintain a moderate cadence of 80 rpm during the 5 s before resistance was applied (MOD). All other components of the WAnT were identical in both trials. Peak power (PP), mean power (MP), minimum power (MinP), time at peak power (PTime), and power drop (Pdrop) were recorded. Body composition was determined by 3-site skinfolding. Comparisons were made using a 2x2 factorial ANOVA (gender x cadence).

**RESULTS:** Regardless of gender, the FAST protocol resulted in 22.2% lower PP ( $612.6 \pm 33.0$  W vs.  $788.3 \pm 43.5$  W), 13.3% lower MP ( $448.4 \pm 22.2$  W vs.  $517.2 \pm 26.4$  W), 11.7% lower MinP ( $280.9 \pm 14.8$  W vs.  $318.3 \pm 17.2$  W), and 9.0% lower Pdrop ( $53.5 \pm 1.3\%$  vs.  $58.8 \pm 1.5\%$ ) than in MOD ( $p < 0.01$ ; means  $\pm$  SE). No difference was observed in PTime. Similar outcomes were observed within gender.

**CONCLUSION:** Commonly-used protocols which instruct the WAnT participant to pedal either as fast as possible or at a moderate cadence with an unloaded flywheel before resistance is applied result in a divergence of anaerobic muscular power indices. Expanding the WAnT protocol to include standardizing the pre-test pedal cadence may be important to exercise testing professionals who are comparing the data to norms or generating norms for specific populations.

**1777 Board #185 MAY 30 3:30 PM - 5:00 PM**

**No Difference in Power Output For Seated Versus Standing Position During Wingate Anaerobic Power Test**

Jeffrey A. Potteiger, FACSM<sup>1</sup>, Jacob Hamm<sup>2</sup>, Mark Walsh<sup>2</sup>, Dean Smith<sup>2</sup>. <sup>1</sup>Grand Valley State University, Grand Rapids, MI. <sup>2</sup>Miami University, Oxford, OH.

(No relationships reported)

**PURPOSE:** To determine if differences in power output exist between the seated versus standing position during the Wingate Anaerobic Power Test (WAPT).

**METHODS:** 14 males (body mass  $79.6 \pm 7.1$  kg) from a College Club level ice hockey team participated in the study. All testing occurred at the same time of day following a 4 h fast. On day one, body fat percent and fat free mass (FFM) were determined using air displacement plethysmography and subjects were given two practice Wingate Anaerobic Power tests (one each in the seated and standing position). On two different days, the subjects performed two 30 s maximal effort WAPT, with each test separated by 7 days. All data were collected using a Monark computerized bicycle ergometer. Following a standard 5 min warm-up, each subject was given a 3 minute rest. The resistance for testing was 7.5% of body mass. Subjects were ramped up during the test with load application and data collection beginning when subjects reached 120 rpm. Differences in power output between the seated and standing position were determined using a paired t-test, with significance set at  $p \leq 0.05$ .

**RESULTS:** The data (means $\pm$ SD) for the primary dependent variables are shown in the table below.

|          | Peak Power (W)   | Peak Power (W/kg) | Peak Power (W/kg/FFM) | Average Power (W) | Average Power (W/kg) | Average Power (W/kg/FFM) |
|----------|------------------|-------------------|-----------------------|-------------------|----------------------|--------------------------|
| Seated   | 959.1 $\pm$ 96.7 | 12.1 $\pm$ 1.4    | 13.5 $\pm$ 1.4        | 618.6 $\pm$ 48.3  | 7.8 $\pm$ 0.5        | 8.7 $\pm$ 0.5            |
| Standing | 971.5 $\pm$ 90.0 | 12.2 $\pm$ 1.5    | 13.7 $\pm$ 1.4        | 629.3 $\pm$ 45.8  | 7.9 $\pm$ 0.7        | 8.9 $\pm$ 0.7            |

There were no significant differences between the two positions for any of the primary dependent variables.

**CONCLUSION:** During Wingate Anaerobic Power testing subjects should be allowed to select the most comfortable position for testing, as both seated and standing produced similar peak and average power measures.

**1778 Board #186 MAY 30 3:30 PM - 5:00 PM**

**Associations of Upper Body Power Tests and Upper and Lower Body Power in ROTC Cadets**

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(Sponsor: Donna J. Terbizan, FACSM)

(No relationships reported)

Upper and lower body power are important physical attributes for a successful soldier, yet are not part of the current U.S. Army physical fitness assessment.

**PURPOSE:** This study assessed the relationship between upper and lower body power in U.S. Army ROTC cadets in an attempt to identify useful power measures for future Army testing. Upper body power was measured by a seated medicine ball throw (MB) and a push up test (PU), and lower body power was measured by a counter-movement vertical jump (VJ).

**METHODS:** A total of 79 cadets (20 females and 59 males) performed all three tests in a single session. The seated MB test consisted of three separate throws of a 4kg medicine ball, measuring for greatest distance. The PU test consisted of three separate, quick and forceful PUs performed on an AMTI Accupower force plate (W/kg). The VJ consisted of three separate double leg counter-movement vertical jumps on the AMTI force plate (W/kg). Participants were asked to perform each test with maximal volitional effort and acceleration. Each attempt was recorded with the best score on each test retained for use in further analysis. Pearson product-moment correlations were calculated to assess the relationship between the MB, PU, and VJ. All analyses were conducted using PASW statistics version 18, with alpha set  $< .05$ .

**RESULTS:** For males, a significant moderate correlation was found between the MB and VJ ( $r=.44$ ,  $p = .001$ ). For females, significant moderate correlations were found between the MB and VJ ( $r=.45$ ,  $p = .047$ ) and between the MB and PU ( $r=.51$ ,  $p=.022$ ).

**CONCLUSIONS:** Although both the MB and PU tests were intended to measure upper body power and thought to be related, our study found mixed results based on gender. There was a significant relationship between the two upper body tests in the females, but not in the males. A significant relationship between upper and lower body power was found in both males and females with the MB and VJ. Limitations of this study include a small sample of women, and not having a gold standard of an upper body power measure to determine which upper body test

was most valid. Including a power measure in future fitness assessment is suggested; however, further investigation is needed to determine which power tests are most reliable and valid for assessing power in ROTC cadets.

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**1779** Board #187 MAY 30 3:30 PM - 5:00 PM  
**Validity Of Adapted Running Anaerobic Sprint Test (arast) For Assessing Anaerobic Power And Predicting Short-distance Performances In Wheelchair Patients.**  
Jorge Franchella, FACSM<sup>1</sup>, Juan Ignacio Sagastibelza<sup>2</sup>, Germán Laurora<sup>2</sup>, Hernán Castro<sup>2</sup>. <sup>1</sup>UBA, Buenos Aires, Argentina. <sup>2</sup>UBA, BUENOS AIRES, Argentina.  
(No relationships reported)

The **PURPOSE** of this study was to investigate, based on a well known test (RAST), the validity of an adapted running anaerobic sprint test (ARAST), specially designed for wheelchair patients, predicting short-distance performance.

**METHODS:** Fifteen members of three different basketball wheelchair teams were recruited for this research. It was divided in two stages. The first stage investigated the distance to be traveled six times to be tested with ARAST. It was performed by using the time people usually last to reach each stage. The RAST test was applied in 20 volunteers. Time to cover 35 meters maximal running performance was measured. Then it was determined the distance 20 patients using their wheelchair, were able to cover in this time. We found the proper distance was between 15 and 20 meters. So we tested both distances in 15 basketball wheelchair patients. The results of 15 meters six times test did not showed negative trend between the last and the first travel. When we tested in 20 meters we found a significant difference  $p < 0.5$  between the last and the first, similar to those seen with original RAST test.

**RESULTS:** in the 20 meters test we founded. Maximum speed: average 3.58 m/sec. Standard deviation: 0.37. Time to cover distance: average 6.05 sec. Standard deviation: 0.66. Losing speed in percentage average: 11.44% Standard deviation: 7.43. We also determined peak power and mean power taking in account power = mass\* distance<sup>2</sup>/ time<sup>3</sup>.

**CONCLUSION:** The advantage of using ARAST for measuring anaerobic power wheelchair patients is that it allows the execution of more specific movements, It is easily applied and low cost, and due to its simplicity can be incorporated into routine training. Future direction could be to test larger number of disable athletes, and also in different Sports. We concluded that this procedure is valid, and can be used to measure running anaerobic power and predict short-distance performances in wheelchair patients.

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**1780** Board #188 MAY 30 3:30 PM - 5:00 PM  
**Peak Power Output During A 15m Wheelchair Overground Sprint Can Be A Measure Of Anaerobic Capacity**  
Jan W. van der Scheer<sup>1</sup>, Sonja de Groot<sup>1</sup>, Tom A. Gakes<sup>2</sup>, Marlies Bouma<sup>2</sup>, Dirk-Jan H.E.J. Veeger<sup>2</sup>, Lucas H.V. van der Woude<sup>1</sup>. <sup>1</sup>University Medical Center Groningen, Groningen, Netherlands. <sup>2</sup>VU University Amsterdam, Amsterdam, Netherlands. (Sponsor: Thomas W.J. Janssen, FACSM)  
(No relationships reported)

Wheelchair-specific anaerobic capacity can be assessed with a 30s Wingate-like sprint test in a handrim-propelled wheelchair ergometer (WC ergometer). Performance on this test has been found sensitive to change in high and low-intensity training programs. However, the ergometer test cannot easily be employed in a sports or rehabilitation setting. An alternative test might be a 15m overground sprint in a handrim-propelled wheelchair (15m WC sprint) equipped with torque sensors.

**PURPOSE:** To test the hypothesis that 1) peak power output and 2) time of a 15m WC overground sprint are valid alternatives for outcome measures of a 30s Wingate-like sprint test in a WC ergometer.

**METHODS:** Able-bodied men and women (age: 18-30y, length: 163-195 cm, weight: 50-94 kg) performed a 30s Wingate-like sprint test in a WC ergometer (start velocity = 0 m·s<sup>-1</sup>). Torque around the right wheel axle was measured, enabling determination of 1) peak power output, 2) mean power over the full 30s-test, and 3) mean power over a 5s-interval after the first start-up strokes. Resistance was individualized to ensure a velocity < 2 m·s<sup>-1</sup>. On another day, subjects performed a 15m WC overground sprint. As in the ergometer sprint, unilateral peak power output was determined from torque around the right wheel axle (measured with a commercially available torque sensor-equipped wheel). In addition, similar to current use of 15m WC sprint tests in rehabilitation settings, performance time was manually recorded. Descriptive statistics and correlation coefficients (Pearson's *r*) were used to test the hypothesis.

**RESULTS:** Unilateral peak power in the 15m WC sprint was 228 (±72) W, and 250 (±85) W in the WC ergometer test. Ergometer-30s power was 44 (±17) W, and ergometer-5s power was 54 (±21) W. Time over 15m was 7.2 (±1.0) seconds. Unilateral peak power in the 15m overground test was strongly correlated to ergometer peak power ( $r = 0.765$ ), 30s-power ( $r = 0.836$ ), and 5s-power ( $r = 0.716$ ) at  $P \leq 0.001$ . Pearson's *r* between 15m time and ergometer peak, 30s-, and 5s-power ranged between -0.479 and -0.612 ( $P < 0.05$ ).

**CONCLUSION:** Peak power output in a 15m WC overground sprint seems to be a valid alternative for mean power output measured in a 30s Wingate-like sprint test in a WC ergometer. Performance time on the 15m sprint seems less suitable for this purpose.

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**1781** Board #189 MAY 30 3:30 PM - 5:00 PM  
**Physiological Different In Taiwan Youth Basketball Player In Different Levels**  
Yen Ting Lin. Asia University, Taichung, Taiwan.  
(No relationships reported)

**PURPOSE:** The purpose of this study was to investigate the physical and physiological different in Taiwan youth basketball player (college age) between different level (elite level: amateur team and college level: first division basketball player).

**METHODS:** 42 players (elites level: n=21, 23.4yr and college level: n= 21, 22.6yr) were involved in this study. The explosive power of the lower limbs was measured by counter movement jump and squat jump. The speed was measured by 20 m sprint. The 505 test was used to measure agility. The anaerobic power of the lower limbs was measured with a 5x6-second repeat-effort test. The maximal oxygen consumption was estimated by a 20-meter multistage shuttle run test. The data were analyzed by independent T-test and significant was accepted at  $p = .05$ .

**RESULTS:** The physiological significant different in basketball player between levels were found in (1) The explosive power of the lower limbs (elite level: CMJ power: 5739.12± 659.06 W, SJ power: 4585.64± 497.32 W; college level: CMJ power: 5241.33± 675.88W, SJ power: 4182.76± 602.15W), (2) agility ability (left foot: elite level: 2.36±0.12 sec; college level: 2.47±0.14 sec, right foot: elite level: 2.35±0.13 sec, college level: 2.47±0.14), and (3) anaerobic power of the lower limbs (elite level: total work: 267.25±43.56 J/kg, power decrement: 10.43± 4.8%; college level: total work: 233.15± 42.63 J/kg, power decrement: 17.35± 0.15%).

**CONCLUSIONS:** The physiological different between level were found in the explosive power and anaerobic power of lower limbs and the agility ability. As the result, the elite level demonstrated better explosive power, anaerobic power, lower power decrement, and better agility ability.

Key words: Leg explosive Power, Intermittent anaerobic power, Speed, Agility, cardiovascular endurance.

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**1782** Board #190 MAY 30 3:30 PM - 5:00 PM  
**Bilateral Strength Assymetry During The Vertical Jump In Professional Soccer Goalkeepers**  
Frantisek Zahalka, Tomas Maly, Lucia Mala, Jaroslav Teplan. Charles University, FPES, Prague, Czech Republic.  
(No relationships reported)

Explosive strength of lower limbs is an important predisposition for specific locomotion of soccer goalkeepers. Powerful legs enable them to leap up and over their teammates and opponents to collect balls kicked into the goal area. For soccer goalkeepers, functional strength is more important than absolute strength.

**PURPOSE:** The aim of the study is to assess the level of explosive strength and asymmetry of biomechanical parameters during the bilateral jump (counter movement jump with free arms - CMJ<sub>FA</sub>) in professional goalkeepers.

**METHODS:** The monitored group was composed of elite soccer goalkeepers (n = 25, age = 26.5±9.1 years, body height = 186.1±7.8 cm, body weight = 86.7±14.8 kg). Strength indicators during CMJ<sub>FA</sub> were observed by means of force platform Kistler B8611A. For statistical processing, methods from descriptive statistics were used; a bilateral difference between parameters was assessed by dependent *t*-test and relation between the height of the jump and monitored parameters was determined by Pearson's correlation coefficient.

**RESULTS:** The jump height of players was 45.26±3.36 cm. Total bilateral force produced at take-off was 2260.6±353.8 N. Take-off force produced by the dominant leg (DL) was



significantly higher when compared to the non-dominant leg (ND) ( $F_{DL} = 1174.6 \pm 167.5$  N vs.  $F_{NL} = 1086.0 \pm 202.8$  N,  $t_{2d} = 3.86$ ,  $p < 0.01$ ). The mean difference in generated force was  $101.0 \pm 103.5$  N, which indicates high heterogeneity in the symmetry of jump implementation in the monitored group of professional players. The smallest difference was 4 N (0.4%) and the greatest 373 N (34.7%). The jump height did not correlate significantly with the size of the bilateral difference in force generated during the jump ( $r = -0.11$ ,  $p < 0.01$ ).

**CONCLUSIONS:** Results showed a lower jump height in our players compared to the values of elite players stated in literature. A significant difference between strength generated in DL and NL, as well as differences on the basis of inter-individual comparison, are the evidence of strength asymmetries in the jump implementation. However, jump height is not dependent on the symmetric implementation of both legs in terms of maximum strength production.

Supported by MSM 0021620864 and GACR P407/11/P784

**1783 Board #191 MAY 30 3:30 PM - 5:00 PM**

**Estimated Times to Exhaustion And Power Outputs At Four Fatigue Thresholds**

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(No relationships reported)

**PURPOSE:** The purposes of this study were to compare the power outputs and estimated times to exhaustion ( $T_{lim}$ ) at the gas exchange threshold (GET), physical working capacity at the rating of perceived exertion threshold ( $PWC_{RPE}$ ), critical power (CP), and respiratory compensation point (RCP).

**METHODS:** Three male and five female subjects (mean  $\pm$  SD: age  $22.4 \pm 2.8$  yr) performed an incremental test to exhaustion on an electronically braked cycle ergometer to determine (dot above)  $VO_2$  peak, GET, and RCP. The two-parameter, linear,  $W_{lim}$  versus time  $T_{lim}$  model was used to estimate CP from four rides to exhaustion at four separate power outputs. Ratings of perceived exertion (RPE) were recorded during the rides to exhaustion. The  $PWC_{RPE}$  was determined from the slope coefficients for the RPE versus time relationships calculated for three rides to exhaustion and plotted as a function of the corresponding power outputs to estimate the  $PWC_{RPE}$ . The estimated  $T_{lim}$  values for each subject at GET, CP,  $PWC_{RPE}$ , and RCP were determined from power curve analyses ( $T_{lim} = ax^b$ ).

**RESULTS:** The results indicated that GET (154 42 W) was significantly ( $p < 0.05$ ) less than RCP (181 54 W). There were no significant differences, however, among the CP (167 46 W),  $PWC_{RPE}$  (176 55 W) or RCP. The estimated  $T_{lim}$  for the GET (26.1 9.8 min) was significantly ( $p < 0.05$ ) greater than  $PWC_{RPE}$  (14.6 5.6 min) and RCP (11.2 3.1 min). The CP (16.0 1.6 min), however, was not significantly different from GET.

**CONCLUSION:** The results indicated that the  $PWC_{RPE}$  occurred at a mean power output that was 12.5% greater than the GET and, therefore, it is likely that the  $PWC_{RPE}$  occurred within the heavy exercise intensity domain. Furthermore, the RCP was 8% greater than CP and, therefore, these thresholds may be associated with different mechanisms of fatigue.

**1784 Board #192 MAY 30 3:30 PM - 5:00 PM**

**Ground Reaction Force Analysis of the Anterior and Crossover Single Leg Hop Tests**

Michael Nelson, Brent Sloss, Bryan L. Riemann. *Armstrong Atlantic State University, Savannah, GA.* (Sponsor: T. Jeff Chandler, FACSM)

(No relationships reported)

In contrast to the landing phase, less research has examined the propulsion phase of the single leg anterior (AHT) and cross over (COHT) hop tests. Additionally, there appears to be a void regarding objective support for using 15cm for the COHT.

**PURPOSE:** To compare propulsive vertical, anterior, and lateral ground reaction forces (GRF) between AHT and COHT.

**METHODS:** Thirty-eight healthy, Division I male basketball, football, baseball, and soccer athletes ( $88.3 \pm 12.3$  kg;  $183.9 \pm 6.0$  cm;  $20.6 \pm 1.4$  years) completed AHT and COHT in a counterbalanced order using their dominant limb. One week prior to data collection, participants completed a practice session of the two tests until performance (hop distance) plateaued. GRF data was collected during the propulsive phase of four trials for each test variation. The propulsive phase was defined as the interval between the end of counter-movement and ground off. Vertical, anterior and lateral peak force and impulse were computed. The composite impulse was computed as the sum of the vertical, anterior and lateral impulses. Acceptable trials were defined as being within  $\pm 5\%$  of the distances established during practice session. Paired t-tests were conducted to statistically compare respective dependent variables between the variations.

**RESULTS:** There was no significant difference in the distance hopped ( $P = .550$ ) or in the composite impulse ( $P = .348$ ) between the variations. In contrast to the lateral impulse being significantly greater for the COHT ( $P < .001$ ), there was no significant difference for either the vertical impulse ( $P = .890$ ) or the anterior impulse ( $P = .176$ ). Both the vertical ( $P < .001$ ) and anterior ( $P < .001$ ) peak forces were significantly greater for the AHT, whereas the lateral peak force ( $P = .045$ ) was significantly greater for the COHT.

**CONCLUSION:** Despite peak force and impulse differences, the total propulsive effort was equal between the two variations as evidenced by the hop distances and composite impulses. These data support the traditional use of 15cm crossover distance to stimulate greater lateral force production demands. Future research is recommended to consider different crossover distances as well as the impacts on ankle, knee and hip contributions.

**1785 Board #193 MAY 30 3:30 PM - 5:00 PM**

**Critical Power and Body Composition during Preparation for a Bodybuilding Competition: A Case Study**

David H. Fukuda<sup>1</sup>, Lindy M. Rossow<sup>1</sup>, Jeremy P. Loenneke<sup>1</sup>, Christopher A. Fahs<sup>1</sup>, Kristina L. Kendall<sup>1</sup>, Abbie E. Smith<sup>2</sup>, Jordan R. Moon<sup>3</sup>, Jeffrey R. Stout<sup>1</sup>, Michael G. Bemben, FACSM<sup>1</sup>. <sup>1</sup>University of Oklahoma, Norman, OK. <sup>2</sup>University of North Carolina, Chapel Hill, NC. <sup>3</sup>United States Sports Academy, Daphne, AL.

(No relationships reported)

Critical power from an all-out cycling test reflects changes to physical training and may provide insight to the under-researched sport of natural bodybuilding.

**PURPOSE:** The purpose of this study was to examine the critical power and body composition adaptations during six months of preparation for a natural bodybuilding competition.

**METHODS:** The subject was a 27 year old bodybuilder (height=186 cm; weight=88.9-102.9 kg) who performed four days of resistance training and two to three days of aerobic training of varying intensity per week. At baseline (M0) and alternating months during the six months of contest preparation (M2, M4, and M6), critical power (CP) and anaerobic working capacity ( $W'$ ) were calculated from a three-minute all-out cycling test, and muscle mass (MM) and body fat percentage (Fat%) were determined from bioelectrical impedance spectroscopy. Change scores between each time point were compared to minimal difference values (MD=standard error of the measurement  $\times 1.96 \times \sqrt{2}$ ) from previous reliability measurements for CP (MD=26 watts;  $n=10$ ),  $W'$  (MD=3.8 kJ;  $n=10$ ), MM (MD=0.3 kg;  $n=11$ ), and Fat% (MD=2.5%;  $n=11$ ).

**RESULTS:** The change in CP exceeded MD between each time point with an increase between M0 and M2 (43 watts), and decreases from M2 to M4 (37 watts) and M4 to M6 (30 watts). The change in  $W'$  exceeded MD between each time point with decreases ranging from 4.2 to 5.9 kJ. Fat% and MM decreased throughout the event preparation and changes were greater than MD for each time point, ranging from 3 to 6% and 0.4 to 1.8 kg, respectively.

**Table 1**

| Time | Weight (kg) | CP (watts) | $W'$ (kJ) | MM (kg) | Fat% |
|------|-------------|------------|-----------|---------|------|
| M0   | 102.9       | 223        | 25.0      | 40.3    | 16.8 |
| M2   | 96.5        | 266        | 19.1      | 38.5    | 13.0 |
| M4   | 90.8        | 229        | 14.9      | 38.1    | 6.6  |
| M6   | 88.9        | 199        | 9.6       | 37.5    | 3.8  |

**CONCLUSION:** Preparatory training for a natural bodybuilding competition was associated with varying reductions in CP,  $W'$ , Fat%, and MM.

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**B-33 Free Communication/Poster - Gait**

MAY 30, 2012 1:00 PM - 6:00 PM  
ROOM: Exhibit Hall

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**1786 Board #194 MAY 30 2:00 PM - 3:30 PM****Asymmetrical Loading Affects Intersegmental Dynamics During The Swing Phase Of Walking**

Jeremy D. Smith<sup>1</sup>, Todd D. Royer<sup>2</sup>, Philip E. Martin, FACS<sup>3</sup>. <sup>1</sup>University of Northern Colorado, Greeley, CO. <sup>2</sup>University of Delaware, Newark, DE. <sup>3</sup>Iowa State University, Ames, IA.  
(No relationships reported)

Much of the research related to lower extremity inertia manipulations has focused on temporal, kinematic and traditional inverse dynamics assessments during locomotion. Intersegmental dynamics is an analytical technique that provides further insights into mechanisms underlying linked-segment motion.

**PURPOSE:** To determine how intersegmental dynamics during the swing phase of walking are altered during asymmetrical lower extremity loading.

**METHODS:** Seven male and five female young healthy adults (Age = 26 ± 6 yrs; Mass = 72.5 ± 10.6 kg; Height = 173.1 ± 6.2 cm), free of any notable gait or structural asymmetries, participated in the study. Participants walked overground at a speed of 1.57 m·s<sup>-1</sup> with 0, 0.5, 1.0, and 2.0 kg attached to one foot. A three segment lower extremity inverse dynamics model was used to determine net, interaction, gravitational, and muscle moments at the ankle, knee, and hip of each leg during each trial. Nine (3 moments x 3 joints) paired Hotellings T<sup>2</sup> tests (SAS 8.02, Cary, NC) were used to test whether asymmetrical lower extremity loading had an effect on the relative contributions of interaction, gravitational, and muscle moments to the absolute angular impulse at each joint.

**RESULTS:** Moment magnitudes at joints of the loaded leg increased systematically with increasing load, whereas unloaded leg moments were unaffected by loading. With increasing load, relative contributions of interaction moments about the knee and hip and gravitational moment about the ankle increased (i.e., 21%, 8%, and 44% increases, respectively for unloaded vs. 2.0 kg; all statistical comparisons had  $F > 65.0$ ,  $p < 0.001$ ), whereas the relative contributions of muscle moments about all three joints declined (i.e., -4%, -13%, and -8% decreases for the ankle, knee, and hip, respectively for unloaded vs. 2.0 kg; all statistical comparisons had  $F > 5.5$ ,  $p < 0.019$ ).

**CONCLUSION:** These results suggest that altered inertia properties of the limb not only affected the amount of muscular effort required to swing the leg, but also increased the influence of the interaction and gravitational moments on leg swing during walking.

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**1787 Board #195 MAY 30 2:00 PM - 3:30 PM****Effect Of Stride Frequency On Metabolic Costs And RPE During Walking In Water**

Kenji Masumoto<sup>1</sup>, Yoshiko Nishizaki<sup>2</sup>, Ayako Hamada<sup>2</sup>. <sup>1</sup>Fukuoka Prefectural University, Tagawa, Japan. <sup>2</sup>Kyushu University, Kasuga, Japan.  
(No relationships reported)

Walking in water has been included in exercise and rehabilitation programs, however, no previous research has investigated the effect of stride frequency (SF) on metabolic costs and the rating of perceived exertion (RPE) during walking in water. Such information is important if gait mechanics in water is to be better understood.

**PURPOSE:** To investigate the effect of SF on metabolic costs and RPE during walking in water.

**METHODS:** Eleven male subjects (means ± SD: age = 23.8 ± 4.2 years, height = 175.7 ± 7.3 cm, body mass = 68.6 ± 7.0 kg) walked on a treadmill on dry land and on an underwater treadmill at their preferred stride frequency (PSF) and walked at an SF which was lower and higher than the PSF (i.e., PSF ± 5, 10, and 15 strides·min<sup>-1</sup>). Walking speed was kept constant at each subject's preferred walking speed in water and on dry land. Oxygen consumption (VO<sub>2</sub>), respiratory exchange ratio, heart rate, minute ventilation, RPE, PSF and preferred walking speeds were measured.

**RESULTS:** Metabolic costs and RPE were significantly higher when walking at low or high SF conditions than when walking at the PSF condition both in water and on dry land (e.g., 73% and 58% increases in VO<sub>2</sub> and RPE during walking in water at PSF+15 versus PSF conditions, respectively; both  $p < 0.001$ ). Additionally, the high SF condition produced significantly higher metabolic costs and RPE than the equivalent low SF condition during walking in water (e.g., 31% increase in VO<sub>2</sub> between PSF+15 versus PSF-15 conditions;  $p < 0.001$ ). Furthermore, metabolic costs (e.g., 12.3 ± 2.4 and 15.3 ± 2.2 ml·kg<sup>-1</sup>·min<sup>-1</sup> in VO<sub>2</sub> for water and dry land conditions, respectively;  $p < 0.05$ ), RPE (i.e., 7.2 ± 1.2 and 8.5 ± 1.4 for water and dry land conditions, respectively;  $p < 0.05$ ), PSF (i.e., 33.1 ± 2.6 and 60.0 ± 3.9 strides·min<sup>-1</sup> for water and dry land conditions, respectively;  $p < 0.001$ ), and the preferred walking speed (1.5 ± 0.3 and 4.7 ± 0.6 km·h<sup>-1</sup> for water and dry land conditions, respectively;  $p < 0.001$ ) were significantly lower in water than on dry land when walking at the PSF.

**CONCLUSION:** These observations suggest that a change in SF may influence metabolic costs and RPE during walking in water.

Supported by a Grant-in-Aid from the Japan Society for the Promotion of Science (18-9364).

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**1788 Board #196 MAY 30 2:00 PM - 3:30 PM****Influence Of Physical Activity History On Ground Reaction Force During Walking**

Henry Wang, Jeff Frame, Clark Dickin. Ball State University, Muncie, IN.  
(No relationships reported)

Military recruits are commonly afflicted by lower-extremity overuse injuries such as tibial stress fracture (TSF). In particular, recruits with low levels of fitness are at a higher risk. Thus, it is advisable to precondition recruits before basic training. Running and basketball are common exercises to improve physical condition. However, patterns of ground impact loading are different between running and playing basketball. Multi-directional loading in basketball may lead to bone adaptation and reduce the risk of TSF. As loaded walking, a major task in basic training exposes recruits to high ground impact forces leading to increased risk of injury, it is important to examine if and how physical activity history (PAH) of running or basketball influences ground impact forces during loaded walking.

**PURPOSE:** To determine differences in vertical ground reaction force (VGRF) and loading rate (VLR) during loaded walking between runners and basketball players.

**METHODS:** Forty recreational runners (n=20, 21±2 yr.) and basketball players (n=20, 21±2 yr.) participated in this study. Participants completed four walking tasks in the following order: walking with 0kg (W00), 15kg (W15), 25kg (W25), and 35kg (W35) loads. Each task was performed for 5 min on a force instrumented treadmill (AMTI) at 1.67 m/s. Peak VGRF and VLR at weight acceptance were normalized to body weight (BW). Two-way repeated measures ANOVAs were performed.  $\alpha = 0.05$ .

**RESULTS:** No statistical differences in VGRF and VLR were found between the two groups ( $P > 0.05$ ). Increasing load carried had a significant effect on VGRF and VLR ( $P < 0.001$ ). As load carried increased, linear increases of VGRF (1.29±0.06, 1.57±0.11, 1.77±0.22, and 1.99±0.19 BW for W00, W15, W25, and W35, respectively) and VLR (17.92±3.72, 22.51±5.02, 27.01±8.33, and 31.56±7.18 BW/s for W00, W15, W25, and W35, respectively) were observed ( $P < 0.001$ ).

**CONCLUSION:** The significant increases of mechanical loading and loading rate are proportional to the increment of load carried. Despite differences in activity loading patterns between runners and basketball players, there were no differences in mechanical loading. Future studies should examine aspects of how PAH influences mechanical responses of tibia during loaded walking to improve the understanding of TSF. US ARMY#W81XWH-08-1-0587

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**1789 Board #197 MAY 30 2:00 PM - 3:30 PM****Metabolic Demands Of Split Belt Treadmill Walking**

Jaimie A. Roper, Ryan T. Roemmich, Lisa A. Zukowski, Mark D. Tillman, FACS<sup>M</sup>, Chris J. Hass, FACS<sup>M</sup>. University of Florida, Gainesville, FL.  
(No relationships reported)

Split belt treadmill walking (SBTW) is a novel intervention shown to improve gait asymmetry and locomotor function in neurologic populations. SBTW is thought to provide an advantage

over traditional treadmill walking (TW) due to its increased reliance on motor learning. To better understand the mechanisms underlying these improvements, it is important to determine whether or not the metabolic costs associated with SBTW are different than TW.

**PURPOSE:** Evaluate effects of SBTW on  $\text{VO}_2$ , heart rate (HR), and rating of perceived exertion (RPE, 16 point).

**METHODS:** Ten participants (age=22.2±1.6 yr; height=168.4±6.2 cm; weight=65.1±7.7 kg) were recruited. Participants were asked to select their fastest comfortable walking speed (fast speed, FS) on the treadmill. Fifty percent of the FS was used as the slow speed (SS). Participants walked for five minutes at both the FS and SS, and five minutes with the belt under the nondominant limb set to the FS and the dominant limb set to the SS (SBTW).  $\text{VO}_2$ , HR, and RPE obtained during the last 30 seconds of each condition were compared by treadmill condition (SS, FS, SBTW) using a one-way repeated measures ANOVA ( $\alpha=0.05$ ).

**RESULTS:** Gait speed and metabolic measures are reported in Table 1.  $\text{VO}_2$  and HR were significantly lower for SS compared to FS and SBTW ( $P=.001$ ,  $.002$ ;  $P<.001$ , respectively). RPE scores were significantly lower for SS compared to FS and SBTW ( $P=.003$ ,  $P=.001$ ).

**CONCLUSION:** SBTW and FS walking exhibit equivalent energy expenditures and RPE scores but differ from SS walking. These findings may indicate that improvements in gait mechanics measured by previous studies are likely due to asymmetric walking patterns used with SBTW rather than exercise intensity.

| Condition | Speed (m/s) | RPE    | $\text{VO}_2$ (ml/min/Kg) | HR       |
|-----------|-------------|--------|---------------------------|----------|
| SS        | 0.78 (.11)  | 7 (1)  | 7.67 (1.2)                | 98 (16)  |
| FS        | 1.56 (.22)  | 10 (2) | 13.54 (3.7)               | 121 (20) |
| SBTW      | 1.17 (.16)  | 9 (1)  | 11.23 (2.4)               | 115 (24) |

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**1790 Board #198 MAY 30 2:00 PM - 3:30 PM**

**Does Backward Walking Enhance Gait or Balance Performance in Older Adults?**

Janet S. Dufek, FACSM<sup>1</sup>, Jennifer M. Aldridge<sup>2</sup>, John A. Mercer, FACSM<sup>1</sup>, Philana-Lee Gouws<sup>1</sup>. <sup>1</sup>University of Nevada, Las Vegas, Las Vegas, NV. <sup>2</sup>Brooke Army Medical Center, Fort Sam Houston, TX.

(No relationships reported)

With advancing age, falls are a major cause of morbidity and mortality.

**PURPOSE:** To investigate the effects of a backward walking intervention on selected gait and balance characteristics in older adults.

**METHODS:** Ten healthy young adults (G1; 21.9±2.1 yrs; 175±10.5 cm; 70.3±11.5 kg) and 10 healthy, non-faller older adults (G2; 69.8±7.7 yrs; 168±11.8 cm; 70.7±15.2 kg) performed self-selected speed forward and backward walking over a 10 m calibrated space during which time three-dimensional lower extremity kinematic parameters were measured with a 12-camera motion capture system (120Hz). Prior to the first walking trial, following the fifth trial and after the last (10<sup>th</sup>) walking trial, a series of static balance measures were completed. The balance tests consisted of four quiet stance conditions: 1) firm surface, eyes open, 2) firm surface, eyes closed, 3) soft surface, eyes open, and 4) soft surface, eyes closed. The intervention consisted of 10-15 min of backward walking, three days/wk, for four wks. Post-intervention testing (week four) replicated the pretest procedures while mid-intervention (week 2) testing evaluated balance only. Kinematic gait descriptors (stride length, cadence, walking velocity, range of motion) during forward walking were evaluated with correlated t-tests for G2. Balance scores and anterior-posterior sway range were assessed with a 2 (group) x 3 (time) mixed model ANOVA ( $\alpha=0.05$ ).

**RESULTS:** G2 exhibited significantly faster self-selected forward walking velocity post-intervention (1.10±0.17 vs 1.22±0.12 m/s;  $p=0.048$ ). Balance scores were significantly different between groups (G1: 90.4±2.0, G2: 85.5±5.13;  $p=0.005$ ) and across time (G1-Pre: 89.85±1.79, Mid: 90.8±2.0, Post: 90.4±2.3; G2-Pre: 83.4±5.9, Mid: 87.3±3.7, Post: 85.9±5.8;  $p=.012$ ) for the most challenging balance test. Anterior-posterior sway range (cm) was also significantly different between groups (0.97±0.10 vs 1.42±0.13  $p=0.014$ ) and across time (Pre: 1.04±0.15 vs 1.60±0.66; Mid: 0.91±0.20 vs 1.27±0.38; Post: 0.96±0.23 vs 1.37±0.58 for G1 vs G2 respectively;  $p=0.028$ ).

**CONCLUSION:** Older adults demonstrated improved balance and increased walking velocity after 2-4 weeks of backward walking. Consideration should be given to including backward walking as part of a regular exercise program for older adults.

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**1791 Board #199 MAY 30 2:00 PM - 3:30 PM**

**Strength Asymmetry Increases Gait Asymmetry and Variability in Older Women**

Dain P. LaRoche<sup>1</sup>, Summer B. Cook<sup>1</sup>, Harold Greeley<sup>2</sup>, Krzysztof Mackala<sup>3</sup>, Timothy J. Quinn, FACSM<sup>1</sup>. <sup>1</sup>University of New Hampshire, Durham, NH. <sup>2</sup>Response Applications, LLC, Hanover, NH. <sup>3</sup>University School of Physical Education, Wroclaw, Poland.

(No relationships reported)

Poor lower-extremity strength and increased gait variability are strongly associated with fall risk in older adults but the relationship between these performance measures has not been well studied.

**PURPOSE:** To determine how bilateral knee extensor strength asymmetry influences gait asymmetry and variability in older women.

**METHODS:** Maximal torque of the knee extensors was measured via dynamometry in 24 older women (65 - 80 yr). Subjects were separated into symmetrical (SG, n = 13) and asymmetrical strength groups (AG, n = 11) based on a knee extensor strength asymmetry cutoff of 20%. Subjects walked at a standard speed of 0.8 m s<sup>-1</sup> and at a self-selected, maximal walking speed on an instrumented treadmill while spatial, temporal, and kinetic gait variables were measured. Gait and strength asymmetry were calculated as (Weak leg value - Strong leg value)/ Strong leg value x 100% and gait variability was computed as the coefficient of variation across ten sequential strides.

**RESULTS:** No difference in strength existed between SG and AG for the strong leg (1.55 ± 0.29 vs. 1.50 ± 0.38 Nm kg<sup>-1</sup>,  $P = 0.352$ ) but differences existed for the weak leg (1.36 ± 0.22 vs. 1.09 ± 0.29 Nm kg<sup>-1</sup>,  $P = 0.008$ ) resulting in greater strength asymmetry in AG (11.7 ± 5.4% vs. 27.4 ± 5.5%,  $P < 0.001$ ). Significant main effects for speed existed for the variability of weight acceptance force, push off force, foot strike location, and stride width such that the average variability of these measures increased from 5.0% at the standard speed to 7.3% at maximal speed ( $P < 0.01$ ). A group x speed interaction ( $P = 0.02$ ) occurred for weight acceptance force variability as the increase from standard to maximal speed was greater in AG (2.5 ± 0.6% to 5.0 ± 2.4%) than in SG (2.7 ± 1.3% to 3.7 ± 1.2%). A group x speed interaction ( $P = 0.017$ ) occurred for weight acceptance force asymmetry such that AG had greater increases in asymmetry at the maximal speed (2.2 ± 1.3% to 6.4 ± 5.3%) than SG (2.1 ± 1.7% to 2.5 ± 2.3%).

**CONCLUSION:** Spatial and kinetic gait variability and asymmetry are increased when older women walk near their maximal capacities and this increase is greatest in those with knee extensor strength asymmetry greater than 20%. The maintenance of strength symmetry may be an important tool in reducing gait variability and fall risk in older adults.

Supported by NIH-NIA Grant L30-AG-038028-01.

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**1792 Board #200 MAY 30 2:00 PM - 3:30 PM**

**Women's Leg Stiffness Increases More than Men's During Fast Forced Cadence Load Carriage**

Shane G. Sauer, Joseph F. Seay, Peter N. Frykman. United States Army Research Institute of Environmental Medicine, Natick, MA.

(No relationships reported)

Forced cadence marching is a common activity in Army Basic Combat Training (BCT) and occurs over a wide range of prescribed cadences (106 - 120 steps/min) at speeds up to 1.7 m/s. During BCT, women suffer proportionally more lower extremity overuse injuries than men. It is possible that women adapt to training activities, like marching in step while carrying a load, differently than men. Increases in leg stiffness ( $K_{Leg}$ ) can be linked to increases in lower extremity overuse injuries. Differences of changes in  $K_{Leg}$  between marching cadences may be linked with higher rates of lower extremity overuse injuries in female BCT recruits.

**PURPOSE:** To evaluate relative changes to  $K_{Leg}$  between men and women while marching at different cadences and speeds.

**METHODS:** Ten volunteers (6M, 4F) with no military experience walked on a force sensing treadmill for 1 hour at 1.3 m/s and 1.7 m/s on separate days. They carried a 20kg load and marched at various cadences, including 106 and 120 steps/min for 10 min each. On each day, kinematic and kinetic data were recorded for 20s after the 5<sup>th</sup> min of both the 106 and 120 cadences.  $K_{Leg}$  was calculated as a ratio of the peak vertical ground reaction force to a kinematically determined change in leg length. A 2-way ANOVA evaluated differences between gender and cadence at each of the two speeds.

**RESULTS:** Men ( $253.0 \pm 172.4$  kN/m) had a significantly greater  $K_{Leg}$  than women ( $106.1 \pm 26.3$  kN/m) at the slower speed of 1.3 m/s, and  $K_{Leg}$  for both increased similarly with cadence. However, as cadence increased at the faster speed of 1.7 m/s the women experienced an increase in  $K_{Leg}$  ( $\Delta 41.9$  kN) ( $p = 0.026$ ) that was 3.5 times greater than the increase in men ( $\Delta 12.0$  kN).

**CONCLUSION:** As expected,  $K_{Leg}$  increased with rising cadence at each speed in both genders. However, a 3.5-fold greater relative increase was observed in women as compared to men. This may indicate that forced cadence load carriage at fast speeds and cadences is a contributing factor to the higher incidence of lower extremity injuries seen in female BCT recruits.

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**1793** Board #201 MAY 30 2:00 PM - 3:30 PM

**The Effect Of Balance Exercise Therapy On Gait Parameters In Individuals With Chronic Stroke**

Tracy A. Dierks<sup>1</sup>, Peter A. Altenburger<sup>1</sup>, Kristine K. Miller<sup>2</sup>, Arlene A. Schmid<sup>2</sup>. <sup>1</sup>Indiana University, Indianapolis, IN. <sup>2</sup>Roudebush VA Medical Center, Indianapolis, IN. (Sponsor: Stuart J. Warden, FACSM)

(No relationships reported)

Balance and gait deficits frequently impact those with chronic stroke. While therapy often aims at improving balance and walking speed for independent community ambulation, improvements remain ambiguous, and little is known regarding the sustainability of such a gait speed once achieved.

**PURPOSE:** Investigate the effect of a balance exercise therapy program on balance and gait speed parameters in those with chronic stroke.

**METHODS:** This is an ongoing study with 29 subjects with chronic stroke to date. Subjects completed an 8-week group exercise program (1-hour twice a week) that incorporated components of yoga. Pre-intervention, balance was assessed with the Berg Balance Scale (BBS). Subjects completed a 10-meter walk, with a gaitmat positioned in the middle, and were instructed to walk at the fastest pace possible that felt safe. Lastly, subjects performed a 6-minute walk at their preferred pace while traversing a 30-meter walkway with the gaitmat positioned in the middle, allowing for multiple passes to measure change in gait parameters over the 6-minutes.

**RESULTS:** Post-program, subjects showed improved balance and faster gait speeds with longer steps/strides and less time in double support (Table 1). No changes were noted for base of support and unilateral stance variables. Over the 6-minute walk, both maximum and end gait velocities increased post-program, but subjects continued to show an inability to sustain a consistent speed compared to the end.

**CONCLUSION:** The intervention was successful at improving balance, which likely led to improved gait parameters and a faster functional gait speed. Further development and testing of a yoga based balance exercise program to address both bilateral and unilateral activities is warranted.

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**1794** Board #202 MAY 30 2:00 PM - 3:30 PM

**Knee Joint Angular Adaptations Due To Asymmetric Load Carrying While Walking On A Treadmill**

Junsig Wang, Ryan T. Roemmich, Mark D. Tillman, FACSM. University of Florida, Gainesville, FL

(No relationships reported)

Bags (backpacks and single sling/messenger bags) have become a daily necessity for individuals of all ages. In particular, messenger bags seem to be increasing in popularity for young people. However, carrying single strap bags induces asymmetrical loading and could be harmful to the human body due to altered postures while walking.

**PURPOSE:** To evaluate gait kinematics and coordinative patterns for lower extremity joints during asymmetrical load carrying.

**METHODS:** Six university students ( $22.6 \pm 3.72$  yrs,  $172.6 \pm 7.5$  cm,  $69.2 \pm 8.2$  kg) walked on a treadmill under three different load conditions: (1) no bag, (2) carrying a messenger bag on one shoulder hanging vertically down to the hip, and (3) carrying a messenger bag on one shoulder draped across the trunk to opposite hip. All participants walked at their preferred pace for one minute in each condition. Kinematic data were acquired using a Vicon motion analysis system with 7 digital cameras (120Hz). Changes in hip, knee, and ankle joint angles across the gait cycle were assessed in frontal and sagittal planes via Cross Correlation Coefficients (CCC). Each gait cycle was divided into swing and stance phases.

**RESULTS:** CCC of knee, ankle, and hip joints in frontal and sagittal planes were high ( $0.954 \pm 0.061$ ) during the swing phase of the gait and slightly lower during stance ( $0.897 \pm 0.164$ ). Within the stance phase, the CCC values for hip and knee joint angles in the frontal plane appear to be altered. More specifically, CCC for the knee joint decreased 25% while carrying a single strap bag (2) compared to no bag (1) and decreased 7.8% under load condition (3) compared to no bag (1). Also, CCC for the hip joints in the frontal plane decreased 8% and 10% under load conditions (2) and (3) respectively compared to (1).

**CONCLUSIONS:** During the stance phase of walking on a treadmill while carrying an asymmetric load, the hip and knee joints follow different movement patterns when comparing right and left. Thus, the bilateral joint movements are less symmetrical. There was no effect on the ankle joints during the gait cycle. The frontal plane differences observed at the hip and knee may be indicative of an adaptive strategy (e.g. lateral bending) that could result in changes in joint forces and moments.

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**1795** Board #203 MAY 30 2:00 PM - 3:30 PM

**Detecting Gait Kinematic Patterns associated with Knee Osteoarthritis using a Support Vector Machine Algorithm**

Kelsey H. Collins, Reginaldo K. Fukuchi, Blayne A. Hettinga, Reed Ferber. University of Calgary, Calgary, AB, Canada. (Sponsor: Louis Osternig, FACSM)

(No relationships reported)

Knee osteoarthritis (KOA) is a degenerative disease known to alter gait kinematics as compared with healthy individuals. It is necessary to understand which factors best describe the kinematic differences between healthy and KOA individuals to gain insight into KOA aetiology. To our knowledge, this research is the first to use a Support Vector Machine (SVM) and feature selection algorithm to objectively rank the most important kinematic variables when discriminating between KOA and control subjects.

**PURPOSE:** Determine which combination of variables best differentiate healthy and KOA subjects by using a SVM along with a feature selection algorithm and assess the ability to predict KOA subjects.

**METHODS:** 38 KOA subjects (27 F, 11 M age  $54 \pm 8$  yrs;  $169 \pm 11$  cm;  $73 \pm 12$  kg) and 30 healthy controls (21 F, 9 M age  $53 \pm 12$  yrs;  $168 \pm 10$  cm;  $69 \pm 13$  kg) were included. Kinematic data were collected using an 8-camera 3D motion capture system. Sixteen discrete kinematic gait variables were chosen to train the SVM algorithm. A 10-fold cross-validation was implemented to assess the SVM recognition rate

**RESULTS:** The overall classification accuracy rate achieved 66.2% when all input variables were considered. This rate improved to 75% when the first 5 selected variables, determined by the feature selection algorithm, were considered. The combination of variables that achieved the best recognition rate were: knee flexion at heel strike (KOA  $-6.1^\circ \pm 4.9^\circ$ , CON  $-3.6^\circ \pm 5.0^\circ$ ), peak knee adduction (KOA  $3.9^\circ \pm 5.6^\circ$ , CON  $1.8^\circ \pm 3.4^\circ$ ), knee abduction excursion (KOA  $3.7^\circ \pm 1.7^\circ$ , CON  $4.1^\circ \pm 1.4^\circ$ ), peak pelvic drop (KOA  $0.3^\circ \pm 3.6^\circ$ , CON  $-0.4^\circ \pm 3.9^\circ$ ), and peak knee abduction (KOA  $-0.5^\circ \pm 4.8^\circ$ , CON  $-2.7^\circ \pm 3.4^\circ$ ).

**CONCLUSIONS:** The SVM was able to classify KOA subjects accurately when using 5 selected variables combined. We expect that the classification accuracy would increase in future studies with more kinematic variables. This methodology identified important variables to consider in future KOA research.

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1796 Board #204 MAY 30 2:00 PM - 3:30 PM

**A Pilot Study: Acute Effects of Doxorubicin on Hind-limb Gait Kinematics in Rats**

John M. Yager, Jeremy D. Smith, Abigail L. Carpenter, Noah M. Gibson, David S. Hydock. *University of Northern Colorado, Greeley, CO.*  
(No relationships reported)

Doxorubicin (DOX) is an effective chemotherapy drug, but it also has detrimental effects on healthy tissues, such as skeletal muscle. For example, *in vivo* DOX treatment in the rat has been shown to decrease hind-limb muscle force production. DOX-induced lower extremity muscle dysfunction and is likely to alter the ability of the muscle to accelerate the limb during the recovery phase of locomotion, but this effect has yet to be determined.

**PURPOSE:** To determine the effects of DOX treatment on rat hind-limb gait mechanics, with specific focus on the acceleration of the limb and spatiotemporal characteristics of gait.

**METHODS:** Fifteen adult male Sprague-Dawley rats were randomly assigned and injected with saline, 10 mg/kg DOX, 12.5 mg/kg DOX, or 15 mg/kg DOX delivered as a bolus *i.p.* injection. Retro-reflective markers were positioned on the left hind-limb at the knee, ankle and foot. Sagittal plane video were collected while rats walked on a treadmill at 27 cm/sec prior to injection and 72 hours post-injection (or as many days as possible). Videos were digitized, and individual stride cycles were identified based on foot contact events. Custom written software was used to filter marker position data (cut-off = 5 Hz), compute ankle angles, and compute accelerations. Two MANOVAS with Helmert contrasts were used to determine effects of DOX on kinematic and spatiotemporal measures.

**RESULTS:** Spatiotemporal measures were not significantly altered by DOX injections ( $\Lambda^*=0.59$ ,  $F_{3,10}=2.31$ ,  $p=0.14$ ). However, DOX injections did affect limb accelerations ( $\Lambda^*=0.08$ ,  $F_{3,10}=6.96$ ,  $p=0.02$ ). Follow-up Helmert contrasts revealed decreased accelerations in ankle vertical motion (-13%,  $p=0.002$ ,  $ES=1.07$ ), foot horizontal motion (-5%,  $p=0.04$ ,  $ES=0.27$ ), and foot vertical motion (-14%,  $p=0.001$ ,  $ES=0.97$ ) for all dose groups compared to the saline group. However, dose magnitude had no effect beyond the baseline comparison ( $p > 0.25$  for all contrasts).

**CONCLUSION:** Regardless of cumulative DOX dosage, reductions in limb accelerations occurred during swing when compared to a saline treated group. These reduced limb accelerations were consistent with reductions in isolated muscle force production previously reported suggesting muscle dysfunction due to DOX treatments may transfer to activities of daily living.

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1797 Board #205 MAY 30 2:00 PM - 3:30 PM

**Effects of Walking Speed on Net Muscle Moments and Contact Forces at the Knee**

Derek J. Haight, Michelle M. Reynolds, Wayne J. Board, Trevor Connor, Melissa Nolte, Raymond C. Browning, FACSM. *Colorado State University, Fort Collins, CO.*  
(No relationships reported)

Lower extremity net muscle moments (NMM) are used as a proxy measure of joint loading, particularly at the knee. However, there is little information regarding the relationship between knee NMM and joint contact forces (JCF) across a range of walking speeds.

**PURPOSE:** To quantify the magnitudes and changes in NMM and JCF during slow and fast walking.

**METHODS:** We collected kinematic and kinetic data as ten subjects (mass = 63.5 (11.0) kg, mean (SD)) walked on a dual-belt force measuring treadmill at 0.75 m/s 1.50 m/s. An OpenSim three-dimensional musculoskeletal model with 23 degrees of freedom and 92 muscles was scaled to each subject. We used OpenSim to calculate NMMs and muscle forces via inverse dynamics and static optimization, respectively, for 5 gait cycles for each subject. We determined JCFs from the vector sum of the joint reaction force and individual muscle forces crossing the knee joint, reported in the tibial reference frame.

**RESULTS:** The peak extensor NMM at the knee increased ~140% from 0.30 (0.23) Nm/kg to 0.7 (0.21) Nm/kg and the peak flexor NMM increased ~50% from 0.38 (0.14) Nm/kg to 0.58 (0.07) Nm/kg as walking speed was increased from 0.75 m/s to 1.50 m/s, ( $p<.01$ , Figure 1a). Peak axial JCF increased ~15% from 3.65 (0.44) BW to 4.18 (0.54) BW at 0.75 m/s and 1.50 m/s respectively, ( $p<.01$ , Figure 1b).

**CONCLUSIONS:** While NMMs increased considerably with gait speed, the increase in axial knee joint force was modest, suggesting that slower walking speeds may not substantially reduce joint loading. These results also suggest that NMM may not be a good proxy measure of joint loading and that musculoskeletal models should be used to quantify joint loads.

Supported by NIH Grant R03AR059264

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1798 Board #206 MAY 30 2:00 PM - 3:30 PM

**Biomechanical Characteristics of Stairway Walking between Able-bodies and Those Wearing Lower Limb Prosthetics**

Yugang Li, Haozhe Ma. *Wuhan Institute of Physical Education, Wuhan, China.* (Sponsor: Yong Tai Wang, FACSM)  
(No relationships reported)

**PURPOSE:** This study was to compare the biomechanical characteristics of stairway walking between the able-bodies and those wearing lower limb prosthetics while negotiating the different stairway slopes.

**METHODS:** Six male able-bodies and six males who wearing lower limb prosthetics (one side) participated in this study. The participants were able to perform stairway walking using the rail with the stairways slopes of 15° and 30°. A three-dimensional motion analysis system was used to record the kinematics and the hand and foot pressure sensors were used to record the hand and foot reaction forces when the participants walked up stairs with the stairway slopes of 15° and 30°. Three trials of walking on each stairway slope were recorded and the trials were averaged. The selected biomechanical variables included the knee flexion angle, speed of the center of mass (COM), peak hand and foot reaction forces. The independent t-test was employed to determine the differences between the able-body group (ABG) and the lower limb prosthetic group (LLPG).

**RESULTS:** For the 15° stairway walking, the knee flexion angles were 73.5°±2.1 for the ABG and 77.7°±4.9 for the LLPG; and the speeds of COM were 0.9±0.05 m/s for the ABG and 0.75±0.17 m/s for the LLPG, respectively. For the 30° stairway walking, the knee flexion angles were 82.5°±3.7 for the ABG and 86.4°±5.3 for the LLPG; and the speeds of COM were 0.81±0.09 m/s for the ABG and 0.66 m/s±0.11 for the LLPG, respectively. For the 15° stairway walking, the hand peak reaction force (46.2%±0.9) of the body weight) in the LLPG is significantly greater ( $p < .05$ ) than that (22.9%±1.7) in the ABG. However, the foot reaction forces were 131%±2.5 for the LLPG and 136%±2.0 for the ABG ( $p > .05$ ). For the 30° stairway walking, the hand and foot reactions forces showed the patterns similar to the 15° stairway walking condition, but no significant difference was observed. During the knee extension phase, the ABG showed the area of center of pressure (COP) around the five toes and front foot, and the LLPG showed the area of the COP around the front and middle foot.

**CONCLUSIONS:** The lower limb prosthetics has a good substitute function for stairway walking. However, attention should be paid to the training of standing/swing phases of the prosthetic leg, and the stairway slopes may affect the stairway walking speed and stability.

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1799 Board #207 MAY 30 2:00 PM - 3:30 PM

**Do Old Adults Modulate Walking Velocity Differently Than Young Adults?**

Paul DeVita, FACSM<sup>1</sup>, Alexis Sidiropoulos<sup>1</sup>, Patrick Rider<sup>1</sup>, Aubrey Taylor<sup>1</sup>, Tibor Hortobagyi, FACSM<sup>2</sup>. <sup>1</sup>East Carolina University, Greenville, NC. <sup>2</sup>University of Groningen, Groningen, Netherlands.  
(No relationships reported)

Young and old adults walk with stereotypical yet distinctly different lower extremity joint power patterns. Old vs. young adults use greater power at the proximal hip and lower power at the more distal knee and ankle when walking at the same velocity. We now ask, does this distal to proximal mechanical plasticity with age also govern the modulation of walking velocity in old vs. young adults? Hypothesis was: old adults have a stronger relationship between hip power and weaker relationships between knee and ankle powers with walking velocity compared to young adults.

**PURPOSE:** Identify the relationships among hip, knee and ankle joint powers and walking velocity in young and old adults.

**METHODS:** Walking velocities and lower limb joint powers were assessed for 20 trials of various velocities in each of 22 young (20 yrs) and 22 old (74 yrs) subjects. Velocities ranged from 0.62 to 2.71 m/s. Joint powers were regressed onto velocity for the both samples and for individual subjects within each sample (over trials).

**RESULTS:** All group maximum powers were moderately related to walking velocity. Group relationships with velocity were also similar at all joints ranging from  $R^2=0.445$  to  $0.608$ . Individual subjects had stronger relationships than group results; nearly all individual  $R^2$  values were higher than analogous group values. Hip power in old adults had the highest explained variance in both ages and all joints.

**CONCLUSIONS:** Individual subject analyses revealed a preference for velocity modulation through hip power adjustments in old but not young adults. Ankle and knee power-velocity relationships did not decrease in strength with age.

Regression analyses between walking velocity and maximum joint

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**1800** Board #208 MAY 30 2:00 PM - 3:30 PM

**Multiscale Entropy Analysis of Gait Control in Health Subjects**

Kuo-Wei Tseng, Hung-Wen Cheng, Hui-mei Lin, Yu-Hua Tseng, *Taipei Physical Education College, Taipei City, Taiwan.*

(No relationships reported)

Traditional approaches to measuring the complexity of biological signals fail to account for the multiple time scales inherent in such time series. The multiscale entropy (MSE) method is notable to studying a wide variety of other physiologic and physical time series data.

**PURPOSE:** To analysis the multiscale entropy of stride interval time series for normal gait group and two unstable gait groups of eyes-closed and dizziness in health subjects.

**METHODS:** We apply the MSE method to the gait cycle interval time derived from acceleration. The accelerometer recordings strides interval time series of 15 health subjects (age:  $21.26 \pm 0.85$  yrs) who walked for 2000 strides at normal gait pattern (N), eyes-closed gait (E) and dizziness gait (D). The subjects performed normal gait with normal spontaneous walking, eyes-closed gait with closed eyes, and dizziness gait with 20 standing spins in each 200 strides.

**RESULTS:** The stride interval in D and E group are shorter than N group ( $520.33 \pm 86.72$ ,  $557.31 \pm 64.53$  vs.  $574.07 \pm 63.60$  ms,  $p < 0.05$ ). In all cases, D and E groups are assigned higher entropy values than N group at larger scales, such as scale factor 18 ( $0.96 \pm 0.08$ ,  $0.92 \pm 0.12$  vs.  $0.62 \pm 0.23$ ,  $p < 0.05$ ), scale factor 19 ( $1.11 \pm 0.07$ ,  $0.94 \pm 0.12$  vs.  $0.61 \pm 0.19$ ,  $p < 0.05$ ) and scale factor 20 ( $0.94 \pm 0.13$ ,  $0.88 \pm 0.09$  vs.  $0.61 \pm 0.13$ ,  $p < 0.05$ ). The results indicate that time series of D and E groups are more complex than N group. (Fig.1)

**CONCLUSION:** The motor control of human locomotor system during unstable walking is more complex than normal walking. The results obtained increasing complex is one of the strategies when the ambulation be disturbed.

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**1801** Board #209 MAY 30 2:00 PM - 3:30 PM

**Sex Differences in the Stride Frequency of Walking while Carrying a Toddler Manikin**

Marcella J. Myers<sup>1</sup>, Alice A. Fasnacht<sup>1</sup>, Cara M. Wall-Scheffler<sup>2</sup>, <sup>1</sup>St. Catherine University, St. Paul, MN. <sup>2</sup>Seattle Pacific University, Seattle, WA. (Sponsor: Mark Blegen, FACSM)

(No relationships reported)

Despite the frequency and necessity of infant/toddler-carrying by parents and other caregivers, very little research has focused on the energetic and behavioral consequences of this activity in adults. In particular, sex differences in carrying behavior and biomechanics has been virtually ignored.

**PURPOSE:** Our specific goal was to determine whether women and men carrying a toddler-sized manikin on their hip or their shoulders choose different stride frequencies at a given speed when asked to walk around the perimeter of a gym at moderate to brisk walking speeds.

**METHODS:** To determine how child-carrying affects the free walking gait choices of adults as a function of sex and task, we calculated the walking speed of 6 females and 6 males as they walked around the perimeter of a gym while performing 6 tasks in a randomized order. Tasks consisted of all combinations of 3 loading conditions - carrying a 10kg toddler-proportioned manikin on the shoulders or hip, or a comparable mass around the waist - and 2 walking speed directives ("walk-all-day" or "brisk" walks). Stride frequency and walking speed were determined from videotape using a stopwatch. Speed was calculated from the time required to walk between two markers 3.7 meters apart, stride frequency was determined over 4 consecutive strides.

**RESULTS:** When speed directive was accounted for, females walked faster than males ( $p=0.001$ ), and this effect was only enhanced by including body mass in the regression model (i.e. body mass differences could not explain the sex difference in walking speed). At a given walking speed, females used higher stride frequencies than males ( $p < 0.001$ ) and stride frequency increased as the load position changed from belt, to shoulder, to hip ( $p=0.006$ ). Adding body mass to the model removed the sex effect.

**CONCLUSIONS:** Although the carrying task was a larger burden for the females due to their smaller body mass, females consistently chose faster walking speeds than males for a given speed directive, and higher stride frequencies for a given walking speed. Sex differences appeared to be the result of differences in body mass and the relative size of the toddler load. Supported by 3M Faculty/Student Collaborative Grant #212607 and the Endowed Professor in the Sciences at St. Catherine University, St. Paul, Minnesota.

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**1802** Board #210 MAY 30 2:00 PM - 3:30 PM

**Effectiveness of a Novel Therapeutic Technique on Improving Gait Characteristics among Children with Cerebral Palsy**

Jeffrey R. McClellan, Janet S. Dufek, FACSM, Robbin Hickman, *University of Nevada, Las Vegas, Las Vegas, NV.*

(No relationships reported)

Large amplitude, high-intensity movement therapy has led to gait improvements in individuals with Parkinson's Disease. Children with Cerebral Palsy (CP) typically demonstrate gait characteristics such as scissoring of the legs during gait and toe walking, with greater unilateral dysfunction being common.

**PURPOSE:** Test the concept of adapting large amplitude, whole body movements, similar to those used in Lee Silverman Voice Training BIG® in order to improve gait characteristics among children with CP.

**METHODS:** After receiving institutionally approved informed consent from a parent and child assent, five children diagnosed with CP ( $7.0 \pm 1.0$  yrs;  $125.7 \pm 7.3$  cm;  $26.0 \pm 5.1$  kg) walked twice across an instrumented electronic walkway (CIR Systems, Inc.; 120hz) at a preferred speed, before and after a 15 minute intervention session focused on large amplitude, whole body movements. Foot pressure data were extracted and analyzed by right and left footfalls, for the heel, midfoot, and forefoot area of the foot. Two dependent variables, pressure-time ( $P^*t$ ) detailing the percent of total pressure distributed across time, and Area (A) detailing the percent of total foot area, in a given foot segment during stance were used to analyze the data. Data were compared pre-post intervention using a single-subject Model Statistic procedure ( $\alpha = 0.01$ ).

**RESULTS:** Results trended towards improvement, but were generally non-significant. S3 improved gait by walking with a more standard heel-toe gait pattern and significantly increased  $P^*t$  ( $0 \pm 0\%$  vs.  $3.4 \pm 2.3\%$ ) and A ( $0 \pm 0\%$  vs.  $13.6 \pm 7.1\%$ ) in the right foot heel segment. S5 improved gait by decreasing pressure from the right heel for  $P^*t$  ( $44.6 \pm 7.3\%$  vs.  $32.7 \pm 8.4\%$ ) and transitioning more to the midfoot as shown by an increase in A ( $27.6 \pm 1.7\%$  vs.  $30.2 \pm 2.0\%$ ) for this segment. Results for other subjects showed no significant results (S1) or displayed mixed results (S2, S4).

**CONCLUSION:** While results remain inconclusive the general effectiveness of large amplitude exercise appears to be strengthened. Future testing and comparison of children with CP to typically developing children is recommended, while continued exploration regarding the effectiveness of clinical doses of large-amplitude movement interventions for this population should be determined.

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**B-34 Free Communication/Poster - Genetics I**

MAY 30, 2012 1:00 PM - 6:00 PM  
ROOM: Exhibit Hall

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**1803 Board #211 MAY 30 3:30 PM - 5:00 PM****Exercise Training Response In Patients With Heart Failure Is Modulated By Adrb1 And Gnas Polymorphisms**

Alberto J. Alves<sup>1</sup>, Fernando Ribeiro<sup>1</sup>, Ehud Goldhammer<sup>2</sup>, Yelena Rivlin<sup>2</sup>, Uri Rosenschein<sup>2</sup>, João Luís Viana<sup>3</sup>, José Alberto Duarte<sup>1</sup>, Michael Sagiv<sup>4</sup>, José Oliveira<sup>1</sup>.  
<sup>1</sup>University of Porto, Faculty of Sport, Porto, Portugal. <sup>2</sup>Bnai-Zion Haifa Medical Center, Haifa, Israel. <sup>3</sup>Loughborough University, School of Sport, Exercise and Health Sciences, Loughborough, United Kingdom. <sup>4</sup>The Zinman College of Physical Education and Sport Sciences at the Wingate Institute, Netanya, Israel.  
(No relationships reported)

Beta1-adrenergic receptors (ADRB1) and Gs proteins (GNAS) play important roles in the regulation of cardiac function.

**PURPOSE:** the aim of the present study was to investigate whether ADRB1 Arg389Gly (rs1801253), GNAS -1211 G/A (rs6123837) and GNAS 2291 C/T (rs6026584) functional polymorphisms have an impact on diastolic function and exercise tolerance measured before and after exercise training in patients with heart failure.

**METHODS:** A total of 61 patients with heart failure completed a 6-month exercise-training program. Mitral inflow velocities (deceleration time of early mitral flow and E/A ratio) and exercise tolerance (METs) were assessed before and after exercise training. Polymorphisms were detected through restriction fragment length polymorphism analysis.

**RESULTS:** There were no associations between polymorphisms and E/A ratio measured before and after exercise training. In contrast, deceleration time at baseline was elevated in GNAS -1211GG and -1211AG genotype carriers compared to -1211A allele homozygotes (238.6 ± 40.3 vs. 239.9 ± 40.6 vs. 196.3 ± 51.0 ms, P<0.05). Exercise training attenuated deceleration time in -1211GG (from 238.6 ± 40.3 to 224.3 ± 21.8 ms, P<0.05) and -1211AG genotypes (from 239.9 ± 40.6 to 224.6 ± 22.2 ms, P<0.05) but not in -1211A allele homozygotes (from 196.3 ± 51.0 to 201.4 ± 30.4 ms, n.s.). There were no associations between polymorphisms and exercise tolerance measured before exercise training. On the other hand, ADRB1 389Gly homozygotes had a greater training-induced increase in exercise tolerance than 389Arg homozygotes (0.88 ± 0.80 vs. 0.33 ± 0.50 METs, P=0.04). However, these differences were no longer significant after being controlled for treatment with Metoprolol and Atenolol.

**CONCLUSIONS:** Our data show that the functional GNAS -1211 G/A polymorphism influences diastolic function measured before and after exercise training in heart failure patients. Furthermore, our data suggest that there is an association between the ADRB1 Arg389Gly polymorphism and the exercise training response in heart failure patients. However, this association seems to be attenuated by treatment with Metoprolol and Atenolol.

Acknowledgements: this study was supported by the grant SFRH/BD/33122/2007 from the Fundação para a Ciência e a Tecnologia (FCT), Portugal.

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**1804 Board #212 MAY 30 3:30 PM - 5:00 PM****High LDL In A Young, Healthy, Canadian Population: A Valuable Target For Gene-stratified Interventions**

Angie Karlos, Elizabeth Gnatiuk, Dustin Hittel. *University of Calgary, Calgary, AB, Canada.*  
(No relationships reported)

Cardiovascular disease (CVD) is the leading cause of death and disability in the world. Historically, observations that siblings and children of those with CVD were more likely to develop the disease led to the conclusion that CVD is heritable. A recently published GWAS identified 95 loci associated with total cholesterol (TC), LDL, HDL and TG levels in over 100 000 individuals of European descent. Despite identifying a large number of SNP's associated with lipid traits, effect sizes were significantly lower than previously reported heritabilities. This has led to the hypothesis that a portion of this missing heritability is due to gene-age interactions. It is expected that studying a young, healthy sample will produce larger effect sizes due to the presence of fewer confounding variables.

**PURPOSE:** To determine the prevalence of abnormal LDL, TC, HDL and TC:HDL ratio levels in a young, healthy, Canadian university population to inform subsequent gene-stratified interventions.

**METHODS:** Subjects were recruited at the University of Calgary (UCalgary) using posters around campus, classroom information sessions and recruitment booths in high traffic areas. Inclusion criteria included being between 18 and 35 years-old, post-pubertal status and ability to provide informed consent. Dependent variables include, HDL, and TC measured via fasting blood draw, and LDL, calculated using the Friedewald method. The National Cholesterol Education Program, III Adult Education Panel criteria was used to identify abnormal cholesterol values.

**RESULTS:** Subjects from UCalgary have a mean age of 22.97 ± 4.04 years for females and 23.56 ± 3.89 years for males. Mean values for body fat, BMI, LDL, HDL and TC were within normal ranges. However, 25.8% of females and 28.3% of males had high LDL. Although very few subjects had below threshold levels of HDL, 22.6% of females and 40% of males had TC:HDL ratios >3.0.

**CONCLUSION:** A higher than expected proportion of subjects had above cutoff values of LDL and TC:HDL cholesterol ratios. Cholesterol is currently the primary focus for gene-stratified nutrition based interventions.

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**1805 Board #213 MAY 30 3:30 PM - 5:00 PM****Candidate Gene Associations with the Blood Pressure Response to Aerobic Exercise Training: A Meta-Analysis**

Michael L. Bruneau, Jr., Tania B. Huedo-Medina, Blair T. Johnson, Kara A. Larson, Linda S. Pescatello, FACSM. *University of Connecticut, Storrs, CT.*  
(No relationships reported)

**PURPOSE:** Aerobic exercise (AE) lowers blood pressure (BP) 5-7 mmHg among those with hypertension, but there is considerable inter-individual variability in the BP response to AE. Genetic predispositions account for 40-65% of this variability; however, identifying genetic variants that associate with the BP response to AE is a challenge. We performed a meta-analysis to integrate the small number of studies that examined the influence of candidate genes on the BP response to AE training.

**METHODS:** Studies retrieved included an AE training intervention; human Caucasians; and BP before and after AE by genotype. Effect sizes were the standardized mean difference of post- vs. pre-exercise BP disaggregated for genotype adjusted for baseline BP differences. Analyses followed fixed-effects assumptions.

**RESULTS:** 11 studies qualified (N=3,218). AE interventions were performed at 63.1±16.5% (Mean±SD) maximum oxygen consumption 2.8±1.1 d/wk for 40 min/session for 15.8±10.6 wk. Participants were mostly men (N= 1,805, 56%) 48.8±13.0 yr with a body mass index of 27.3±3.2 kg/m<sup>2</sup> and BP of 136.0±15.7 / 82.6±10.7 mmHg. The effect of genotype on the BP response to AE was small, non-significant, and very heterogeneous for systolic BP (SBP) (d+ = 0.044 [95% CI = - 0.034 to 0.122], 1.67 mmHg, I<sup>2</sup>=81.51); and diastolic BP (DBP) (d+ = 0.016 [95% CI = - 0.062 to 0.0984], 0.55 mmHg, I<sup>2</sup>=71.35). To explain the large heterogeneity, we categorized genotype by BP regulatory pathway. The genotype effect for SBP was moderate for polymorphisms involved with energy metabolism [d+ = -0.422 (95% CI = - 0.127 to - 0.758, -1.60 mmHg)] and weak for those in the sympathetic nervous system [SNS, d+ = - 0.280 (95% CI = - 0.125 to -0.436, - 0.46 mmHg)]. The genotype effect for DBP was weak for polymorphisms in the renin-angiotensin system [RAS, d+ = - 0.119 (95% CI = - 0.227 to - 0.010, - 0.05 mmHg)] and SNS [d+ = - 0.237 (95% CI = -0.083 to - 0.391, - 0.016 mmHg)].

**CONCLUSIONS:** The overall effect of genetic predispositions on the BP response to AE training is small due to the large heterogeneity among trials. When polymorphisms are grouped by BP regulatory pathway, polymorphisms involved with energy metabolism and those in the SNS and RAS emerge as genetic variants more likely to be associated with the BP response to AE training that should be explored in future work.

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1806 Board #214 MAY 30 3:30 PM - 5:00 PM

**Cardiorespiratory Fitness Affects Polymorphism In FABP2 Ala54Thr-caused Increase In Arterial Stiffness And Blood Pressure**

Shumpei Fujie<sup>1</sup>, Motoyuki Iemitsu<sup>1</sup>, Haruka Murakami<sup>2</sup>, Kiyoshi Sanada<sup>1</sup>, Hiroshi Kawano<sup>3</sup>, Yuko Gando<sup>3</sup>, Ryoko Kawakami<sup>2</sup>, Motohiko Miyachi<sup>2</sup>. <sup>1</sup>*Ritsumeikan University, Kusatsu, Japan.* <sup>2</sup>*National Institute of Health and Nutrition, Tokyo, Japan.* <sup>3</sup>*Waseda University, Tokorozawa, Japan.* (Sponsor: Izumi Tabata, FACSM)  
(No relationships reported)

Fatty acid binding protein 2 (FABP2) Ala54Thr polymorphism is a candidate gene associated with the risk of cardiovascular disease. Recently, the ThrThr genotype of FABP2 polymorphism causes the decrease in systolic blood pressure compared with AlaAla and AlaThr genotypes. Habitual exercise brings higher cardiorespiratory fitness and results in the improvement of cardiovascular disease risk. However, the effect of cardiorespiratory fitness level and FABP2 Ala54Thr polymorphism on the risk of cardiovascular disease remains unclear.

**PURPOSE:** In the present study, a cross-sectional investigation of 843 Japanese men and women (18-70 years old) was performed to clarify the effects of cardiorespiratory fitness on the relationship between risk of cardiovascular disease and FABP2 Ala54Thr gene polymorphism.

**METHODS:** Carotid beta-stiffness, measured by ultrasound and tonometry, and brachial blood pressure, measured by oscillometry, were assessed as risks of arteriosclerosis and arteriosclerosis. We measured peak oxygen uptake (VO<sub>2</sub>peak) during an incremental cycle ergometer exercise test, and then the study subjects were divided into high-cardiorespiratory fitness (High-Fit) and low-cardiorespiratory fitness (Low-Fit) groups based on the median value of VO<sub>2</sub>peak in each sex and decade. FABP2 Ala54Thr polymorphism was determined by real-time PCR with Taqman probe.

**RESULTS:** There were no significant effect of FABP2 Ala54Thr polymorphism on carotid beta-stiffness and blood pressure. Carotid beta-stiffness, systolic blood pressure, and diastolic blood pressure in the Low-Fit subjects increased in AlaAla genotype individuals compared with AlaThr and ThrThr genotype of FABP2 Ala54Thr, however, had no effect on FABP2 polymorphisms in High-Fit subjects. Additionally, serum triglyceride and plasma glucose levels were lower and serum HDL cholesterol levels were higher in High-Fit subjects compared with in Low-Fit subjects, but there were no significant effect of FABP2 polymorphism.

**CONCLUSION:** These results suggest that the higher cardiorespiratory fitness may be associated with attenuated central arterial stiffness and blood pressure related to FABP2 Ala54Thr polymorphism, regardless of increase in conventional metabolic risk factors, such as hyperglycemia and dyslipidemia.

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1807 Board #215 MAY 30 3:30 PM - 5:00 PM

**A Systematic A Priori Search for Candidate Genes Associated with the Exercise Blood Pressure Response**

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(No relationships reported)

Identifying genetic variants associated with the blood pressure (BP) response to exercise is hindered by lack of standard criteria for candidate gene selection, underpowered samples, and lack of conclusive whole genome studies.

**PURPOSE:** To develop a prioritized panel of candidate genetic variants that may have increased likelihood of associating with the BP response to exercise to be used in conjunction with genome wide association studies (GWAS).

**METHODS:** We searched for candidate genetic variants meeting preestablished criteria using PubMed and published systematic reviews. These preestablished criteria were: 1) associated with BP, exercise, and/or the response to antihypertensive medications in major BP regulatory pathways; 2) from GWAS of BP meeting preestablished statistical criteria for genome-wide significance; 3) associated with energy metabolism and/or body composition as obesity is a risk factor for hypertension; 4) associated with other established and emerging cardiovascular disease (CVD) risk factors that have been implicated in the etiology of hypertension; and 5) from GWAS of BP meeting nominal statistical significance after correction for multiple testing.

**RESULTS:** Meeting the inclusion criteria were: 1) 167 variants from 56 candidate genes within major BP regulatory pathways including the renal and renin angiotensin systems (114 variants, 32 genes), sympathetic nervous system (39 variants, 20 genes), and nitric oxide synthase pathway (14 variants, 4 genes); 2) 60 variants from GWAS meeting pre-established statistical criteria; 3) 68 variants on 25 candidate genes associated with energy metabolism and/or body composition; 4) 102 variants on 27 candidate genes associated with other CVD risk factors including lipids and lipoproteins (57 variants, 9 genes) and inflammatory, thrombotic, or haemostatic factors (45 variants, 18 genes); and 5) 129 variants from GWAS meeting nominal statistical significance after correction for multiple testing.

**CONCLUSIONS:** This prioritized panel of 526 genetic variants provides function and mapping information that can serve as a reference for future work investigating the genetic basis of the BP response to exercise.

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1808 Board #216 MAY 30 3:30 PM - 5:00 PM

**Insulin Secretion-related SNPs Are Associated With Prevalent And Incident Diabetes In The Sos Bariatric Surgery Cases**

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(No relationships reported)

Obesity is a major risk factor for type 2 diabetes mellitus (T2DM) and weight loss is an effective way to prevent the onset of T2DM or even reverse the disease process. Positive family history is a strong predictor of T2DM morbidity and recent genome-wide association studies (GWAS) have identified dozens of DNA sequence variants associated with T2DM.

**PURPOSE:** The purpose of our study was to investigate associations between GWAS-derived T2DM risk SNPs and 1) prevalent T2DM in obese subjects, and 2) incidence of T2DM in obese subjects treated with bariatric surgery.

**METHODS:** A total of 17 SNPs shown to be associated with T2DM in several GWAS reports were genotyped in 1835 obese (average BMI 42.5 kg/m<sup>2</sup> [SD 4.5]) subjects who underwent bariatric surgery in the Swedish Obese Subjects study. Ten of the SNPs have been reported to be related to insulin secretion (CAMK1D, CDKAL1, HHEX, HNF1B, IFGBP2, KCNJ11, SLC30A8, TCF7L2, THADA, WFS1) and three to insulin sensitivity (ADAMTS9, FTO, PPARG) while four (CDKN2A, JAZF1, NOTCH2, TSPAN8) do not yet have a clear functional assignment.

**RESULTS:** At baseline, 320 subjects had T2DM, while 1515 were T2DM-free. Among the latter, during a mean follow-up of 9.9 years, average maximum weight loss was 34.9 kg (28.7%) and 105 subjects developed T2DM. At baseline (pre-surgery), three of the 17 SNPs were associated with prevalent T2DM: TCF7L2 (OR 1.37 [95% CI 1.13-1.67], p=0.001), HNF1B (1.30 [1.02-1.90], p=0.003), and SLC30A8 (1.28 [1.06-1.56], p=0.011). Only one SNP (SLC30A8: 1.39 [1.02 - 1.90], p=0.04) was associated with T2DM incidence. A summary score capturing the number of risk alleles in 10 insulin secretion-related SNPs was associated with both T2DM prevalence (1.12 [1.05-1.09], p<0.0001) and incidence (1.08 [1.00 - 1.17], p=0.04), while a score reflecting insulin sensitivity-related markers was not associated with T2DM prevalence or incidence (P>0.7 for both).

**CONCLUSION:** Our results suggest that in obese individuals, insulin secretion-related SNPs are associated with prevalent T2DM as well as with T2DM incidence after bariatric surgery, while SNPs related to insulin sensitivity do not show similar associations.

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1809 Board #217 MAY 30 3:30 PM - 5:00 PM

**The Effect Of Salbutamol On Cycling Performance Partitioned By The ADRB2 C79G SNP Genotype**

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(No relationships reported)

The C79G single nucleotide polymorphism (SNP) of the adrenergic  $\beta_2$ -receptor gene (*ADRB2*) is associated with the regulation of cardiorespiratory responses to the inhalation of salbutamol, including the regulation of bronchodilation, heart rate and ventilation. The GG genotype at the C79G SNP (rs 1042714, Glu<sup>27</sup>Gln) was associated with decreased airway response to inhaled  $\beta_2$ -agonists compared to the CC genotype in asthmatics.

**PURPOSE:** To determine the effect of genetic variation at the *ADRB2* C79G SNP on lung function and athletic performance in cyclists with and without exercise-induced bronchoconstriction (EIB) after the inhalation of salbutamol (SAL).



**METHODS:** The C79G SNP genotype (CC:  $n=14$ ; CG:  $n=19$ ; GG:  $n=7$ ; unidentified:  $n=2$ ) was determined in competitive 19 - 40 year old male cyclists with EIB (EIB+,  $n=10$ ) and without EIB (EIB-,  $n=32$ ). Athletes performed two 10-km time trials (TTs) on a cycle ergometer 60-min after the inhalation of either 400  $\mu\text{g}$  SAL or placebo. Forced expiratory volume in 1 second (FEV<sub>1</sub>) was assessed immediately before and 30-min after inhalation of SAL. Performance was measured by mean power output relative to body weight.

**RESULTS:** There was no association between the C79G SNP and EIB prevalence ( $p \geq 0.05$ ). The significant increase in FEV<sub>1</sub> after the inhalation of SAL ( $p \leq 0.001$ ) was independent of the genotypes at the C79G SNP: GG ( $M$  (SD) = 4.70 (2.51) %), CG (7.88 (8.23) %); and CC (5.94 (2.31) %); ( $p \geq 0.05$ ). The C79G SNP did not affect average power output after the inhalation of SAL: GG (4.1 (0.4)  $\text{W}\cdot\text{kg}^{-1}$ ), CG (3.9 (0.3)  $\text{W}\cdot\text{kg}^{-1}$ ) and CC (4.0 (0.2)  $\text{W}\cdot\text{kg}^{-1}$ );  $p \geq 0.05$ . Nevertheless, the C79G SNP was associated with the change in ventilation during the TT after SAL inhalation: Athletes with the CC genotype presented with an increased minute ventilation (1.82 (0.35)  $\text{L}\cdot\text{kg}^{-1}\text{min}^{-1}$ ) compared to placebo (1.64 (0.38)  $\text{L}\cdot\text{kg}^{-1}\text{min}^{-1}$ ;  $p = 0.03$ ), but athletes with the GG genotype maintained ventilation after the inhalation of SAL (1.82 (0.27)  $\text{L}\cdot\text{kg}^{-1}\text{min}^{-1}$ ), compared to placebo (1.83 (0.32)  $\text{L}\cdot\text{kg}^{-1}\text{min}^{-1}$ ).

**CONCLUSIONS:** In competitive male cyclists, FEV<sub>1</sub> is improved after the inhalation of 400  $\mu\text{g}$  SAL. Despite this improvement in lung function, mean power output during a 10-km TT was not altered regardless of the athletes' susceptibility to EIB and genetic variation at the *ADRB2* C79G SNP.

**1810 Board #218 MAY 30 3:30 PM - 5:00 PM**

**The Association Between An Indel Polymorphism In The Alp Gene And Athletic Performance**

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(No relationships reported)

the presence of alpha-actinin-3 in type-II fibres is known to affect skeletal muscle function and metabolism. The R-allele of the gene ACTN3 (polymorphism R577X) is associated with sprint/power performance, whilst the X-allele (alpha-actinin-3 absent) is associated with endurance performance. ALP is a muscle protein that interacts with alpha-actinins, possibly affecting its expression/function. The human ALP gene displays a large Indel polymorphism (~2.6 kb) whose function remains poorly understood. Here, we explored the possibility of this polymorphism being associated with athletic performance.

**PURPOSE:** to compare the frequency of the polymorphic allele (I-allele) of the gene ALP between two distinct cohorts (athletes vs. non-athletes).

**METHODS:** DNA from 307 Australian athletes and 160 Australian Caucasian controls were submitted to a PCR reaction designed to amplify a fragment of the ALP gene with (I-allele) and without the ~2.6 kb insertion (D-allele). Allele's frequencies were compared by means of the  $\chi^2$  test.

**RESULTS:** although no differences were found between athletes and controls, the I-allele was slightly more frequent in power/sprint athletes as compared to endurance and controls. The frequency of the I-allele was twice as high in specific sports (i.e., T&F and cycling) and three times lower in rowing when compared to the control group (Table 1).

**CONCLUSIONS:** the frequency of the I-allele may help to explain the success in specific sports, especially T&F, cycling and rowing.

| Allele frequencies among athletes and controls. |          |          |                |
|---|----------|----------|----------------|
|   | D-allele | I-allele | chi-square (p) |
| Controls (n=160)                                | 92%      | 8%       | -              |
| Power/sprint athletes (n=112)                   | 87%      | 13%      | 2.85 (0.06)    |
| Endurance athletes (n=195)                      | 91%      | 9%       | 0.14 (0.99)    |
| Specific sports T&F (n=65)                      | 83%      | 17%      | 6.06 (0.008)   |
| Cycling (n=84)                                  | 86%      | 14%      | 4.01 (0.027)   |
| Rowing (n=83)                                   | 97%      | 3%       | 4.48 (0.02)    |
| Swimming (n=59)                                 | 93%      | 6.8%     | 0.34 (0.58)    |

**1811 Board #219 MAY 30 3:30 PM - 5:00 PM**

**Genome-wide Association Study On Physical Performance Among Children: Panic Study**

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(No relationships reported)

Low physical performance increases the risk of many chronic diseases and mortality. In past decades physical performance among children has decreased mainly due to sedentary lifestyle. However, genetic factors associated with physical performance in children are unclear. Genome-wide association studies (GWAS) provide an efficient strategy to investigate the associations of large numbers of common gene variants with many health-related phenotypes in large human data sets.

**PURPOSE:** To identify new gene variants associated with physical performance in children.

**METHODS:** We studied the associations of 194 729 single nucleotide polymorphisms (SNPs), analyzed by MetaboChip array, with maximal work load in Watts divided by lean body mass in kilograms ( $W_{\text{max}}/\text{LBM}$ , in  $\text{W}/\text{kg}$ ), assessed by bicycle ergometer exercise test, in a representative population sample of 512 Caucasian girls and boys 6-8 years of age. The genome-wide associations with  $W_{\text{max}}/\text{LBM}$  were analyzed with unadjusted dominant linear regression models. Altogether 17 SNPs with genome-wide significance ( $p < 9.99 \times 10^{-5}$ ) were further analyzed with multiple linear regression models adjusted for gender and age.

**RESULTS:** After adjustment for gender and age, 2 SNPs were associated with  $W_{\text{max}}/\text{LBM}$ . Rs212593 near *CBLN4* explained 1.2% of variance in  $W_{\text{max}}/\text{LBM}$  ( $p=0.008$  for linear regression model), and carriers of minor T allele had a 0.7  $\text{W}/\text{kg}$  higher  $W_{\text{max}}/\text{LBM}$  than major C allele homozygotes ( $p=0.006$  for difference between 2 genotype groups). There were no minor T allele homozygotes in the cohort. Rs11596811 near *PRKCQ* explained 0.6% of variance in  $W_{\text{max}}/\text{LBM}$  ( $p=0.042$  for linear regression model), and homozygotes for minor A allele had a 0.3  $\text{W}/\text{kg}$  lower  $W_{\text{max}}/\text{LBM}$  than heterozygotes and a 0.5  $\text{W}/\text{kg}$  lower  $W_{\text{max}}/\text{LBM}$  than major C allele homozygotes ( $p=0.162$  for difference across 3 genotypes).

**CONCLUSIONS:** These preliminary data suggest that SNPs near *CBLN4* and *PRKCQ* genes are associated with physical performance among children. These findings should be replicated in other populations.

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1812 Board #220 MAY 30 3:30 PM - 5:00 PM

**Genetic And Environmental Influences On Longitudinal Changes In Physical Activity From Adolescence To Young Adulthood**

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(No relationships reported)

Leisure time physical activity (LTPA) habits are the results of a complex interplay of both genetic and environmental influences. Large epidemiological cross-sectional studies have evidenced that the heritability of physical activity behavior ranges between 30% and 70%. However, at present little is known about the factors mediating change in physical activity behavior across the critical periods of life.

**PURPOSE:** The aim of this study was to estimate genetic and environmental influences on the longitudinal evolution of LTPA habits from adolescence to young adulthood.

**METHODS:** The research is part of the FinnTwin16 Cohort study and the sample consisted of 4 915 monozygotic and dizygotic twins, born between the years 1975 and 1979. The LTPA volume was assessed as frequency of physical activity and participants were categorized in three groups: inactive, moderately active and active. Data was gathered at four time points; mean ages 16.1, 17.1, 18.6 and 24.4. Genetic and environmental influences on change in LTPA were estimated using linear growth modeling with a multiple threshold approach and sex-limitation effects. Analyses were developed in R-CRAN software utilizing the OpenMX package.

**RESULTS:** For both boys and girls the heritability of LTPA remained moderate (25%–40%) during the 8-year follow-up. The main results suggested important sex-differences in the estimates for additive genetic (A), common environmental (C), and specific environmental (E) influences on this behavior. The overall level of LTPA during the follow-up was moderately accounted for by A in boys (A=36.6%, C=56.2%, E=7.2%), while the corresponding percentage was lower in girls (A=17.3%, C=77.3%, E=5.4%). More noticeably, longitudinal changes in LTPA were largely accounted for by C in boys (A=1.0%, C=96.5%, E=2.4%) and by A in girls (A=62.5%, C=17.5%, E=20.0%).

**CONCLUSIONS:** The study evidenced relevant sex-differences in genetic and environmental influences in the evolution of LTPA habits from adolescence to young adulthood. Environmental factors showed critical to explain longitudinal changes in LTPA in boys, while girls' variations were mostly accounted for by additive genetic influences. These outcomes emphasize the need of specific actions to each sex in order to promote physical activity habits during this period of life.

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1813 Board #221 MAY 30 3:30 PM - 5:00 PM

**Effects Of Cag Repeat Polymorphism In The Androgen Receptor Gene On Fitness In Children.**

Lorena Rodríguez-García, Jesús G. Ponce-González, Amelia Guadalupe-Grau, Jose Losa-Reyna, Francisco Germán Rodríguez-González, Cecilia Dorado, Bonifacio Nicolás Díaz-Chico, José A. L Calbet. UNIVERSIDAD DE LAS PALMAS DE GRAN CANARIA, LAS PALMAS, Spain.

(No relationships reported)

Androgen receptor (AR) CAG<sub>n</sub> (polyglutamine) repeat polymorphism determines part of the androgenic effect and may influence body composition and physical performance.

**PURPOSE:** To determine if androgen receptor polymorphism (CAG<sub>n</sub>) may influence body composition and the physical fitness in children.

**METHODS:** The association between body fat mass and physical fitness with the AR CAG<sub>n</sub> polymorphism was studied in 250 physically active children, 145 boys and 105 girls (mean±SD: 11.7±2.6 and 10.2±3.4 years old, respectively). The vertical jumping height (and power), running speed, and VO<sub>2</sub>max was determined in all subjects. CAG repeat number was determined by PCR and fragment analysis, and confirmed by DNA sequencing of selected samples. Boys were grouped as CAG short (CAG<sub>S</sub>) if harboring repeat lengths ≤21, the rest as CAG long (CAG<sub>L</sub>). The corresponding cut-off CAG number for girls was 22.

**RESULTS:** The boys harboring CAG<sub>S</sub> achieved better running performance in the 300 m running test than their CAG<sub>L</sub> counterparts (71.0±12.3 vs 74.2±13.0, respectively; P=0.018). This difference remained statistically significant after accounting for height and age covariates. No statistically significant differences between CAG<sub>S</sub> and CAG<sub>L</sub> groups were found either in boys or in girls for the rest of the physical fitness variables.

**CONCLUSION:** Androgen receptor (AR) CAG<sub>n</sub> (polyglutamine) repeat polymorphism has if any little influence on children physical fitness. However, a short CAG repeat number may favor performance in the 300 m running speed test in boys.

This study was supported by Ministerio de Educación y Ciencia (DEP2006-56076-C06-04/ACTI) and FEDER, Gobierno de Canarias (PI2005/177), Proyecto Interreg IIB BIOPOLIS, Fundación del Instituto Canario de Investigación del Cáncer (FICIC), Cabildo de Gran Canaria, Cabildo de Tenerife and La Caja de Canarias, and Proyecto Estructurante "Integración de los grupos de investigación en Ciencias de la Salud", ULPGC, Gobierno de Canarias.

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1814 Board #222 MAY 30 3:30 PM - 5:00 PM

**Androgen Receptor Gene Polymorphisms Fat Mass Accumulation, And Maximal Fat Oxidation Capacity. A Longitudinal Study**

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(No relationships reported)

Androgens play an important role in the regulation of lipolysis and fat tissue mass. The cellular sensitivity to androgens varies depending on polymorphic variations of androgen receptors (AR).

**PURPOSE:** The aim of this longitudinal study was to evaluate if extreme CAG and GGN repeat polymorphisms of the AR may influence body fat mass, its regional distribution, fat accumulation, basal metabolic rate, and basal and maximal fat oxidation (MFO), maximal oxygen uptake (VO<sub>2</sub>max), as well as the serum concentration of hormones implicated in the regulation of fat mass like leptin, testosterone and osteocalcin.

**METHODS:** CAG and GGN repeats length were measured in 319 young and physically active men (mean ± SD: 28.3 ± 7.6 years old). From these we selected the subjects with short (CAG<sub>S</sub>; ≤ 19) and long (CAG<sub>L</sub>; ≥ 24) CAG repeats, and the subjects with short (GGN<sub>S</sub>; ≤ 22) and long (GGN<sub>L</sub>; ≥ 25) GGN repeats, using the median CAG and GGN value as a cut off value.

**RESULTS:** CAG repeat polymorphism was not associated to fat mass. CAG<sub>S</sub> and CAG<sub>L</sub> subjects had similar basal metabolic rate and maximal fat oxidation capacity and accumulated comparable amounts of fat tissue over 6.4 ± 1.0 years of follow up. Men with GGN<sub>S</sub> ≤ 22 had greater whole body and trunk fat mass than men with GGN<sub>L</sub> ≥ 25. This concurs with a trend for a greater maximal fat oxidation capacity in the GGN<sub>L</sub> group (P=0.06), who accumulated less fat mass, particularly in the trunk region seven years later. In the whole group of subjects the VO<sub>2</sub>max (per kg of lower extremity lean mass) explained 53% of the variance in MFO, whilst age explained an additional 5%.

**CONCLUSION:** The CAG repeat polymorphism has little, if any, influence in fat mass deposition in young adults whilst a long GGN polymorphic variant may protect from fat mass accumulation.

This study was supported by Ministerio de Educación y Ciencia (DEP2006-56076-C06-04/ACTI) and FEDER, Gobierno de Canarias (PI2005/177), Proyecto Interreg IIB BIOPOLIS, Fundación del Instituto Canario de Investigación del Cáncer (FICIC), Cabildo de Gran Canaria, Cabildo de Tenerife and La Caja de Canarias, and Proyecto Estructurante "Integración de los grupos de investigación en Ciencias de la Salud", ULPGC, Gobierno de Canarias.

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1815 Board #223 MAY 30 3:30 PM - 5:00 PM

**Actn3 And Ace Genotypes In Elite Japanese Track And Field Athletes**

Eri Mikami<sup>1</sup>, Noriyuki Fuku<sup>2</sup>, Haruka Murakami<sup>3</sup>, Hideyuki Takahashi<sup>4</sup>, Nao Ohiwa<sup>4</sup>, Yannis P. Pitsiladis, FACSM<sup>5</sup>, Hiroyasu Tsuchie<sup>6</sup>, Mitsuru Higuchi, FACSM<sup>1</sup>, Motohiko Miyachi<sup>3</sup>, Takashi Kawahara<sup>4</sup>, Masashi Tanaka<sup>2</sup>. <sup>1</sup>Waseda University, Saitama, Japan. <sup>2</sup>Tokyo Metropolitan Institute of Gerontology, Tokyo, Japan. <sup>3</sup>National Institute of Health and Nutrition, Tokyo, Japan. <sup>4</sup>Japan Institute of Sports Sciences, Tokyo, Japan. <sup>5</sup>University of Glasgow, Glasgow, United Kingdom. <sup>6</sup>Josai University, Saitama, Japan.

(No relationships reported)

The  $\alpha$ -actinin-3 (ACTN3) and angiotensin-converting enzyme (ACE) genes have been the subject of considerable investigation in terms of associating with sporting performance with conflicting results reported in ethnically diverse groups.

**PURPOSE:** To investigate whether ACTN3 R577X and ACE I/D polymorphisms are associated with elite Japanese track and field athlete status.

**METHODS:** 257 elite Japanese track and field athletes (93 sprint/power athletes: SPA [sprinters, jumpers and throwers]; 164 middle-power/endurance athletes: MEA [middle- and long-distance runners]) and 649 Japanese population controls (CON) were genotyped for ACTN3 R577X and ACE I/D polymorphisms using TaqMan Genotyping Assay, and allele and genotype frequencies were compared between groups using a Chi-square test. All athletes were national or international level, and the group included medalists at the Olympic games.

**RESULTS:** For ACTN3 R577X polymorphism, the frequency of the R allele was significantly higher in SPA than in CON (0.55 vs. 0.47,  $P=0.032$ ); there was no significant difference between MEA and CON (0.49 vs. 0.47,  $P=0.438$ ) and between EMA and SPA (0.55 vs. 0.49,  $P=0.191$ ). When the three genetic models were tested, SPA showed a higher frequency of RR+RX genotype than CON (80/93 [86.0%] vs. 478/649 [73.7%],  $P=0.010$  under the R dominant model). There was also a significant difference between SPA and CON when using the additive genetic model ( $P=0.025$ ). Further subgroup analysis dividing the SPA into sprinters ( $n=61$ ) and field athletes ( $n=32$ ) revealed a higher RR+RX genotype frequency in sprinters than in CON (56/61 [91.8%] vs. 478/649 [73.7%],  $P=0.002$  under the R dominant model) and than in EMA (56/61 [91.8%] vs. 125/164 [76.3%],  $P=0.009$  under the R dominant model). No association was found for ACE I/D polymorphism in elite Japanese track and field athletes.

**CONCLUSIONS:** The ACTN3 R577X polymorphism-and not the ACE I/D polymorphism-was associated with elite Japanese track and field athlete status and only in sprint/power performance (not endurance).

1816 Board #224 MAY 30 3:30 PM - 5:00 PM

**Genome-Wide Association Study In Elite Japanese Track And Field Athletes**

Noriyuki Fuku<sup>1</sup>, Eri Mikami<sup>2</sup>, Takashi Kawahara<sup>3</sup>, Hideyuki Takahashi<sup>3</sup>, Nao Ohiwa<sup>3</sup>, Hiroaki Tanaka<sup>4</sup>, Yannis P. Pitsiladis, FACSM<sup>5</sup>, Masashi Tanaka<sup>1</sup>. <sup>1</sup>Tokyo Metropolitan Institute of Gerontology, Tokyo, Japan. <sup>2</sup>Waseda University, Saitama, Japan. <sup>3</sup>Japan Institute of Sports Sciences, Tokyo, Japan. <sup>4</sup>Fukuoka University, Tokyo, Japan. <sup>5</sup>University of Glasgow, Glasgow, United Kingdom.

(No relationships reported)

Although an ever increasing number of genes, both the nuclear and mitochondrial genomes, have been suggested to effect performance and health-related fitness, there is very little replication of this evidence linking the putative performance genes with sporting performance.

**PURPOSE:** To identify genetic polymorphisms that associate with elite Japanese sprint/power or endurance athlete status by use of the genome-wide association study (GWAS) approach.

**METHODS:** A GWAS was performed in 48 elite sprint/power athletes and 48 elite endurance athletes (representing Japan in Olympic Games, World and Asian Championships and including several medalists) by use of Illumina HumanOmniExpress BeadChip Arrays. Frequencies of each polymorphism between sprint/power and endurance athletes were compared using Chi-square tests by use of JMP Genomics version 4.

**RESULTS:** Among 730,525 genetic polymorphisms analyzed by GWAS, 5 allele frequencies differed significantly ( $p$  value  $< 1.0 \times 10^{-5}$ ) between sprint/power and endurance athletes. These polymorphisms are located in gene loci, which are related to cell differentiation, cell proliferation, cell adhesion and blood coagulation.

**CONCLUSION:** Despite the relatively small sample size in terms of GWAS, 5 genetic polymorphisms were associated with elite athlete status. Further studies are necessary to replicate these findings.

1817 Board #225 MAY 30 3:30 PM - 5:00 PM

**Predictive power of a Genetic Predisposition Score For Knee Strength Responses to Training in Seniors**

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(No relationships reported)

Genetic profiling efforts have been applied to predict elite athlete status, however, prediction of training responses in older individuals are lacking. **PURPOSE:** To test the predictive value of a genetic predisposition score (GPS) for the response in isometric knee extension strength in older subjects after an 11 month intervention program.

**METHODS:** 22 variants in 12 genes (CNTF/R, GR, IL6, IL15RA, VDR, ACTN3, IGF2, PPP3R1, GDF8, COL1A1, MYLK), previously associated with muscle mass/strength phenotypes were analyzed in an 'increasing allele' approach. Subjects were randomized over three intervention programs: a supervised aerobic/strength/balance training (FIT, 5 x/2 weeks), a whole body vibration training (WBV, 5 x/2 weeks) or a home-based life time intervention program (LIFE). Regression analysis tested the significance for GPS, with age, gender, height, weight, exercise type and baseline strength as covariates. Genotyping data ( $>20$  variants), baseline and post-training isometric knee extension force (Biodex) were available in 68 male and 74 female seniors (66.5 $\pm$ 4.3 yr).

**RESULTS:** Baseline knee strength was equal in all groups. Responses to training were higher in the FIT and WBV group compared to LIFE ( $P=0.01$ ), whereas all groups showed large individual variability. The GPS did significantly contribute to response variability in knee strength ( $r^2=8.0\%$ ,  $P=0.02$  in multiple regression model). Each additional increasing allele increased the response in knee strength by 0.9%, while age, LIFE and baseline strength were negative predictors.

**CONCLUSIONS:** A 22 variant GPS could only partially explain knee strength responses after training in seniors, with about 1% increase in strength response per additional increasing allele.

1818 Board #226 MAY 30 3:30 PM - 5:00 PM

**Trhr Single Nucleotide Polymorphisms And Sarcopenia**

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(No relationships reported)

Sarcopenia is described as a substantial loss of skeletal muscle mass and is related to important changes in body composition and related functions. Its etiology is not fully known, however, there is controversy in the literature regarding the contribution of genetic variability in fat-free mass.

**PURPOSE:** This study aims to examine the association of single nucleotide polymorphisms TRHR (Thyrotropin-releasing Hormone Receptor) and sarcopenia.

**METHODS:** Blood samples and total fat-free mass (TFFM) were collected of 241 elderly in the Federal District - Brazil. Were selected for this study the SNPs rs16892496 (alleles G and T) and rs7832552 (alleles A and G). Were classified as sarcopenia the elderly women who had values of relative TFFM (TFFM/ body weight) below 5.45 kg/m<sup>2</sup>.

**RESULTS:** The sample showed the following average values for age, body mass, height, years of menopause, fat-free mass: 66.65  $\pm$  5.5 years, 65.81  $\pm$  11.9 kg, 1.53  $\pm$  0.1 cm, 17.96  $\pm$  7.5 years, 37.95  $\pm$  4.9 kg, respectively. The prevalence of sarcopenia was 17.4%. There was no significant association ( $p > 0.05$ ) between the SNPs and the values of TFFM relative and sarcopenia.

**CONCLUSIONS:** Although current studies have found significant association between the TRHR's polymorphisms and phenotype of sarcopenia, this study found no association. Thus, we can conclude that in our sample, the SNPs rs16892496 and rs7832552 were not associated with sarcopenia.

Supported by FAPDF Grant #193000555/2009

**1819** Board #227 **MAY 30 3:30 PM - 5:00 PM**  
**Total Weightings Genotype Score predicting Explosive Leg Strength among Elite Italian Soccer Players.**

Myosotis Massidda, Carla M. Calò. *University of Cagliari, Cagliari, Italy.*  
(No relationships reported)

Some authors have quantified an “optimal” polygenic profile by means of an algorithm resulting from the best accumulation of the polymorphisms candidate to explain individual variations in sport performance.

**PURPOSE:** Constructing a new model aimed to quantify the weightings attributable to genotypes in explaining the individual variations of explosive leg strength among elite soccer players.

**METHODS:** Using the model originally developed by Williams and Folland (2008) we determined the “Total Genotype Score” (TGS, from the accumulated combination of ACE, ACTN-3, BDKRB2, VDR-ApaI, VDR-BsmI genes, associated with muscle performance) in a groups of 84 top-level soccer players and 102 sedentary healthy males (controls). Successively, we determined the “Total Weighting Genotype Score” (TWGS) computed on the basis of the proportion of the variance of muscle strength significantly predicted by the accumulated combined genotypes. Forward stepwise multiple regression models were used to explore the predictive role of each genotypic variables for muscle phenotypes, measured by means of Squat Jump (SJ) and Counter Movement Jump (CMJ). Finally, correlation between TWGS and explosive leg strength was tested by means of linear regression analysis.

**RESULTS:** There were no significant differences ( $F=0.076$ ,  $p=0.782$ ) in the TGS between athletes and controls. The soccer players with higher TGS score have performed a significantly better performance in SJ ( $R^2=.0902$ ,  $F=6.550$ ,  $p=0.012$ ). The number of polymorphisms which significantly enter in the regression equation were only three (ACTN-3, ACE and BDKRB2) for both tests. Among all polymorphisms, the ACTN-3 was the most important. Finally, the soccer players with higher TWGS have performed a better performance in both SJ ( $R^2=.1546$ ,  $F=12.075$ ,  $p<0.001$ ) and CMJ ( $R^2=.1012$ ,  $F=7.438$ ,  $p<0.001$ ) tests.

**CONCLUSIONS:** Our results showed that giving the respective weighting to each predictor genotypes and by means of the new TWGS model, it could identified a polygenic profile that allows, at least partly, to predict the levels of explosive muscle strength in professional soccer players. Nevertheless, other genetic variants that we did not include in our model could also contribute to better explain the individual variations for attaining a high level of explosive strength in soccer.

**1820** Board #228 **MAY 30 3:30 PM - 5:00 PM**  
**Ghrelin Precursor Gene Variants and Fluid Intake in 10-km Runners**

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(No relationships reported)

**PURPOSE:** We examined the association between three single-nucleotide polymorphisms (SNPs) within the ghrelin precursor gene (GHRL) and fluid intake in 10-km runners.

**METHODS:** The subjects ( $n=91$ ) were apparently healthy biologically unrelated Hispanic male recreational long distance runners (Age =  $26 \pm 3$  yr; Ht =  $170 \pm 11$  cm; Wt =  $61.5$  kg; mean  $\pm$  SD). Data were collected before and after an international 10-km road race. For each subject a “race number labeled” 500 mL water bottle was available at the 3<sup>rd</sup>, 5<sup>th</sup>, 7<sup>th</sup> and 9<sup>th</sup> km. Fluid intake was calculated by measuring the weight of bottles before and after fluid ingestion. Three SNPs were genotyped: rs35684 (A/G: a transition substitution in exon 1), rs2075356 (C/T: intron), and rs26311 (A/G: near the 3' untranslated region) of GHRL were genotyped.

**RESULTS:** All SNPs were in Hardy-Weinberg equilibrium ( $X^2$ ,  $P \geq 0.05$ ). Carriers of the rs26311 A allele had a significantly greater fluid intake ( $1.4 \pm 1.8$  L) than non-carriers ( $0.5 \pm 1.1$  L) ( $P < 0.05$ ).

**CONCLUSIONS:** The present study provide some support to the hypothesis of association between a genetic variation in the ghrelin precursor gene (GHRL) and fluid intake in long distance runners.

**1821** Board #229 **MAY 30 3:30 PM - 5:00 PM**  
**Actn3 R577x Polymorphism Influences Muscular Power In Japanese Athletes**

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(No relationships reported)

$\alpha$ -actinin-3 (ACTN3) is one of the most studied “performance genes” and have been reported about the relationship with muscle composition, muscular strength and elite performance.

**PURPOSE:** To investigate whether ACTN3 R577X polymorphism would be relevant to muscular power in Japanese collegiate athletes.

**METHODS:** 105 male athletes and 243 controls (94 male and 149 female) were recruited in this study. Athletes performed 30s Wingate Anaerobic Test (WnAT) with a load equal to 7.5% of body weight. Genotyping was executed by using TaqMan approach for the ACTN3 (rs1815739) polymorphism.

**RESULTS:** ACTN3 polymorphism of athletes and controls was in Hardy-Weinberg Equilibrium. The distribution of ACTN3 XX genotype was significantly lower in athletes than controls (16% vs. 29%;  $P < 0.001$  under the R allele dominant model). There was no significant difference in 30s WnAT mean power among each genotype. However, WnAT peak power was significantly higher in RR or R allele dominant model groups than XX group.

**CONCLUSIONS:** The above data suggested that the ACTN3 RR and R allele would influence peak power of Wingate Anaerobic Test in Japanese collegiate athletes.

**1822** Board #230 **MAY 30 3:30 PM - 5:00 PM**  
**A Ghrelin Genetic Variant Associates with Physical Activity**

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(No relationships reported)

Ghrelin (GHRL) acts on the central nervous system to regulate energy homeostasis. Ghrelin (GHRL) single nucleotide polymorphisms (SNPs) associate with obesity, the metabolic syndrome, and habitual physical activity (PA).

**PURPOSE:** We sought to replicate whether GHRL 408G>T (Leu72Met; rs696217), 346G>A (Arg51Gln; rs34911341), and 3412A>T (Gln90Leu; rs4684677) SNPs associate with PA among healthy, Caucasian adults.

**METHODS:** Subjects [ $n=476$ ,  $23.5 \pm 0.3$ yr, body mass index (BMI):  $24.7 \pm 0.2$ kg·m<sup>-2</sup>] were genotyped for GHRL 408G>T, 346G>A, and 3412A>T. They completed the Paffenbarger PA Questionnaire. PA phenotypes were total kcal/wk, and kcal/wk in vigorous, moderate and light intensity PA, and sports and recreation. Multivariable ANCOVA tested associations among genotypes and PA by gender adjusted for age and BMI.

**RESULTS:** Subjects carrying the GHRL 408 T allele reported expending more kcal/wk than non-carriers ( $3551.1 \pm 292.8$  vs  $2708.1 \pm 129.0$ ) ( $p=0.009$ ). Subjects carrying the T allele reported more kcal/wk in moderate intensity PA ( $836.5 \pm 121.4$  vs  $488.4 \pm 53.5$ ) ( $p=0.009$ ) and sports and recreation ( $2176.6 \pm 256.5$  vs  $1526.5 \pm 113.0$ ) ( $p=0.021$ ) than non-carriers. Men with the T allele reported more kcal/wk than non-carriers ( $4292.4 \pm 495.9$  vs  $2682.4 \pm 215.3$ ) ( $p=0.003$ ). Men with the T allele reported more kcal/wk in moderate intensity PA ( $875.9 \pm 135.1$  vs  $377.3 \pm 58.7$ ) ( $p=0.001$ ) and sports and recreation ( $2629.1 \pm 418.0$  vs  $1480.3 \pm 181.3$ ) ( $p=0.012$ ) than non-carriers. GHRL 408G>T explained approximately 3.8% of total kcal/wk and 5.5% of moderate PA in men ( $p < 0.05$ ). GHRL 408G>T did not associate with PA in women ( $p \geq 0.05$ ). GHRL 346G>A and 3412A>T did not associate with PA ( $p \geq 0.05$ ).

**CONCLUSION:** GHRL 408G>T, but not GHRL 346G>A or 3412A>T, modulated habitual PA in men. GHRL 408G>T encodes an amino acid that may affect splicing of prepro-GHRL

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## B-35 Free Communication/Poster - Nitrates

MAY 30, 2012 1:00 PM - 6:00 PM  
ROOM: Exhibit Hall

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### 1823 Board #231 MAY 30 2:00 PM - 3:30 PM

#### Did Popeye® Know Something About Nitrates?

Simone Porcelli<sup>1</sup>, Lorenzo Pugliese<sup>2</sup>, Enrico Rejc<sup>2</sup>, Gaspare Pavei<sup>2</sup>, Matteo Bonato<sup>2</sup>, Antonio La Torre<sup>2</sup>, Mauro Marzorati<sup>1</sup>, Claudio Marconi<sup>1</sup>. <sup>1</sup>National Council of Research, Segrate (MI), Italy. <sup>2</sup>University of Milan, Milan, Italy. <sup>3</sup>University of Udine, Udine, Italy.  
(No relationships reported)

In 1930s, Popeye became so popular for his incredible strength due to ingestion of a can of spinach that immediately increased muscular strength and power. Recent studies suggest a physiological relevance of nitrates (abundant in green leafy vegetables, such as spinach) in skeletal muscle fibers. Nitrate seem to reduce O<sub>2</sub> cost of exercise and enhance mechanical efficiency.

**PURPOSE:** No studies have investigated if nitrates supplementation enhances muscle strength and anaerobic performance as well.

**METHODS:** Seven healthy male subjects (age 25.2 years) participated in a randomized double-blind cross-over study and were tested before (PRE) and after 6 days of 0.5 l/day spinach juice (5.5 mol/day nitrate) (SPINACH) or placebo (PLACEBO). The following tests were carried out: a) maximal voluntary isometric contraction (MVC) of knee extensors; b) fatiguing, intermittent sub-maximal (75% MVC) isometric knee extension; c) Wingate 30s test (W<sub>30s</sub>); d) Repeated Sprint Ability test (RSA) comprising one set of 5 x 6-s maximal sprints with 24 s of passive recovery between repetitions. During the isometric exercises, EMG of vastus lateralis and biceps femoris was recorded. Blood lactate (La) was obtained at rest and after exercise on a mechanically braked cycle ergometer.

**RESULTS:** Relative to PRE, in PLACEBO there were not significant differences for the investigated variables. In contrast, SPINACH vs. PLACEBO: a) Maximal voluntary torque of knee extensors was not significantly different (187 ± 13 vs. 189 ± 13 Nm, p<0.05); total muscle work, estimated as the sum of impulses generated during the fatiguing sub-maximal contractions, was significantly higher (361 ± 69 vs. 254 ± 57 Nm\*s\*kg<sup>-1</sup>, p<0.05). b) During W<sub>30s</sub> mean power was significantly higher (541 ± 22 vs. 506 ± 19 W, p<0.05) and fatigue index was significantly lower (40.4 ± 1.8 vs. 45.9 ± 2.9 %, p<0.05). La<sub>peak</sub> was not significantly different. As for RSA, peak power was significantly higher during the 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> repetition.

**CONCLUSIONS:** A moderate dietary dose of nitrates significantly enhanced variables of anaerobic performance in humans. These effects could be due both to a reduction of ATP cost and to an increase of ATP oxidative production. Although Popeye didn't know anything about nitrate, we can hypothesize that nitrates could be the "force" of Popeye's spinach.

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### 1824 Board #232 MAY 30 2:00 PM - 3:30 PM

#### Acute Dietary Nitrate Supplementation Does Not Improve 50-mile Time Trial Performance in Highly Trained Cyclists

Daryl P. Wilkerson, Giles Hayward, Bailey J. Stephen, Vanhatalo Anni, Blackwell R. Jamie, Jones M. Andrew, FACSM. *Exeter University, Exeter, United Kingdom.*  
(No relationships reported)

Dietary nitrate supplementation has been shown to improve 4 and 16.1 km time trial (TT) performance by ~2.7% in sub-elite cyclists. However, it is not known if these ergogenic effects persist in longer endurance events or if dietary nitrate supplementation can enhance performance to the same extent in highly trained individuals.

**PURPOSE:** To determine the effect of acute dietary nitrate supplementation on 50-mile TT performance in trained cyclists.

**METHODS:** After familiarization, 8 trained male cyclists performed 50-mile TTs under two experimental conditions: i) 2.5 h after consuming 0.5 L of beetroot juice (BR; containing ~6.2 mmol of nitrate) and ii) 2.5 h after consuming 0.5 L of nitrate-depleted BR (placebo; containing ~0.005 mmol of nitrate). The two conditions were administered using a counter-balanced, single-blind, crossover design. A minimum of 7 days separated visits to allow recovery and washout.

**RESULTS:** BR significantly elevated plasma [nitrite] (BR: 500 ± 59 vs. placebo: 411 ± 22 nM; P<0.05) and resulted in a group mean reduction in completion time for the 50-mile TT of 0.8% (BR: 136.7 ± 5.6 vs. placebo: 137.9 ± 6.4 min) which was not statistically significant (P>0.05). There was a significant correlation between the increased post-beverage plasma [nitrite] with BR and the reduction in TT completion times (r = -0.84, P<0.05). Power output (PO) was not different between the conditions at any point (P>0.05) but oxygen uptake (V<sub>O2</sub>) tended to be lower in BR (P=0.06), resulting in a significantly greater PO:V<sub>O2</sub> ratio (BR: 67.4 ± 5.5 vs. placebo: 65.3 ± 4.8 W·L<sup>-1</sup>·min<sup>-1</sup>; P<0.05).

**CONCLUSION:** Acute dietary nitrate supplementation with nitrate-rich beetroot juice did not significantly improve 50-mile TT performance in trained cyclists despite the significantly greater PO:V<sub>O2</sub>. It appears that rather than attain a higher PO for a given O<sub>2</sub>, the cyclists maintained a similar PO but at a lower V<sub>O2</sub>. It is noteworthy that although the reduction in 50-mile TT completion time of 0.8% did not attain statistical significance, an improvement in performance of this magnitude would likely be practically meaningful to an athlete.

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### 1825 Board #233 MAY 30 2:00 PM - 3:30 PM

#### The Impact of a 6-Week Resistance Training Program with Exercise Performance Supplementation on Cardiovascular Risk in Trained Men

D David Thomas<sup>1</sup>, Jeong-Su Kim<sup>1</sup>, W Kyle Mandler<sup>1</sup>, Amber W. Kinsey<sup>1</sup>, Timothy P. Scheett<sup>2</sup>, Lynn B. Panton, FACSM<sup>1</sup>, Michael J. Ormsbee<sup>1</sup>. <sup>1</sup>Florida State University, Tallahassee, FL. <sup>2</sup>The College of Charleston, Charleston, SC.  
(No relationships reported)

**PURPOSE:** The potential cardiovascular or metabolic health risks or benefits associated with consumption of performance enhancing supplements containing multiple ingredients over the course of a periodized resistance training (RT) regimen are unknown. The purpose of this study was to investigate the combined effect of resistance training (RT) and commercial pre- and post-exercise performance supplements, NO-Shotgun® (SHOT) and NO-Synthesize® (SYN), respectively, on cardiovascular (CV) risk in resistance-trained men.

**METHODS:** Twenty-four resistance-trained men completed 6 weeks (3d/wk) of whole-body periodized RT. The participants were randomly assigned to 2 groups. Group 1 (n=13; Performance Supplement; PS) consumed one serving of SHOT before and 1 serving of SYN immediately after each RT session; SYN was also consumed on all non-RT days. Group 2 (n=11; Placebo; PL) consumed an isocaloric maltodextrin placebo in an identical manner as utilized by PS. Pre and post-RT measures included: resting heart rate (HR), blood pressures (BP), fasting blood lipids, total body fat, android fat, gynoid fat and plasma nitrate concentrations. Statistical analysis was conducted using a 2 x 2 (group x time) repeated measures ANOVA. Significance is set at p<0.05.

**RESULTS:** There were no group x time interactions for HR, BP, blood lipids or plasma nitrate concentrations. However, there were significant decreases in body fat (PS: -1.2±1.2%; PL: -0.9±1.1%), android fat (PS: -1.8±2.1%; PL: -1.6±2.0%), and gynoid fat (PS: -1.3±1.6%; PL: -1.0±1.4%) for both groups. There were also no significant group, time, or group x time effects for plasma nitrate concentrations.

**CONCLUSIONS:** Six weeks of SHOT and SYN supplementation during RT does not alter CV health parameters in healthy, resistance-trained men. This study was supported by a supplement donation from Vital Pharmaceuticals, Inc.

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1826 Board #234 MAY 30 2:00 PM - 3:30 PM

**Dietary Nitrate Supplementation Reduces The Oxygen Cost Of Exercise In Healthy Older Adults**

James Kelly, Anni Vanhatalo, Jonathan Fulford, Olivia French, James R. Blackwell, Andrew M. Jones, FACSM. *University of Exeter, Exeter, United Kingdom.*  
(No relationships reported)

Dietary nitrate (NO<sub>3</sub><sup>-</sup>) supplementation, which might enhance nitric oxide bioavailability, has recently been shown to reduce resting blood pressure and the oxygen cost of exercise in healthy young adults.

**PURPOSE:** We investigated whether the beneficial effects of nitrate supplementation reported previously in young adults are also evident in healthy older adults.

**METHODS:** Twelve (6 males) healthy, older (60-70 yrs) adults volunteered to participate in this ethically-approved study which employed a double-blind, randomized, crossover design. The subjects supplemented their diet for 3 days with either nitrate-rich concentrated beetroot juice (BR; 2 x 70 ml·d<sup>-1</sup>, each containing ~0.3 g NO<sub>3</sub><sup>-</sup>) or a nitrate-depleted beetroot juice placebo (PL; 2 x 70 ml·d<sup>-1</sup>, containing ~0.74 mg NO<sub>3</sub><sup>-</sup>). Before and after the intervention periods, resting blood pressure was measured and venous blood samples were drawn for the determination of plasma nitrite concentration. The subjects also completed two 6-min bouts of moderate-intensity treadmill walking for the assessment of exercise economy by respiratory gas exchange. Differences between conditions were assessed by paired samples t-tests and statistical significance was accepted at *P*<0.05.

**RESULTS:** Dietary nitrate supplementation significantly increased plasma nitrite concentration (BR: 1037 ± 627 vs. PL: 286 ± 188 nM; *P*<0.01), while both systolic blood pressure (BR: 115 ± 9 vs. 120 ± 6 mmHg; *P*<0.05) and mean arterial pressure (BR: 85 ± 5 vs. PL: 88 ± 4 mmHg; *P*<0.05) were reduced. There was a reduction in the V<sub>O<sub>2</sub></sub> amplitude (BR: 373 ± 182 vs. PL: 437 ± 219 ml·min<sup>-1</sup>, *P*<0.05) and steady-state V<sub>O<sub>2</sub></sub> (BR: 901 ± 233 vs. PL: 955 ± 270 ml·min<sup>-1</sup>, *P*<0.05) during moderate-intensity treadmill walking.

**CONCLUSIONS:** In accordance with previous studies in young healthy adults, dietary nitrate supplementation elevated plasma nitrite concentrations and reduced both resting blood pressure and the oxygen cost of moderate-intensity treadmill exercise in healthy older adults. These results may have important implications for the enhancement of cardiovascular health, functional capacity and quality of life in senescence.

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1827 Board #235 MAY 30 2:00 PM - 3:30 PM

**Effects Of Performance Supplements On Body Composition And Strength In Trained Men During 6 Weeks Of Resistance Training.**

Michael J. Ormsbee, W. Kyle Mandler, D. David Thomas, Amber W. Kinsey, Colin J. Riley, Lynn B. Pantan, FACSM, Jeong-Su Kim. *Florida State University, Tallahassee, FL*  
(No relationships reported)

**PURPOSE:** Resistance training (RT) enhances muscle protein synthesis and increases muscle strength and hypertrophy. Performance supplements have been shown to augment the physiological improvements associated with RT. The purpose of this study was to investigate the impact of pre- and post-workout performance supplements on body composition, muscle strength, and power.

**METHODS:** Twenty-four (24.6 ± 4.9 yrs; 180.4 ± 5.5 cm; 80.7 ± 8.8 kg), resistance trained men completed 6 wks of periodized RT (3x/wk). They were assigned to one of two groups based upon maximal voluntary contraction of the quadriceps (Biodex) to lean mass (LM) ratio. Group 1 (n=13; Performance Supplement; PS) consumed NO-Shotgun® before each workout and NO-Synthesize® (Vital Pharmaceuticals, Inc., Davie, FL) immediately after each workout as well as on non-RT days, while Group 2 (n= 11; Placebo; PLA) consumed a flavor-matched isocaloric placebo. Body composition (DXA) and circumferences, 1-repetition maximal strength (1RM) of the upper (chest press; CP) and lower body (leg press; LP), and anaerobic power (Wingate test) were assessed. A 2 x 2 (group x time) ANOVA with repeated measures was used. Tukey LSD post hoc tests were used to examine pairwise difference. Significance was set at (*p*<0.05).

**RESULTS:** The PS group increased LM by 4.7% with no change for PLA. LP 1RM increased in the PS group with training by 19.56% and the PLA group increased by 25.94%. BP 1RM increased in the PS group by 8.4% and the PLA group increased by 6.9%. There were no significant differences between groups for 1RM in either BP or LP. Circumferences increased for the arm in both groups (PS 2.2%, PLA 2.6%), but only the PS group increased thigh measures by 2.5%. The PS group significantly increased relative anaerobic power by 9.38%, while PLA remained unchanged.

**CONCLUSIONS:** Pre- and post-exercise consumption of NO-Shotgun® and NO-Synthesize® during 6 wk-periodized RT facilitated RT-induced improvements in LM and anaerobic power in trained males. These supplements do not appear to alter 1RM muscle strength or reduce body fat mass. This project was supported by supplement donation by Vital Pharmaceuticals.

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1828 Board #236 MAY 30 2:00 PM - 3:30 PM

**Effects Of The Phosphodiesterase-5 Inhibitor Tadalafil On Parameters Of Aerobic Fitness In Healthy Men**

Cosme Franklim Buzzachera, Gian Pietro Emerenziani, Emanuele Franciosi, Maria Chiara Gallotta, Luigi Di Luigi, Laura Guidetti, Carlo Baldari, FACSM. *University of Rome Foro Italico, Rome, Italy.*  
(No relationships reported)

The stimulation of nitric oxide (NO)-3'5' cyclic guanosine monophosphate (cGMP) signaling pathway results in vasorelaxation and increased muscle blood flow during rest and exercise. Tadalafil, a phosphodiesterase-5 inhibitor used for therapeutic and nontherapeutic purposes, reduces cGMP hydrolysis inducing vasodilation and increases exercise capacity in healthy men in hypoxia.

**PURPOSE:** To examine whether 48 h exposure to Tadalafil influences aerobic fitness parameters during graded exercise test (GXT) in healthy men in normoxia.

**METHODS:** Twelve subjects were randomly assigned to receive either a two consecutive days administration of placebo or Tadalafil (e.g. 20 mg with 36 hours of interval) in a double-blind crossover design, with a 14-days wash-out period between conditions. About 12 hours after the second administration of either placebo or Tadalafil, the subjects performed GXT on a cycle ergometer. Gas exchange measures and heart rate (HR) were recorded throughout GXT and blood lactate concentrations (La) were measured every 3-min stage of the test. Lactate threshold (LT), maximal oxygen uptake (V<sub>O<sub>2</sub></sub>max), maximal power output (MPO), time to fatigue (TTF), time to achieve V<sub>O<sub>2</sub></sub>max, and time at V<sub>O<sub>2</sub></sub>max were assessed. Differences in aerobic fitness parameters between Tadalafil and placebo conditions were compared by paired t-tests (*P*<0.05).

**RESULTS:** Compared to placebo, the Tadalafil condition did not influence LT (3.75 ± 0.41 vs. 3.88 ± 0.44 mmol/L) and V<sub>O<sub>2</sub></sub>max (3.46 ± 0.33 vs. 3.31 ± 0.28 L/min, respectively for placebo and Tadalafil conditions). Similarly, MPO (285.2 ± 27.0 vs. 275.0 ± 25.0 Watts) and TTF (1306.2 ± 101.8 vs. 1340.0 ± 146.5 s, respectively for placebo and Tadalafil conditions) did not differ between the two conditions. However, time to achieve V<sub>O<sub>2</sub></sub>max was significantly faster in Tadalafil (1228.7 ± 91.4 s) compared with placebo (1288.7 ± 132.2 s), whereas the time at V<sub>O<sub>2</sub></sub>max was longer in Tadalafil (77.5 ± 32.5 s) than in placebo condition (51.2 ± 26.7 s) (*P*<0.05).

**CONCLUSION:** In healthy men, the 48 hours exposure to Tadalafil did not substantially influence parameters of aerobic fitness during exercise in normoxia. However, Tadalafil significantly affected temporal responses during GXT by shortening the time to achieve V<sub>O<sub>2</sub></sub> max and delaying the exhaustion at V<sub>O<sub>2</sub></sub>max.

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1829 Board #237 MAY 30 2:00 PM - 3:30 PM

**Dietary Nitrate Supplementation Improves Rowing Performance In Highly Trained Rowers**

Andrea J. Braakhuis<sup>1</sup>, Hannah Bond<sup>2</sup>, Lillian Morton<sup>2</sup>. <sup>1</sup>United States Olympic Committee, Chula Vista, CA. <sup>2</sup>Waikato Institute of Technology, Hamilton, New Zealand.  
(No relationships reported)

Increased plasma nitrate concentrations from dietary sources of nitrate have proven to benefit exercise performance. Beetroot contains relatively high levels of sodium nitrate which increases nitric oxide production.

**PURPOSE:** This study investigated whether dietary nitrate supplementation, in the form of a beetroot beverage, improved rowing performance during ergometer repetitions.

**METHODS:** In a randomised crossover design, fourteen elite male rowers consumed either beetroot containing ~5.5mmol.day<sup>-1</sup> NO<sub>3</sub> (BR) or placebo (PL) isocaloric drinks daily, for six days. Following supplementation, rowers completed six maximal 500m ergometer repetitions and times were recorded. A seven day washout period separated the two trials. Blood pressure, oxygen

saturation, maximum heart rate, urine (specific gravity, pH and nitrites) and lactates were collected for analysis at baseline (one-month testing prior to experiment), once, 30-min pre and then immediately, 1- and 2-min post-performance testing.

**RESULTS:** Changes in the mean with 95% confidence limits were calculated. There was a likely benefit to average repetition time in the BR condition, compared to PL (0.4%, 95% confidence limits,  $\pm 1.0\%$ ). In particular, repetitions 4 - 6 showed an almost certain benefit in rowing time on BR (1.7%, 95% CL,  $\pm 1.0\%$ ). The underlying mechanisms for the observed results remain unknown as differences observed in rowers' physiological measures between the two conditions were generally unclear.

**CONCLUSIONS:** Nitrate supplementation in the form of beetroot juice resulted in improved maximal rowing ergometer repetitions, particularly in the later stages of exercise.

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## B-36 Free Communication/Poster - Protein and Amino Acids

MAY 30, 2012 1:00 PM - 6:00 PM

ROOM: Exhibit Hall

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### 1830 Board #238 MAY 30 3:30 PM - 5:00 PM

#### Effects of Branched-chain Amino Acids Supplementation on Glucose Homeostasis and Lipid Profile in Humans

Claudia R. da Luz<sup>1</sup>, Humberto Nicastro<sup>1</sup>, Daniela FS Chaves<sup>1</sup>, Nelo E. Zanchi<sup>1</sup>, Daniel Simoes<sup>1</sup>, Katherine MA Veras<sup>1</sup>, Luis AR Costa<sup>1</sup>, François Blachier<sup>2</sup>, Antonio H. Lancha, Jr.<sup>1</sup> <sup>1</sup>University of São Paulo, São Paulo, Brazil. <sup>2</sup>INRA/AgroParisTech, Paris, France.

(No relationships reported)

Branched-chain amino acids (BCAA), particularly leucine, play an important role on glucose homeostasis through insulin secretagogue action. Some studies have also demonstrated that BCAA may modulate the immune response on inflammatory conditions. However, it is unknown if BCAA may affect the glucose homeostasis kinetics at rest and if the inflammatory response can modulate such response.

**PURPOSE:** To evaluate the effects of BCAA and leucine supplementation on glucose homeostasis, lipid profile, and the possible interaction with inflammatory response in healthy humans.

**METHODS:** In a double-blind, randomized, and crossover design 08 healthy male adults (24.4  $\pm$  1.2 years; 79.1  $\pm$  3.5 kg; 179.5  $\pm$  2.5 cm; BMI 24.55  $\pm$  1.0 kg·m<sup>-2</sup>) ingested either BCAA (2.4 g of leucine, 1.6 g of isoleucine, and 1.6 g of valine), leucine (LEU; 2.4 g of leucine + 3.2 g of alanine) or isonitrogenous supplement (PLA; 5.6 g of alanine). Experimental sessions were conducted on different days (7 d apart). After an overnight fast, participants ingested a single dose of the supplement and blood samples were collected before, and after 15, 30, 60, 90, and 120 min to determine serum glucose and insulin concentrations, lipid profile, and interleukin (IL)-6 concentration. Data were analyzed using repeated measures ANOVA ( $p < 0.05$ ) one-way or two-way as appropriated and are presented as mean  $\pm$  SEM changes.

**RESULTS:** Serum glucose curve and AUC did not differ between treatments ( $p > 0.05$ ). BCAA and LEU increased serum insulin 60' after ingestion when compared to PLA (BCAA 75.1  $\pm$  23.8 mU·L<sup>-1</sup>; LEU 76.2  $\pm$  12.3 mU·L<sup>-1</sup>; PLA 25.3  $\pm$  3.6 mU·L<sup>-1</sup>;  $p < 0.05$ ). However, there was no difference on serum insulin AUC ( $p > 0.05$ ). There was no difference on serum lipid profile curve and AUC in all time points between treatments ( $p > 0.05$ ). LEU decreased serum IL-6 concentration 60' after ingestion when compared to BCAA and PLA (LEU -1.7  $\pm$  0.3 pg·mL<sup>-1</sup>; BCAA 1.1  $\pm$  1.5 pg·mL<sup>-1</sup>; PLA 2.3  $\pm$  0.4 pg·mL<sup>-1</sup>;  $p < 0.05$ ).

**CONCLUSION:** BCAA and leucine supplementation had no effects on serum glucose and lipid profile kinetics but increased serum insulin concentration 60' after ingestion. This effect may be related to insulin secretagogue role of BCAA and/or to the possible role of leucine on IL-6 secretion.

Supported by FAPESP (2011/04690-6)

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### 1831 Board #239 MAY 30 3:30 PM - 5:00 PM

#### Effect of an Amino Acid Beverage on Exercise Recovery and Subsequent Anaerobic Exercise Performance

Bei Wang, Zhenping Ding, Wanyi Wang, Jungyun Hwang, Yi-Hung Liao, John L. Ivy, FACSM. University of Texas at Austin, Austin, TX.

(No relationships reported)

An amino acid mixture, composed of 5 amino acids, has been reported to lower glucose response to an oral glucose challenge in healthy overweight adults. Glucose uptake by skeletal muscle may be the major mechanism responsible for the hypoglycemic effect of the mixture.

**PURPOSE:** To investigate the effect of two different doses of an amino acid mixture on exercise recovery and subsequent anaerobic exercise performance in healthy active individuals.

**METHODS:** After a 2 h intense cycling bout, ten subjects (27.5 $\pm$ 2.0 yrs) received a CHO/HAA (1.2g/kg bw CHO, 13g amino acid mixture), CHO/LAA (1.2g/kg bw CHO, 6g amino acid mixture), or CHO (1.2g/kg bw CHO) supplement immediately and 2 h post exercise. Muscle biopsies were performed immediately and 4 h post exercise. After the second biopsy, a Wingate Anaerobic Test (WAnT) was performed.

**RESULTS:** The CHO/HAA and CHO/LAA treatments significantly decreased glucose response compared with CHO, which was supported by the finding that the glucose AUC for the CHO/HAA and CHO/LAA treatments was significantly lower than that for the CHO treatment (CHO/HAA 1259.9 $\pm$ 27.7, CHO/LAA 1251.5 $\pm$ 47.7, CHO 1376.8 $\pm$ 52.9 mmol/L·4h,  $p < 0.05$ ). However, glycogen storage rate was significantly lower in the CHO/HAA compared with CHO, while it did not differ significantly between the CHO/LAA and CHO treatments (CHO/HAA 15.4 $\pm$ 2.0, CHO/LAA 18.1 $\pm$ 2.0, CHO 21.5 $\pm$ 1.4  $\mu$ mol/g wet wt·4h<sup>-1</sup>). Phosphorylation of AS160 and glycogen synthase did not differ across treatments. Likewise, there were no differences in blood lactate, creatine kinase, or myoglobin responses or WAnT performance across treatments.

**CONCLUSION:** An amino acid mixture lowers the glucose response to a carbohydrate supplement after strenuous exercise. However, it was not effective in facilitating subsequent muscle glycogen storage or anaerobic performance.

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### 1832 Board #240 MAY 30 3:30 PM - 5:00 PM

#### Acute and Long-term Branched Chain Amino Acid Changes With Gastric Bypass Surgery

Monica J. Hubal<sup>1</sup>, Lynn Yieh<sup>2</sup>, John Pender<sup>3</sup>, William Chapman<sup>3</sup>, Walter Pories<sup>3</sup>, G. Lynis Dohm<sup>3</sup>. <sup>1</sup>Children's National Medical Center, Washington, DC. <sup>2</sup>Johnson and Johnson, San Diego, CA. <sup>3</sup>East Carolina University, Greenville, NC. (Sponsor: Eric S. Rawson, FACSM)

(No relationships reported)

Gastric bypass surgery (RYGB) often initiates a weight-loss independent resolution of Type 2 diabetes, though the underlying mechanism(s) driving this effect are unknown. One possible mechanism involves amino acid metabolism changes with surgery that can affect glucose homeostasis. Studies have reported branched chain amino acid (BCAA) correlations to obesity and changes in BCAAs during the months following RYGB, but fasting glucose levels often drop more acutely (within days following surgery), necessitating earlier inquiry.

**PURPOSE:** To define acute and chronic changes in amino acids and clinical correlates in diabetic versus non-diabetic obese women following RYGB. Baseline differences between these groups and lean controls were also defined.

**METHODS:** Fasting plasma samples were obtained from the following groups of Caucasian females: Lean controls (N=7; L; baseline only), obese diabetics (D; N=9) and obese non-diabetic (Ob; N=8) subjects at baseline, 7d and 3mo after RYGB. Metabolite profiling was completed on a combination of mass spectroscopy platforms (Metanomics Health GmbH). Other clinical values obtained included anthropomorphic measures and insulin/glucose-related values from IVGTT. Statistical tests included RM ANCOVA and Pearson correlations with alpha set at  $< 0.05$ .

**RESULTS:** RYGB caused similar reductions in BMI over time between groups, with greater reduction in fasting plasma glucose (FPG; 2 fold;  $p = 0.04$ ) in the D group. Baseline differences were found for all BCAAs (Leu, Ile and Val), such that D>Ob>L, but no BCAA differences were seen between groups following surgery. Val levels in the D group dropped 20% acutely, while Leu and Ile did not significantly change. Acute elevations were seen in Leu (20%) and Ile (17%) in Ob, with no change in Val. All BCAAs dropped at 3 mo post-surgery in both groups (-35 to -46% for D, -23 to -57% for Ob), to lean control levels. While BCAA levels at baseline and across all time points correlated well with BMI (r=0.6), FPG (r=0.7) and HOMA (r=0.6), changes in BCAAs at either time point did not significantly correlate to changes in clinical values.

**CONCLUSIONS:** While BCAAs decrease to lean control levels over 3 months following RYGB, these changes do not occur as rapidly as improvements in glucose homeostasis.

**ACKNOWLEDGEMENT:** Study sponsored by Johnson & Johnson.

**1833** Board #241 **MAY 30** **3:30 PM - 5:00 PM**

**The Effects of Endurance Training and Different Methionine-contained Diets on Insulin/IGF-1 System in Skeletal Muscle**

Young-Yu Liang<sup>1</sup>, Hsin-wen Chang<sup>1</sup>, Liang-Tong Kuo<sup>1</sup>, Sandy S. Hsieh<sup>2</sup>, Ming-Shin Chang<sup>1</sup>, Tsang-Hai Huang<sup>1</sup>. <sup>1</sup>National Cheng Kung University, Tainan, Taiwan, Tainan, Taiwan. <sup>2</sup>National Taiwan Normal University, Taipei, Taiwan, Taipei, Taiwan.

(No relationships reported)

**PURPOSE:** To investigate the effects of different methionine (M)-contained diets combined with endurance exercise (E) training on insulin/IGF-1 system in skeletal muscles.

**METHODS:** Male Sprague Dawley rats (7 weeks old, n=72) were randomly assigned to six groups, which were the 0.86%M, 0.52%M, 0.17%M, 0.86%M+E, 0.52%M+E, and 0.17%M+E groups (n=12 for each group). After 8-week diets and exercise training interventions, animals were sacrificed, and skeletal muscle and blood samples were collected and stored for further analysis. Two-way ANOVA (M×E) was used for statistical analysis ( $\alpha=0.05$ ).

**RESULTS:** Serum TBARS, insulin, insulin-like growth factor-binding protein-3(IGFBP-3), IGF-1/IGFBP-3 ratio reached the significant level both in the main effects of diet and exercise. The results of *post hoc* comparisons were: 1) TBARS( $\mu$ M) (E: 20.2±2.0 < non-E: 33.9±2.0; 0.86%M: 32.0±2.4 > 0.17%M: 21.6±2.4); 2) insulin( $\mu$ g/l) (E: 0.27±0.02 < non-E: 0.34±0.02; 0.52%M: 0.38±0.02 > 0.86%M: 0.31±0.02 > 0.17%M: 0.23±0.02); 3) IGFBP-3(ng/ml) (E: 132.1±18.5 < non-E: 204.8±19.1; 0.52%M: 209.7 ± 22.3 > 0.17%M: 122.4±18.5); 4) IGF-1/IGFBP-3 ratio (E: 1.73±0.32 < non-E: 2.75±0.33, 0.86%M: 3.0±0.4 & 0.52%M : 2.55±0.38 > 0.17% 1.09±0.4). Significant interaction was shown in serum IGF-1(ng/ml)(*post hoc* comparison: 0.86%M : 539.1±53.6 > 0.86%M+E: 330.1±51.2; 0.52%M: 673.3±90.5 > 0.52%M+E: 219.9±33.7; 0.17%M: 320.3±52.9 > 0.17%M+E: 38.6±15.6; 0.86%M: 539.1±53.5 & 0.52%M : 673.3±90.5 > 0.17%M: 212.4±39.3 ; 0.86%M+E: 347.1±50.1 > 0.52%M+E: 219.9±33.7 > 0.17%M+E: 38.6±15.1). Skeletal muscle markers, IGF-1 receptor (IGF-1R), insulin receptor (IR) all reached the significant level in the main effect of exercise. The results of *post hoc* comparison were 1) IGF-1R (E: 0.01±0.05% < non-E: 1.15±0.04%); 2) IR: (E: 0.91±0.04%, non-E 1.18±0.04%).

**CONCLUSIONS:** Compared to 0.86%M and 0.52%M diets, 0.17%M diet showed better effects on the longevity index. The endurance exercise mainly improved the sensitivity of insulin/IGF-1 system.

**1834** Board #242 **MAY 30** **3:30 PM - 5:00 PM**

**The Importance Of Leucine In Stimulating Protein Signaling After Resistance Exercise In Young Females**

Marcus Borgenvik, William Apró, Marjan Pontén, Björn Ekblom, Eva Blomstrand. Åstrand Laboratory, Swedish School of Sport & Health Sciences, Stockholm, Sweden.

(No relationships reported)

Essential amino acids (EAA) and resistance exercise are well-documented in their capacity to stimulate human muscle protein. Out of the EAA, leucine has been proposed to have a unique role in promoting protein synthesis through activation of the mammalian target of rapamycin (mTOR) pathway.

**PURPOSE:** To evaluate the role of leucine with regard to mTOR signaling and mRNA expression of possible regulators of mTOR in young females following resistance exercise.

**METHODS:** Eight healthy females performed two sessions of leg press exercise and were randomly supplied a mixture of EAA with or without leucine (EAA-Leu). Blood samples were taken repeatedly throughout the experiment and muscle biopsy samples were collected before, 1h, and 3h after resistance exercise and analyzed for phosphorylation status of proteins in the mTOR pathway and mRNA expression of mTOR-associated genes. In addition, levels of free amino acids were determined plasma and muscle samples.

**RESULTS:** The phosphorylation of mTOR at Ser<sup>2448</sup> was elevated ~2-fold above baseline at 1h and 3h post exercise with both supplements (P<0.05). During EAA supplementation the phosphorylation of p70<sup>S6K</sup> at Thr<sup>389</sup> was 30-fold higher than at baseline and 5-fold higher than EAA-Leu (P<0.05) 1h post exercise. The mRNA expression of Rheb increased ~ 1.7 fold and that of Redd1 decreased ~ 60 % 3h post exercise (P<0.05), with no differences between supplements. The plasma levels of isoleucine, valine, methionine, tryptophan and tyrosine were all 16 to 58 % lower after EAA than EAA-Leu following 2 and 3h of recovery (P<0.05). At 3h after exercise muscle levels of these amino acids were 28 to 59 % lower when leucine was present in the drink (P<0.05). In addition, in the EAA trial muscle levels of leucine increased 64 and 32 % while in the EAA-Leu trial a 44 and 39 % reduction was observed 1 and 3h post exercise, respectively.

**CONCLUSION:** The significantly higher response with regard to p70<sup>S6K</sup> phosphorylation in the presence of leucine emphasizes its importance in the activation of enzymes in the mTOR pathway. In addition, the larger reduction of essential amino acids in plasma and muscle provide further support for a specific role of leucine in stimulating protein synthesis. Supported by Swedish National Center for Research in Sports

**1835** Board #243 **MAY 30** **3:30 PM - 5:00 PM**

**Role of Dietary Leucine on Amino Acid Transporter mRNA Expression Following Resistance Exercise**

Tyler A. Churchward-Venne<sup>1</sup>, Andrew Philp<sup>2</sup>, George R. Marcotte<sup>1</sup>, Cameron J. Mitchell<sup>1</sup>, Daniel W.D. West<sup>1</sup>, Leigh Breen<sup>1</sup>, Steven K. Baker<sup>1</sup>, Keith Baar, FACSM<sup>2</sup>, Stuart M. Phillips, FACSM<sup>1</sup>. <sup>1</sup>McMaster University, Hamilton, ON, Canada. <sup>2</sup>University of California, Davis, CA.

(No relationships reported)

Skeletal muscle amino acid transporters (AAT) may play a key role in the regulation of muscle protein metabolism via their ability to transport amino acids (AA) across the sarcolemma and relay signals to downstream protein targets. The mRNA expression of some AAT is increased after essential amino acid (EAA) intake and resistance exercise (RE); however, the combined effect of AA and RE on AAT mRNA expression and whether greater leucine intake alters the response is unknown.

**PURPOSE:** To examine the effect of AA/whey protein intake (with high and low leucine content) after RE on the mRNA expression of select AAT in human skeletal muscle.

**METHODS:** 24 adult men (22±1 y) completed unilateral knee-extensor RE before consuming one of the following: WHEY (25 g whey protein); LEU (6.25 g whey protein supplemented with leucine to be iso-leucine with WHEY); and EAA-LEU (6.25 g whey protein supplemented with EAA except leucine to be iso-EAA with WHEY for each EAA except for leucine). Muscle biopsies were obtained before RE and 1, 3, and 5h after from both rested-fed (FED) and exercise-fed legs (EX-FED). qRT-PCR was used to determine changes in mRNA expression of LAT-1, CD-98, and PAT-1 AAT and members of the general AA control pathway GCN-2 and ATF-4.

**RESULTS:** mRNA expression of CD-98 and LAT-1 (fold-change from basal) increased in FED and EX-FED, however the response at 5h was greater in EX-FED (CD-98 FED = 2.17 vs. EX-FED = 3.52 (P=0.003); LAT-1 FED = 3.58 vs. EX-FED = 5.18 (P=0.025)). PAT-1 increased in FED and EX-FED, however EX-FED was greater in WHEY vs. EAA-LEU (WHEY = 3.26 vs. EAA-LEU = 1.89 (P=0.031)). ATF-4 showed time dependent changes in all treatments while the FED response of GCN-2 was greater in LEU vs. WHEY and EAA-LEU at 5h (LEU = 2.07 vs. WHEY = 1.44 vs. EAA-LEU = 1.02 (P=0.004)).

**CONCLUSION:** RE prior to whey protein/AA intake increases the mRNA expression of select AAT above feeding alone at 5h post RE. WHEY induced greater changes in PAT-1 vs. EAA-LEU suggesting unique benefits of whey protein that extend beyond total leucine content. EAA-LEU resulted in robust increases in select AAT comparable to LEU despite containing ~75% less leucine, suggesting that a high leucine content is not critical in increasing AAT expression after AA intake. The functional physiological significance of these changes remains to be elucidated. Supported by NSERC.

**1836** Board #244 **MAY 30** **3:30 PM - 5:00 PM**

**Effect Of  $\beta$ -alanine And Sodium Bicarbonate Supplementation On High Intensity Performance**

Anu Koivisto<sup>1</sup>, Ida Svendsen<sup>1</sup>, Erlend J. Hem<sup>1</sup>, Truls Råstad<sup>2</sup>. <sup>1</sup>Olympiatoppen, The Norwegian Olympic and Paralympic Committee and Confederation of Sports, Oslo, Norway. <sup>2</sup>Norwegian School of Sport Sciences, Oslo, Norway.

(No relationships reported)

Supplementation with  $\beta$ -alanine can increase the level of intracellular buffer carnosine in skeletal muscle. Studies have shown that increased carnosine concentration can limit metabolic



acidosis and enhance high-intensity exercise performance. Supplementation with sodium bicarbonate can increase buffer capacity in blood and enhance maximal exercise capacity in sports lasting 1-5 minutes.

**PURPOSE:** To determine the effect of  $\beta$ -alanine and sodium bicarbonate supplementation, separately and in combination, on high-intensity cycling capacity.

**METHODS:** Fourteen physically active students were block randomised to either a placebo or  $\beta$ -alanine group (4g/day for 5 weeks) based on  $\text{VO}_{2\text{max}}$ . Before and after the 5-week loading phase with either  $\beta$ -alanine or placebo, two 5-minute cycling tests (test 1, test 2, with a 20-minute break between tests) were conducted. Performance was measured as average power in 5 minutes ( $W_{5\text{min}}$ ). The repeated performance tests were conducted twice, before and after the loading phase, with either sodium bicarbonate (0.3g/kg body weight) or placebo (maltodextrin) in a randomised cross-over design.

**RESULTS:** Bicarbonate supplementation alone did not have any effect on  $W_{5\text{min}}$ . As a result of 5-week loading phase there was a significant increase in  $W_{5\text{min}}$  in  $\beta$ -alanine ( $9 \pm 7 \text{ W}$  (3-4%),  $p=0.03$ ) but not in placebo group.  $W_{5\text{min}}$  decrease between the repeated performance tests (test 1 and 2) was smaller when subjects received bicarbonate supplementation vs placebo ( $-5 \pm 10 \text{ W}$ , vs.  $-16 \pm 19 \text{ W}$   $p = 0.04$ ) after the  $\beta$ -alanine loading phase.

**CONCLUSIONS:** Supplementation with  $\beta$ -alanine enhanced performance in a 5-minute cycling capacity test. Supplementation with sodium bicarbonate alone did not have any performance enhancing effect, but when combined with  $\beta$ -alanine, the reduction in cycling capacity in the repeated performance test (after 20min) was reduced.

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**1837** Board #245 **MAY 30** **3:30 PM - 5:00 PM**

**Effects Of Beta-alanine Supplementation Combined Or Not With Sodium Bicarbonate On Anaerobic Performance**

Gabriel C. Tobias, Guilherme G. Artioli, Fabiana B. Benatti, Antonio H. Lancha, Jr. *University of São Paulo, São Paulo, Brazil.*

(No relationships reported)

Evidences indicate that muscle acidosis is one major cause of fatigue during short-term, high-intensity exercises. It is well known that anaerobic performance is improved by artificially increasing intra or extracellular buffering capacity. However, the additional ergogenic effects of increasing both intra and extracellular buffering capacity are yet to be determined.

**PURPOSE:** to investigate the effects of isolated or combined Beta-Alanine (BA) and Sodium Bicarbonate (SB) supplementation on Anaerobic Performance of upper Limbs.

**METHODS:** This was a randomized, double-blinded, placebo-controlled trial. Subjects were divided into 4 groups (BA + Placebo; Placebo + SB; Placebo+Placebo; and BA + SB). Thirty athletes (age=25 $\pm$ 5 yrs; weight=78.8 $\pm$ 9.9 kg; training experience= 6 $\pm$ 4 yrs; training volume=6.8 $\pm$ 2 h/wk) were assessed for intermittent anaerobic performance, through the use of 4 bouts of the Wingate Anaerobic Test for upper body, interspersed by 3 min recovery period. All athletes undertook the same experimental procedures twice (i.e., PRE and POST the supplementation period).

**RESULTS:** We observed a significant main effect of time ( $F=38.81$ ;  $p<0.0001$ ) and a significant group\*time interaction ( $F=6.7$ ;  $p<0.001$ ). BA, SB and BA+SB elicited significant improvement in performance (between subjects;  $p<0.05$ ), whereas performance did not change in placebo group whatsoever. Moreover, the athletes from BA+SB group presented the highest improvement in performance as compared to BA or SB alone.

|         | PRE                 | POST                 |
|---------|---------------------|----------------------|
| BA      | 477824 $\pm$ 41994  | 513169 $\pm$ 53935a  |
| SB      | 512340 $\pm$ 81878  | 548953 $\pm$ 84608b  |
| BA + SB | 470424 $\pm$ 49407  | 549338 $\pm$ 79530c  |
| Placebo | 548524 $\pm$ 113000 | 549988 $\pm$ 99842ns |

<sup>a</sup> $p=0.009$ ; <sup>b</sup> $p=0.005$ ; <sup>c</sup> $p<0.0001$ ; <sup>ns</sup>nonsignificant

**CONCLUSION:** BA or SB alone improves intermittent anaerobic performance in a very similar fashion, and BA+SB combined showed additive ergogenic effects.

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**1838** Board #246 **MAY 30** **3:30 PM - 5:00 PM**

**Effects Of  $\beta$ -alanine Supplementation On Exercise Performance: A Meta-analysis**

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(No relationships reported)

$\beta$ -alanine is a substrate of carnosine (which contributes to  $\text{H}^+$  buffering during high-intensity exercise) and is a popular ergogenic aid to sports performance.

**PURPOSE:** There have been several recent qualitative reviews published on the topic; here we present a preliminary quantitative review of the literature through meta-analysis.

**METHODS:** A comprehensive literature search identified all studies suitable for inclusion; strict exclusion criteria, generally relating to inappropriate methodological design, were applied. Exercise tests were analysed as a complete group for the overall effect of  $\beta$ -alanine supplementation (BA) compared to a placebo (PLA). Due to the mechanisms by which  $\beta$ -alanine is proposed to have an ergogenic effect, the data were then sub-divided into type of exercise test (capacity, performance); duration of exercise test (<60 s, 60-240 s, >240 s); and the daily and total dose of  $\beta$ -alanine administered. Mann-Whitney U-tests and Spearman's correlation coefficients were used to analyse the data.

**RESULTS:** Fifteen published manuscripts were included in the analysis, which reported the results from 57 exercise tests, using 18 supplementation regimes and a total of 360 participants (174 BA, 186 PLA). BA improved the outcome of exercise tests to a greater extent than PLA (median effect size (IQR): BA 0.366 (0.138-0.665), PLA 0.108 (-0.019-0.465);  $P=0.002$ ). Some of this effect might be explained by the improvement in exercise capacity tests with BA (0.591 (0.341-1.071)) compared to PLA (0.156 (0.040-0.566);  $P=0.013$ ); no improvement was seen for performance tests ( $P=0.204$ ). In line with the purported mechanisms for an ergogenic effect of  $\beta$ -alanine, exercise tests lasting 60-240 s were improved in BA (0.665 (0.481-1.110)) compared to PLA (0.121 (0.087-0.221);  $P=0.001$ ), as were exercise tests of >240 s (BA 0.368 (0.133-0.797); PLA 0.095 (-0.059-0.607);  $P=0.046$ ). In contrast, there was no benefit of BA on exercise tests lasting <60 s ( $P=0.312$ ). There was also no relationship between the dose of  $\beta$ -alanine administered and the difference between the effect size of the BA and PLA groups in the exercise tests ( $P=0.337$ ).

**CONCLUSION:** Overall,  $\beta$ -alanine supplementation results in a 2.85% (-0.37-10.49%) improvement in the outcome of an exercise test, when a total of 179g of  $\beta$ -alanine is supplemented.

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**1839** Board #247 **MAY 30** **3:30 PM - 5:00 PM**

**Effects Of Bcaa Administration On Fatigue, Muscle Damage And Energy Metabolism Substances After Endurance Exercise**

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(No relationships reported)

**PURPOSE:** examine the effects of branched-chain amino acids (BCAA) administration on fatigue substances (serotonin, ammonia and lactate), muscle damage substances (CK and LDH) and energy metabolism substances (FFA and glucose) after endurance exercise.

**METHODS:** Subjects ( $n = 20$ , college-aged males) were randomly divided into an experimental ( $n=10$ , EXP) and a placebo ( $n=10$ , CON) group. Subjects both EXP and CON performed a bout of cycle training (70%  $\text{VO}_{2\text{max}}$  intensity) to exhaustion. Subject in the EXP were administered BCAA (78ml/kg[[Unsupported Character - &#8228;]]w) prior to the bout of cycle exercise. Fatigue substances, muscle damage substances and energy metabolism substances were measured before administration, 10 min before exercise, 30 min into exercise, post exercise, and recovery 30 min. Data were analyzed by two-way repeated measure ANOVA, with statistical significance was set at  $p<0.05$ .

**RESULTS:** There were no significant differences between groups for any of the outcome variables. During experimental period, serotonin was decreased in the EXP but not the CON. The post exercise, ammonia in the EXP was significantly increased ( $p<0.011$ ) but decreased at the recovery 30min. At the 30 min into exercise, lactate was significantly increased in both EXP and

CON ( $p < .001$ ). CK in the EXP was decreased during experimental period. LDH in both EXP and CON was increased at the 30 min into exercise. FFA in the EXP was significantly increased at the post exercise and recovery 30 min ( $p < .001$ ). Glucose was significantly decreased during experimental period in both EXP and CON ( $p < .001$ ).

**CONCLUSIONS:** These results indicate that supplementary BCAA decreased serum concentrations of the intramuscular enzymes as CK and LDH following exhaustive exercise. This observation suggests that BCAA supplementation may reduce the muscle damage associated with endurance exercise.

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**1840** Board #248 MAY 30 3:30 PM - 5:00 PM

**Beta-alanine Supplementation Increases Muscle Carnosine Content And Physical Capacity In Elderly Subjects**

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(S. del Favero: Royalty; Natural Alternatives International Inc., San Marcos, USA. Consulting Fee; Natural Alternatives International Inc., San Marcos, USA. Ownership Interest; Natural Alternatives International Inc., San Marcos, USA.)

Ageing is associated with a significant reduction in skeletal muscle carnosine resulting in a decline in the buffering capacity of the muscle. As a result elderly subjects will experience a decrease in their capacity to undertake anaerobic exercise. It has been shown that supplementation with beta-alanine has the potential to increase muscle carnosine content by 60 to 80% in healthy young adults, and this is accompanied by an improvement in the ability to perform high-intensity exercise. Improving the buffering capacity of muscle could be important for muscle function and daily-life activities in the elderly.

**PURPOSE:** To investigate the effects of beta-alanine supplementation on exercise performance capacity and on the muscle carnosine content in elderly subjects.

**METHODS:** Eighteen elderly subjects ( $65 \pm 4$  yrs) were randomly assigned to receive either beta-alanine (BA,  $n=12$ ) or placebo (PL,  $n=6$ ) for 12 weeks. The BA group received 3.2g of beta-alanine per day (2x800mg, given 2 times per day). The PL group received the exact same amount of placebo. At baseline (PRE) and after 12 weeks (POST-12) of supplementation we assessed the muscle carnosine content and anaerobic exercise capacity. Food intake was monitored throughout the study.

**RESULTS:** A significant increase in the muscle carnosine content of the gastrocnemius muscle was found in the BA group (+85.4%) when compared with the PL group (+7.2%) ( $p=0.004$ ; ES: 1.21). The time-to-exhaustion in the TLIM test was significantly improved ( $p=0.05$ ; ES: 1.71) in the BA group (+36.5%) versus the PL group (+8.6%). Similarly, time-to-exhaustion in the incremental test was also significantly increased ( $p=0.04$ ; ES: 1.03) following beta-alanine supplementation (+12.2%) when compared with placebo (+0.1%). We also observed significant positive correlations between the relative change in the muscle carnosine content and the relative change in the time-to-exhaustion in the TLIM test ( $r=0.62$ ;  $p=0.01$ ) and in the incremental test ( $r=0.48$ ;  $p=0.02$ ). Dietary intake was unchanged.

**CONCLUSION:** beta-alanine supplementation is effective in increasing the muscle carnosine content in healthy elderly subjects, with subsequent improvement in their exercise capacity.

Supported by FAPESP Grant 2010/11221-0.

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**1841** Board #249 MAY 30 3:30 PM - 5:00 PM

**L-Alanyl-L-Glutamine Ingestion Maintains Performance during a Competitive Basketball Game**

Jay R. Hoffman, FACSM, David R. Williams, Nadia S. Emerson, Mattan W. Hoffman, Adam J. Wells, Daniele M. McVeigh, William P. McCormack, Gerald T. Mangine, Adam M. Gonzalez, Maren S. Fragala. University of Central Florida, Orlando, FL.

(No relationships reported)

**PURPOSE:** Examine the efficacy of L-alanyl-L-glutamine (AG) ingestion on basketball performance, including jump power, reaction time, shooting accuracy and fatigue during a basketball game.

**METHODS:** Ten women ( $21.2 \pm 1.6$  years; height:  $177.8 \pm 8.7$  cm; body mass:  $73.5 \pm 8.0$  kg), all scholarship NCAA Division I basketball players, volunteered for this study. Subjects participated in four trials, each consisting of a 40-min basketball game with controlled time-outs for rehydration. During the first trial (DHY) subjects were not allowed to rehydrate, and the total weight lost during the contest was used to determine fluid replenishment during the subsequent three experimental trials. During one trial subjects consumed only water (W), while during the other two trials subjects consumed the AG supplement marketed as Sustamine™ mixed in water using either a low dose (1 g per 500 ml) (AG1) or high dose (2 g per 500 ml) (AG2) concentration.

**RESULTS:** During DHY subjects lost  $1.72 \pm 0.42$  kg (2.3% loss of their body mass). No differences in fluid intake ( $1.55 \pm 0.43$  L) were seen between rehydration trials. A 12.5% ( $p=0.016$ ) difference in basketball shooting performance was noted between DHY and AG1 and an 11.1% ( $p=0.029$ ) difference was seen between AG1 and W. Visual reaction time was significantly greater following AG1 ( $p=0.014$ ) compared to DHY. Differences ( $p=0.045$ ) in fatigue, as determined by player loads, were seen only between AG2 and DHY. No significant differences were seen in the pre to post game differences in either peak or mean vertical jump power during any trial.

**CONCLUSIONS:** In conclusion, rehydration with AG appears to maintain basketball skill performance and visual reaction time to a greater extent than water only.

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**1842** Board #250 MAY 30 3:30 PM - 5:00 PM

**The Impact Of Glycine Propionyl-L-Carnitine Supplementation On Power Production In Recreationally Active Women**

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(No relationships reported)

Many people use dietary supplements to enhance the effects of exercise. This has led to the development of a \$14 billion supplement industry (Sarubin, 2000). One such supplement, glycine propionyl-L-carnitine (GPLC), is marketed to non-athlete exercisers for the purpose of increasing work output while delaying fatigue. Such a supplement may assist individuals in establishing an effective exercise routine that meets health recommendations. GPLC has been shown to increase anaerobic power in resistance-trained men (Jacobs et al, 2009). Recognizing that women may respond differently to exercise and nutritional supplementation, a study focusing on women participants is warranted.

**PURPOSE:** To study the effects of GPLC supplementation on anaerobic power production in recreationally active women.

**METHODS:** A double-blind, repeated measures design was used in this investigation. Participants ( $n=8$ ) completed four sessions. The first session served to familiarize the participants to the anaerobic power test. Subsequently, 3 testing sessions were performed separated by 1 week. Sessions were counterbalanced by supplement; 3.0 g GPLC, 1.5 g GPLC, or control (200 mg brown rice powder). Ninety minutes following supplement ingestion, participants completed a 5 minute warm-up and then a 5-stage anaerobic power test on a cycle ergometer. The ergometer was loaded with 5% of the individual's body weight. Each stage lasted 10 seconds and was separated by 1 min of active recovery. Active recovery was done by pedaling an unloaded cycle ergometer at 50 RPM. Peak power (PP) and mean power (MP) were measured and recorded.

**RESULTS:** A RM-GLM revealed a significant time effect for both PP ( $p=.001$ ) and MP ( $p=.001$ ). There was not a significant condition effect for either PP or MP ( $p>.05$ ). A non-significant time\*condition interaction was seen for both PP ( $p=.076$ ) and MP ( $p=.063$ ). Higher initial power was seen for those consuming 3.0 g GPLC ( $313.0 \pm 16.0$  W) than either 1.5 g GPLC ( $304.6 \pm 11.5$  W) or control ( $306.0 \pm 15.1$  W).

**CONCLUSIONS:** Consuming 3.0 g GPLC prior to exercise may result in an increase in power production among recreationally active women. This may enable individuals to exercise at intensities sufficient to derive health benefit.

1843 Board #251 MAY 30 3:30 PM - 5:00 PM

**Effect of an L-Arginine/L-Citrulline Supplement on Muscle Oxygen Saturation and Maximal Exercise Performance**

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(No relationships reported)

L-Arginine (LA) is a semi-essential amino acid that is commonly used as a supplement to enhance blood flow and improve performance in resistance and aerobic exercise. LA exerts its primary effect by conversion to nitric oxide (NO), increasing vasodilation potential in the vasculature of the body. The addition of L-citrulline (LC) to LA has been shown to enhance the potential ergogenic effects of LA.

**PURPOSE:** To examine the effects of an acute dose of LA/LC supplementation on skeletal muscle oxygen saturation (StO<sub>2</sub>) and maximal cycle exercise performance.

**METHODS:** Twelve healthy, college-aged participants (9 M, 3 F; 20.69 ± 0.95 yr) completed two maximal cycle ergometer exercise tests after ingesting either LA/LC (LA 5000mg, LC 1500mg) in 0.5 L water or placebo approximately 90 minutes prior to testing. Order of drink mixture was determined by randomized, blinded counter balance design. Respiratory gases were collected for the determination of maximal oxygen consumption (VO<sub>2</sub>max) and ventilatory threshold (VT). Heart rate (HR), blood pressure (BP) and rating of perceived exertion (RPE) were measured throughout exercise. Near infrared spectroscopy (NIR) was used to assess StO<sub>2</sub> in the vastus lateralis muscle by analyzing the StO<sub>2</sub> slope measured from the first significant reduction during exercise to the point of the VT.

**RESULTS:** No significant difference was found between supplement and placebo for time to exhaustion (13.50 ± 0.56 vs 13.64 ± 0.57 min; *P* = 0.279), maximal workload (315.8 ± 18.3 vs 317.6 ± 18.2 watts; *P* = 0.653), VO<sub>2</sub>max (47.97 ± 3.07 vs 47.69 ± 2.68 ml·kg<sup>-1</sup>·min<sup>-1</sup>; *P* = 0.731), StO<sub>2</sub> slope (-0.0418 ± 0.0033 vs -0.0384 ± 0.0043; *P* = 0.448), and time to VT (10.55 ± 0.492 vs 10.55 ± 0.494 min; *P* = 0.999), respectively. All participants showed consistency in maximal effort based on an RER of greater than 1.10 for all tests for both supplement and placebo trials.

**CONCLUSION:** The results of this study suggest that acute LA/LC supplementation does not significantly affect maximal exercise test results or the onset of the VT. In addition, skeletal muscle oxygen utilization from the beginning of exercise up to the VT was not affected by the LA/LC supplement when compared to placebo.

1844 Board #252 MAY 30 3:30 PM - 5:00 PM

**L-arginine Combined With Resistance Exercise On Growth Hormone, Growth Hormone Secretagogues, And Insulin-like Growth Factor-1**

Scott C. Forbes, Vicki Harber, Gordon Bell. *University of Alberta, Edmonton, AB, Canada.* (Sponsor: Dr. Darren Delorey, FACSM)  
(No relationships reported)

Acute resistance exercise and L-arginine independently have both been shown to elevate plasma growth hormone (GH) concentrations; however, their combined effect in strength trained participants is controversial.

**PURPOSE:** To investigate the combined effects of resistance exercise and L-arginine supplementation on plasma L-arginine, GH, GH secretagogues, and IGF-1 in strength trained males.

**METHODS:** Fourteen strength trained males (age: 25±4 yrs; weight: 81.4±9.0 kg; height: 179.4±6.9 cm; body fat: 11.5±3.8 %; training experience: 6.3±3.4 yrs; one repetition maximum (1RM) bench press relative to body mass ratio: 1.3±0.2) participated in a crossover study (separated by ~7 days) in which they were randomized to L-arginine supplementation (0.075 g·kg<sup>-1</sup> body mass) or a placebo. Subjects reported to the laboratory at 08:00 in a fasted state, consumed the supplement 60 min prior to performing a resistance training session (3 sets of 8 exercises, 10 repetitions at ~75% 1RM). Blood samples were collected at rest, before exercise, and 0, 15, 30, 60 minutes after exercise.

**RESULTS:** The L-arginine condition significantly increased plasma L-arginine concentrations (from 236 to 518 μmol·L<sup>-1</sup>) while no change was detected in the placebo condition. There were no differences between conditions for GH, GH-releasing hormone, GH-inhibiting hormone, ghrelin, or IGF-1 at any time point. However, integrated area under the curve for GH was significantly blunted in the L-arginine condition (L-arginine = 288.4±368.7 vs. placebo = 487.9±482.0 min·ng·ml<sup>-1</sup>, *p*<0.05).

**CONCLUSION:** Acute L-arginine supplementation when combined with resistance exercise blunted the GH response; however, this response was not due to changes in GH-releasing hormone, GH-inhibiting hormone, ghrelin, or IGF-1.

1845 Board #253 MAY 30 3:30 PM - 5:00 PM

**Effects Of β-hydroxy-β-methylbutyrate (hmb) Supplementation On Exercise Performance, Body Composition And Hematological Response In Male Athletes**

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(No relationships reported)

**PURPOSE:** Studies have shown that β-hydroxy-β-methylbutyrate (HMB) supplementation is able to increase muscle strength and lean-body mass and to prevent muscle damage with resistance training in untrained individuals. However, there have been less studies to examine the effects of HMB supplementation on these responses in trained individuals. The purpose of this study was therefore to examine the effects of HMB supplementation on exercise performance, body composition and hematological response over 4 weeks of resistance training in athletes.

**METHODS:** Fourteen male athletes were divided into two groups: HMB supplementation group (HMB, 3.0 g/day; *n* = 7) and placebo group (maltodextrin; *n* = 7). Resistance training consisted of 2 different exercises (bench press and leg press) at 75-80% of 1-repetition maximum (1-RM), performed 2-3 days/week for 4 weeks. 1-RM muscle strength, anaerobic power (Wingate test) and body composition were assessed before and after 4 weeks of resistance training. Blood samples were obtained before and at 2 and 4 weeks after starting HMB supplementation.

**RESULTS:** No significant differences were observed between the groups in 1-RM muscle strength, body composition, and hepatic enzyme activity. Anaerobic power at 5 sec during the Wingate test was significantly greater in the HMB group than in the placebo group (880±61 W vs. 804±40 W, *p*<0.05). The rate of increase in 1-RM leg press tended to be higher in the HMB group than in the placebo group (15±12% vs. 7±5%, *p*=0.15). High-density lipoprotein was significantly lower in the HMB group than in the placebo group after 4 weeks (46±5 mg/dl vs. 58±5 mg/dl, *p*<0.01). There were decreasing tendencies of creatine phosphokinase (*p*=0.11) and lactate dehydrogenase (*p*=0.07) in the HMB group compared with the placebo group.

**CONCLUSION:** These results suggest that HMB supplementation for 4 weeks is unable to increase muscle strength and lean body mass in athletes. However, it tends to reduce training-induced muscle damage by increasing cholesterol metabolism, and to maintain anaerobic performance.

1846 Board #254 MAY 30 3:30 PM - 5:00 PM

**The Effect Of N-acetylcysteine Supplementation On Recovery Of Strength Following Eccentric Muscle Injury**

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(No relationships reported)

N-acetylcysteine (NAC) supplementation has demonstrated pro- and anti-inflammatory effects in human subjects following exercise-induced muscle injury. However, there is limited data examining the effects of NAC on recovery of maximal isometric torque (MIT) following injurious exercise.

**PURPOSE:** The purpose of this study was to examine the effect of NAC supplementation on recovery of MIT following eccentric contraction-induced muscle injury.

**METHODS:** Non-resistance-trained female subjects (*n* = 21, age = 20.7 ± .1 yr, weight = 68.1 ± 10 kg, height = 1.7 ± .07 m) performed one bout of eccentric exercise involving the non-dominant forearm flexor muscles. Subjects were given a placebo (P) (*n* = 10) or NAC supplement (10 mg·kg<sup>-1</sup> bw·d<sup>-1</sup>; *n* = 11) for 7d prior to and 10d following the eccentric exercise bout. Maximal isometric torque, muscle soreness (SORE), range of motion (ROM), and arm circumference (CIRC) were measured at pre-exercise (PRE), immediately post-exercise (POST), and at 1d, 3d, 7d and 10d post-exercise. In addition, serum interleukin-6 (IL-6), serum creatine kinase (CK), and serum glutathione were measured. Subjects completed a food frequency questionnaire (FFQ) to determine the antioxidant content of their diet.

**RESULTS:** There was no difference in MIT values between the P and NAC group POST ( $26.93 \pm 6.4$  vs.  $24.95 \pm 9.4$  Nm) or at 1d ( $27.83 \pm 5.7$  vs.  $26.9 \pm 8.5$  Nm), 3d ( $38.35 \pm 6.7$  vs.  $34.69 \pm 10.2$  Nm), 7d ( $46.9 \pm 8.8$  vs.  $42.5 \pm 11.8$  Nm), or 10d ( $57.83 \pm 11.7$  vs.  $52.92 \pm 14.3$  Nm) post-exercise. In addition, there was no difference in SORE ( $p = .752$ ), CIRC ( $p = .535$ ), ROM ( $p = .539$ ), serum CK ( $p = .449$ ), serum glutathione ( $p = .967$ ), or serum IL-6 ( $p = .360$ ) at any time point. FFQ scores demonstrated that dietary antioxidant intake was not significantly different between groups ( $p = .054$ ).

**CONCLUSION:** A bout of eccentric forearm flexor resulted in a significant decrease in MIT values (>50% PRE MIT at POST) in both groups. Supplementation with NAC had no effect on recovery of MIT, SORE, CIRC, ROM, serum CK, serum IL-6, or serum glutathione at any time point following the exercise bout when compared to a P group. These results suggest that oral ingestion of NAC, at a dosage of  $10 \text{ mg}\cdot\text{kg}^{-1}\text{ bw}\cdot\text{d}^{-1}$ , has no effect on recovery of MIT following eccentric muscle injury. Supported by doctoral dissertation grant from Gatorade Sports Science Institute.

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**1847** Board #255 MAY 30 3:30 PM - 5:00 PM

**Muscle Protein Metabolism In Neonatal Alloxan-administered Rats: Effects Of Resistance Training**

Carla Ribeiro, Lucieli Teresa Cambri, Fabricio de Azevedo Voltarelli, Rodrigo Augusto Dalia, Michel Barbosa de Araujo, Jose Diego Botezelli, Leandro Pereira de Moura, Maria Alice Rostom de Mello. *Sao Paulo State University, Rio Claro, Brazil.*

(No relationships reported)

Currently, it has been observed that type 2 diabetes mellitus (T2DM) changes the serum levels of several amino acids that may contribute to disturbances in insulin secretion and action. However resistance training has the potential for increasing muscle strength and lean muscle mass which could enhance functional status on muscle protein metabolism in the T2DM.

**PURPOSE:** Thus, this study aimed to examine the effects of resistance training on muscle protein metabolism in neonatal alloxan-administered rats.

**METHODS:** Alloxan was injected in newborn rats at 6 days of age ( $250 \text{ mg/kg bw}$ ). At 28 days of age, the animals were divided into sedentary alloxan (SA), sedentary control (SC), resistance trained alloxan (TA), resistance trained control (TC) groups. The resistance training protocol (T) consisted of four series of 10 jumps in the water in individual cylinder tanks (25cm diameter x 50 cm depth), one min interval between them, with an overload of 50% of b. w during 12weeks, 5days a week. At 120 days the animals were subjected to glucose tolerance test (GTT), analyzed by the total area under the serum glucose curve (AUC mg/dLx120min). After 48hs of the last test, all animals were killed for analysis of protein synthesis (pmol/mg.h) and degradation (pmol/mg.h) in the soleus muscle; DNA concentrations (mg/100mg) and DNA/protein ratio in the gastrocnemius muscle. Data were analyzed by 2- way ANOVA ( $p < 0.05$ ), followed by Newman-Keuls post hoc.

**RESULTS:** The AUC was higher in the SA and TA when compared to corresponding controls SC and TC (SA=14140  $\pm$  672 > SC=13064  $\pm$  683 TA=15234  $\pm$  657 > TC=14085  $\pm$  392). No differences in protein synthesis (SC=12.77  $\pm$  5.76 SA= 11.06  $\pm$  2.21 TC=15.32  $\pm$  2.73 TA=16.48  $\pm$  3.03) and protein degradation (SC=287.93  $\pm$  37.38 SA=350.56  $\pm$  90.71 TC= 281.26  $\pm$  127.88 TA= 305.11  $\pm$  124.13) in the soleus muscle among the groups were observed. The DNA concentrations were higher in the SC group than the TC group (SC=0.058  $\pm$  0.010 SA=0.053  $\pm$  0.013 TC= 0.037  $\pm$  0.013 TA= 0.043  $\pm$  0.016), whereas the DNA/protein ratio was higher in the resistance training groups (SC=108.02  $\pm$  27.80 SA=110.35  $\pm$  20.37 TC= 161.04  $\pm$  26.59 TA= 161.20  $\pm$  42.13).

**CONCLUSIONS:** It was concluded that resistance training sessions were effective in altering muscle growth by hypertrophy in alloxan-administered animals.

**Support:** Fapesp (proc: 09/51538-5), Capes, CNPq.

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**1848** Board #256 MAY 30 3:30 PM - 5:00 PM

**Routine Practice of Yoga Effects Whole Body Protein Utilization in Middle-Aged Women**

Megan Colletto, Jose Rodriguez, Jeffrey DelFavero, Nancy Rodriguez, FACSM. *University of Connecticut, Storrs, CT.*

(No relationships reported)

Whole body protein turnover (WBPTO) reflects the balance between protein flux (Q), protein breakdown (PB) and protein synthesis (PS). The influence of routine yoga practice on WBPTO in middle-aged men and women has not been characterized.

**PURPOSE:** To determine differences in WBPTO between middle-aged (50-70 y) men and women who practice yoga and healthy sedentary controls.

**METHODS:** WBPTO, protein (g/d) and energy intake (cal/d) were determined in healthy middle-aged yoga practitioners (YOGA) and sedentary controls (CON). The 15N glycine method was used to measure WBPTO. Following the evening meal, subjects provided a spot urine sample for background enrichment of 15N glycine and then consumed the 2 mg/kg 15N glycine dose. Urine was collected overnight for 7-10 h and urinary 15N ammonia enrichment determined by IRMS at a commercial laboratory (Metabolic Solutions, Nashua, NH). Protein and energy intakes were estimated from 7 d diet records. Subjects estimated portion sizes with a food scale and visual guide. Records were verified by research assistants and analyzed using Nutritionist Pro software version 4.7.0 (Stafford, TX).

**RESULTS:** Data are presented as mean  $\pm$  SE. Age, weight and BMI were similar for YOGA ( $n=8$ ,  $58.2 \pm 1.5$  y,  $67.0 \pm 4.2$  kg, BMI =  $24.7 \pm 0.6$ ) and CON ( $n=11$ ,  $55.4 \pm 1.5$  y,  $73.7 \pm 4.8$  kg, BMI =  $26.3 \pm 0.8$ ). Components of WBPTO did not differ between YOGA and CON ( $p = 0.09$ ; Q:  $0.74 \pm 0.10$  vs.  $0.94 \pm 0.098$ ,  $p = 0.26$ ; PB:  $3.43 \pm 0.60$  vs.  $4.05 \pm 0.66$ ,  $p = 0.12$ ; PS:  $3.97 \pm 0.58$  vs.  $5 \pm 0.58$ ). For women only, Q and PS were lower for YOGA versus CON ( $p < 0.05$ ; Q:  $0.60 \pm 0.06$  vs.  $0.75 \pm 0.04$ ,  $p < 0.05$ ; PS:  $3.22 \pm 0.40$  vs.  $4.47 \pm 0.52$ ) while PB did not differ ( $p = 0.26$ ;  $3.43 \pm 0.60$  vs.  $4.05 \pm 0.66$ ). No group or gender specific differences were found for protein ( $81 \pm 6$  vs.  $91 \pm 8$ ) and calorie ( $1811 \pm 120$  vs.  $2077 \pm 626$ ) intake.

**CONCLUSIONS:** Findings suggest that protein turnover may be down regulated in middle-aged women who routinely practice yoga. Given the increased popularity of yoga, further research is warranted to characterize the protein related metabolic response of this alternative mode of exercise in middle-aged men and women as a potential strategy for maintenance of muscle mass with aging.

Project funded by Dairy Research Institute.

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**1849** Board #257 MAY 30 3:30 PM - 5:00 PM

**Post-exercise Carbohydrate Plus Whey Protein Hydrolysates Supplementation Stimulates Muscle Protein Synthesis In Rats**

Atsushi Kanda<sup>1</sup>, Kyosuke Nakayama<sup>1</sup>, Tomoyuki Fukasawa<sup>1</sup>, Jinichiro Koga<sup>1</sup>, Kentaro Kawanaka<sup>2</sup>, Mitsuru Higuchi, FACSM<sup>3</sup>. *Meiji Co., Ltd., Saitama, Japan.*  
<sup>2</sup>Niigata University of Health and Welfare, Niigata, Japan. <sup>3</sup>Waseda University, Saitama, Japan.

(No relationships reported)

**PURPOSE:** Recent studies have shown that co-ingestion of carbohydrate and protein is more effective than ingestion of carbohydrate alone for stimulating muscle protein synthesis after exercise. However, it remains to be demonstrated which form of whey protein (intact protein, protein hydrolysates, or amino acids) is the most effective stimulator of protein synthesis and translation initiation in skeletal muscle. The aim of this study was to compare the effects of different forms of dietary whey protein on protein synthesis and translation initiation in skeletal muscle in the post-exercise phase.

**METHODS:** Male Sprague-Dawley rats, pre-trained for 3 days, swam for 2 hours. Immediately after the exercise, one of the following four isocaloric solutions was administered: carbohydrate (CHO); carbohydrate plus protein (intact whey protein [WPC], whey protein hydrolysates [WPH], or whey amino acid mixture [WAA]) ( $n = 8$ ). A bolus dose ( $45 \text{ mg/kg BW}$ ,  $22.5 \text{ mg/mL}$ ) of phenylalanine labeled with deuterium was injected via the tail vein 45 min after administration for the measurement of the protein fractional synthesis rate (FSR). One hour after administration, the triceps muscle was excised and quickly frozen. Subsequently, plasma insulin level, and protein synthesis and phosphorylated Akt/PKB in the triceps muscle were analyzed.

**RESULTS:** WPH caused significant increases ( $p < 0.05$ ) in FSR ( $6.93 \pm 0.10$  %/day), compared with WPC ( $6.01 \pm 0.23$  %/day), WAA ( $5.83 \pm 0.30$  %/day), or CHO ( $4.56 \pm 0.22$  %/day). Post-exercise ingestion of WPH or WPC caused significant increases ( $p < 0.05$ ) in plasma insulin (WPH,  $0.86 \pm 0.12$  ng/mL; WPC,  $0.83 \pm 0.07$  ng/mL) levels compared with CHO ( $0.44 \pm 0.06$  ng/mL). In contrast, there were no significant differences in the plasma insulin increase after WAA ingestion ( $0.63 \pm 0.12$  ng/mL) and CHO ingestion. Furthermore, the level of Akt/PKB phosphorylation was significantly higher ( $p < 0.05$ ) after WPH ingestion (164%) than after CHO ingestion, but not significantly different after WPC (140%), WAA (127%), and CHO ingestion.

**CONCLUSIONS:** It is concluded that post-exercise supplementation with WPH increases skeletal muscle protein synthesis better than post-exercise supplementation with WPC or WAA by activating key enzymes such as Akt/PKB.

1850 Board #258 MAY 30 3:30 PM - 5:00 PM

**Muscle Protein Balance with the Ingestion of a Protein Blend Following Resistance Exercise**

Paul T. Reidy<sup>1</sup>, Dillon K. Walker<sup>1</sup>, Jared M. Dickinson<sup>1</sup>, David M. Gundermann<sup>1</sup>, Micah J. Drummond<sup>1</sup>, Kyle L. Timmerman<sup>1</sup>, Christopher S. Fry<sup>1</sup>, Mark B. Cope<sup>2</sup>, Ratna Mukherjee<sup>2</sup>, Elena Volpi<sup>1</sup>, Blake B. Rasmussen<sup>1</sup>. <sup>1</sup>UTMB, Galveston, TX. <sup>2</sup>Solae, LLC, St. Louis, MO. (Sponsor: Elizabeth Protas, FACSM)  
(No relationships reported)

The ingestion of amino acids or protein following resistance exercise are necessary to produce a greater overall muscle protein net balance compared to exercise alone. Proteins such as whey are digested at a fast rate whereas soy and casein are digested at an intermediate and slow rate, respectively.

**PURPOSE:** To determine if the ingestion of a protein blend of soy, whey and casein would extend post-exercise muscle protein synthesis and reduce muscle protein breakdown resulting in an overall greater net protein balance as compared to whey.

**METHODS:** Twenty young adults participated in a double-blind, randomized clinical trial and ingested ~20g of a protein blend or ~20g of whey (N=10 per group) 1h after a bout of high-intensity leg resistance exercise. We utilized stable isotopic methods in conjunction with femoral catheterization to measure leg muscle protein synthesis and breakdown with the 2- and 3-pool mathematical models. Muscle biopsies (*vastus lateralis*) and blood samples were collected at baseline following an overnight fast and from 1-5h following exercise. As we are currently blinded to this ongoing trial, we report differences between the two beverages as Protein A and Protein B (data will be unblinded for presentation at the ACSM meeting).

**RESULTS:** With post-ex averages we found similar blood flow ( $3.4\pm 0.3$ ,  $3.6\pm 0.8$  ml/100g muscle/min) and amino acid delivery ( $219\pm 28$ ,  $195\pm 41$  nmol/100g muscle/min) to the muscle for Protein A and B, respectively ( $p>0.05$ ). Also, net phenylalanine balance across the leg increased from baseline to a similar extent ( $7.4\pm 1.8$ ,  $11.6\pm 3.3$  nmol/100g muscle/min) in both A and B, respectively ( $p>0.05$ ). Protein breakdown across the leg was reduced post-exercise with no differences between Protein A and B.

**CONCLUSION:** We conclude, from these preliminary data, that the ingestion of a protein blend affects the overall muscle protein anabolic response following resistance exercise to a similar extent compared to whey protein.

Supported by a grant from Solae LLC.

1851 Board #259 MAY 30 3:30 PM - 5:00 PM

**Effect Of Protein Intake On Muscle Strength And Muscle Mass According To Physical Activity Level**

Marie-Eve Filion, Sebastien Barbat-Artigas, Marie-Eve Ringuet, Antony D. Karelis, Mylène Aubertin-Leheudre. *Université du Québec à Montréal, Montréal, QC, Canada.* (Sponsor: Jean P Boucher, FACSM)  
(No relationships reported)

**INTRODUCTION:** Several studies reported that muscle mass and strength play a key role in the maintenance of functional capacities with aging. Protein intake and physical activity appear to be important for maintaining muscle mass and strength. However, there is no clear recommendation concerning the needs in protein for elderly. Indeed, Vellas et al. have proposed 1.2 gr/kgBW/d for elderly instead of the Recommended Daily Allowance (RDA) of 0.8 gr/kgBW/d.

**PURPOSE:** The purpose of this study was to investigate the relationship between protein intake and muscle mass or muscle strength according to physical activity level among postmenopausal women.

**METHOD:** Seventy-two sedentary postmenopausal women aged between 50 and 75 years with a body mass index (BMI) between 20 to 35 kg/m<sup>2</sup> were recruited. Body composition (BIA), muscle strength (grip strength), physical activity level (Podometer), resting metabolic rate (RMR: Moxus) and dietary intake (Candat) were evaluated. Women were divided in 2 groups according to their protein intake (Prot+: > 1.2 g/kgBW/d; Prot-: < 1.2 g/kgBW/d).

**RESULTS:** No significant difference was observed for age, RMR and physical activity level between groups. Prot- group have significantly higher body weight, BMI and fat mass percentage. No differences for skeletal muscle mass and muscle mass index were noted between the 2 groups. However, Prot+ presents significantly higher handgrip (kg/BW;  $p<0.001$ ) and knee extensor strength (kg/BW;  $p<0.001$ ). Total calorie intake ( $p=0.002$ ), essential amino acid ( $p<0.001$ ) and non-essential amino acid intake ( $p<0.001$ ) were also higher in Prot+. Finally, Prot+ presented a significantly higher excessive energetic balance compared with Prot- ( $p=0.023$ ).

**CONCLUSION:** In conclusion, our results showed that high protein intake is associated with high muscle strength, independently of the physical activity level. Furthermore, a high protein intake seems to be associated with lower BMI and fat mass percentage, in spite of an excessive energetic balance. Thus, a protein intake of 1.2 gr/kgBW/d should probably be considered as a recommended daily allowance in elderly individuals. Future studies need to investigate the effect of a high protein intake combined with exercise interventions on muscle mass and muscle strength as well as their impact on functional capacities.

1852 Board #260 MAY 30 3:30 PM - 5:00 PM

**Effectiveness Of Protein, Leucine And  $\beta$ -hydroxy- $\beta$ -methylbutyrate On Signaling Proteins Involved In Protein Synthesis And Degradation**

Wanyi Wang, Yi-Hung Liao, Ming Hsieh, Joowon Lee, Zhenping Ding, John L. Ivy, FACSM. *University of Texas at Austin, Austin, TX.* (Sponsor: John L. Ivy, FACSM)  
(No relationships reported)

Whey protein, which is high in leucine content, has been used extensively to stimulate protein synthesis. Leucine alone can stimulate protein synthesis by activating mTOR and its downstream proteins, whereas its metabolite  $\beta$ -hydroxy- $\beta$ -methylbutyrate (HMB) is able to attenuate protein degradation when provided chronically. However, the mechanisms of HMB's actions remain unclear.

**PURPOSE:** To investigate the effects of HMB on signaling pathways regulating protein synthesis and degradation. **METHOD:** Female rats were orally administered by vehicle, whey protein (187.5mg/kg), HMB (400mg/kg) or leucine (1.4g/kg). Blood was collected before, 45 min and 90 min after supplement administration. Gastrocnemius muscle was excised 90 min after supplement administration and fast-twitch red (RG) and white (WG) portions separated.

**RESULTS:** Blood glucose area under curve (AUC) for leucine was lower than all other treatments (vehicle  $-40.0\pm 167.5$ , protein  $-3.8\pm 176.9$ , HMB  $90.0\pm 164.0$  leucine  $-953.0\pm 113.3$  mg/dl  $\cdot 90$ min,  $p<0.05$ ). Insulin AUC for HMB was lower than vehicle, but it was higher for leucine (vehicle  $9.9\pm 7.2$ , protein  $-14.1\pm 6.6$ , HMB  $-28.5\pm 11.6$ , leucine  $16.5\pm 6.6$  ng/ml  $\cdot 90$ min,  $p<0.05$ ). Western blot analysis revealed that HMB increased Akt phosphorylation in RG (vehicle  $0.18\pm 0.03$ , protein  $0.17\pm 0.03$ , HMB  $0.28\pm 0.05$  leucine  $0.20\pm 0.03$  arbitrary units,  $p<0.05$ ). Both HMB and leucine increased phosphorylation of mTOR in RG (vehicle  $0.40\pm 0.08$ , protein  $0.39\pm 0.04$ , HMB  $0.65\pm 0.06$ , leucine  $1.06\pm 0.10$  arbitrary units,  $p<0.05$ ) and WG (vehicle  $0.34\pm 0.06$ , protein  $0.36\pm 0.02$ , HMB  $0.46\pm 0.03$ , leucine  $0.59\pm 0.06$  arbitrary units,  $p<0.05$ ), but the effect of leucine was stronger. Leucine also increased the phosphorylation of p70s6k and 4E-BP1 in both RG and WG, whereas HMB did not. Conversely, phosphorylation of FOXO3A was stimulated only by HMB (vehicle  $0.53\pm 0.09$ , Protein  $0.59\pm 0.09$ , HMB  $1.61\pm 0.24$  Leucine  $0.81\pm 0.08$  arbitrary units,  $p<0.05$ ).

**CONCLUSION:** Leucine appears to be an effective activator of signaling proteins involved in protein synthesis, whereas HMB appears to be involved in inhibiting protein related to protein degradation. These results suggest that supplementing with a combination of leucine and HMB could possibly increase protein synthesis and limit protein degradation thereby increasing protein accretion.

1853 Board #261 MAY 30 3:30 PM - 5:00 PM

**Whey Protein Supplementation Results in Greater Gains in Lean Body Mass Compared to Soy Protein during a Progressive 9-month Resistance Training Program**

Brittanie M. Volk, Erin E. Quann, Kevin D. Ballard, Brian R. Kupchak, Ana L. Gomez, William J. Kraemer, FACSM, Jeff S. Volek. *University of Connecticut, Storrs, CT.*  
(No relationships reported)

**PURPOSE:** Whey and soy are two quality protein sources used by athletes. Few studies have directly compared their ability to promote gains in lean body mass. We compared the effect of

daily supplementation with whey protein (WP) or soy protein (SP) on lean body mass responses to a 9-month progressive resistance training program

**METHODS:** Non-resistance trained men and women were randomized into a WP (n=19) or SP (n=22) group. The supplement provided ~22 g carbohydrate plus 21 g of either whey protein concentrate or soy isolate. All subjects participated in a supervised, whole-body non-linear periodized resistance training program for 9 months (3x/wk). Body composition was assessed every 3 months via dual x-ray energy absorptiometry (DXA).

**RESULTS:** Average daily protein intake, including the supplement, was 1.4 g/kg body weight. Despite consuming similar calories and protein during the intervention, gains in lean body mass were significantly greater in the WP (3.3 ± 1.5 kg) than the SP (1.8 ± 1.6 kg) group. There were no significant differences in body mass and fat mass responses between groups.

**CONCLUSION:** Whey protein supplementation was more effective than soy protein in promoting gains in lean body mass in response to chronic resistance training.

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**1854** Board #262 **MAY 30** **3:30 PM - 5:00 PM**

### **Effects Of Chocolate Milk And A Whey Protein Drink On Muscle Damage And Performance**

Jamie R. Fornal, Catherine G.R. Jackson, FACSM, Timothy R. Anderson, Felicia A. Greer. *California State University, Fresno, Fresno, CA.*

*(No relationships reported)*

**PURPOSE:** To compare muscle recovery effects of fat-free chocolate milk (CHOCM) and a chocolate whey protein drink mixture (CWPM) on performance and measures of muscle damage.

**METHODS:** Eight male recreational athletes (age 24 ± 4y; body mass 80.1 ± 12.5 kg; height 17.87 ± 0.66 m) completed three testing sessions after muscle damage, measured by elevated serum creatine kinase (CK) levels, was induced by a sprint protocol. On day one of each testing session, a standardized warm-up was followed by 15 X 30 meter sprints with a 10 meter deceleration zone leading to a complete stop with 60 second rest periods. CK and performance assessments [peak quadriceps isometric force (MVC), vertical jump (VJ), pro agility (PA), muscle soreness (MS), and Mental and Physical State and Trait Energy and Fatigue Scales (MPSTEFs)] were measured immediately after and at 48 and 96 hours post. Testing session 1 established baseline measures with no supplementation. In testing sessions 2 and 3, subjects received 2 cups of either CHOCM or CWPM post-exercise. Treatment beverages were isocaloric and given in a randomly counterbalanced double-blind protocol.

**RESULTS:** One-way ANOVA with repeated measures revealed no significant differences in sprint performances across tests, indicating no training effect over time (p>0.05). Individual univariate ANOVAs were used to analyze all other dependent variables. CK levels were clinically elevated (mean=517.13 U/L) above normal range (44-196 U/L) immediately following all sprint protocols indicating exercise-induced muscle damage. CK levels were highest 48 hours post (mean=603.92 U/L) and lowest 96 hours post (mean=444.61 U/L) exercise. When CK levels at 48 and 96 hours were compared, CHOCM (mean=400.94 U/L) levels were significantly lower (p<0.05) than CWPM (mean=448.93 U/L). There were no differences between CHOCM and CWPM for MVC, VJ, PA, MS, or MPSTEFs assessments (p>0.05).

**CONCLUSION:** These findings indicate that CHOCM attenuates elevated CK following exercise-induced muscle damage faster at 48 and 96 hours than CWPM. Although there were no significant differences found for performance variables, cellular level muscle recovery was enhanced. CHOCM may therefore lessen exercise-induced muscle damage if used chronically as a post-exercise drink.

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**1855** Board #263 **MAY 30** **3:30 PM - 5:00 PM**

### **Whey Protein Supplementation Exhibits Limited Additional Benefit in Older Men Undergoing Resistance Training**

Alan Hayes, Graeme J. Smith. *Victoria University, Melbourne, Australia.*

*(No relationships reported)*

The loss of muscle mass that occurs with age can be at least partially reversed by resistance training (RT). While whey protein isolate (WPI) supplementation has proven effective in augmenting the effects of RT in younger individuals, any benefit in older individuals is less established, as is any effect of WPI on the redox status of the cell in older individuals.

**PURPOSE:** To assess the effect of WPI supplementation in addition to 12 weeks RT on body composition, strength, and cellular redox status in older males.

**METHODS:** Male participants (aged >55 years, n=16) gave written, informed consent to be randomized, double-blinded, to undertake progressive overload RT (3 days/week for 12 weeks) either with (1.5 g/kg/day) or without WPI supplementation. Body composition, muscle strength and protein content, and redox status were measured before and after training. All procedures were approved by the Victoria University Human Research Ethics Committee.

**RESULTS:** No differences existed between the groups at baseline, with the exception that the group to be supplemented had a higher energy intake (2132 ± 239 vs 1728 ± 333 kcal/day, p<0.05) due to higher carbohydrate intake. As expected, 12 weeks RT significantly improved 1-repetition maximum muscle strength (129 ± 27 vs 186 ± 43 kg and 61 ± 25 vs 76 ± 22 kg in the leg press and bench press, respectively, p<0.001). Isometric and isokinetic knee extension and isokinetic knee flexion strength was similarly increased. In addition, highly significant (p<0.001) improvements in body composition (increased lean mass, decreased fat mass) were also observed. However, WPI supplementation demonstrated no incremental benefit in the above measures compared to RT alone. Total muscle protein content was not altered by RT, although there was a significant difference (p<0.05) in the change in the WPI group (+13.4 mg/g) compared to the change in the non-supplemented group (-10.9 mg/g). Plasma and tissue thiols and disulfides were unaffected by RT, nor were they changed by WPI supplementation.

**CONCLUSION:** WPI supplementation offered no incremental benefit over RT in novice older male participants in terms of body composition or muscle strength. Neither a 12-week RT program on its own, nor in combination with WPI dietary supplementation, altered the plasma or tissue redox states.

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**1856** Board #264 **MAY 30** **3:30 PM - 5:00 PM**

### **The Influence of Bovine Colostrum Combined with a Recovery Beverage During an 8-Week Resistance Training Program**

Fabrizio Gargiulo, Justin D. Roberts, Lindsay S. Kass, Michael G. Roberts. *University of Hertfordshire, Hatfield, United Kingdom.*

*(No relationships reported)*

Current research interest exists concerning the use of bovine colostrum (BC) supplementation to enhance strength and performance gains during high intensity training programmes. Furthermore, there is minimal information regarding the use of BC in combination with additional recovery formulas to enhance ergogenic benefits.

**PURPOSE:** To determine if combined supplementation of BC and a carbohydrate-protein recovery beverage (REC) enhances maximal strength performance and recovery during an 8-week resistance training programme.

**METHODS:** In a randomised, double blind, placebo controlled, repeated measures design, 24 healthy males volunteered for participation (Age: 26.8±7.4 years; Weight: 84.8±10.8 kg; Height: 179.9±4.8cm). Subjects were administered daily either 20g BC or a calorie matched placebo in the morning; additionally subjects consumed either a REC beverage or calorie matched placebo post-resistance training after each training session (3d.week-1) during the 8-week programme. Laboratory based measurements for 1-repetition maximum strength (1RM), body composition, plasma creatine kinase (CK), subjective muscle soreness (SMS) and muscular fatigue were assessed every 2 weeks.

**RESULTS:** 1RM squat strength performance improved by 35.6% in the placebo group over the 8 week programme, however, data for the BC/REC group was significantly greater in comparison (40.3%; p=0.006). 1RM bench press performance increased significantly amongst all groups across the 8 week programme (p=0.001), although no significant differences were found between groups (p=0.824). Total body composition, for both fat free mass and percentage body fat, was not

significantly altered across the 8-week programme. Additionally, CK (mean results for BC/REC; baseline - 75.5±24.8, week 8 -

82.3±54.7u.L-1) SMS and sub-maximal performance to fatigue was not found to be significantly influenced by the BC/REC supplementation intervention after 8-weeks.

**CONCLUSION:** Overall, recovery was not influenced by the supplementation intervention. It is however possible that elevated levels of insulin-like growth factors found in BC, could have influenced increases in muscle protein synthesis via mTOR pathways, resulting in increased strength performance but did not affect recovery from resistance exercise.

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## B-37 Free Communication/Poster - Resistance Exercise I

MAY 30, 2012 1:00 PM - 6:00 PM

ROOM: Exhibit Hall

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1857 Board #265 MAY 30 2:00 PM - 3:30 PM

### Differences In Electromyography Activity Of Five Lower Limb Muscles During One-legged And Two-legged Squats

John K. Petrella, FACSM, Thomas G. Broussard, Jeremy R. Towns, Robert W. Hensarling, Alan P. Jung, FACSM. *Sanford University, Birmingham, AL*

(No relationships reported)

**PURPOSE:** Neuromuscular activation of the gluteal muscle group while executing the single-leg squat has been well studied. The electrical activity of other major muscle groups of the lower leg during single-leg squats is not as well known. The purpose of this study was to examine the electrical activity of the quadriceps, hamstrings, adductors, gastrocnemius, and tibialis anterior during a single-leg and double-leg squat.

**METHODS:** Eleven male intercollegiate athletes participated in the study. Electromyography (EMG) of the quadriceps, hamstrings, adductors, gastrocnemius, and tibialis anterior were recorded during 5 repetitions of dual-legged squats and single-leg squats. Participants performed the squat in time with a metronome such that each complete squat occurred in 2 seconds resulting in total of 10 seconds of activity for each trial. For the dual-leg movement, participants were instructed to squat until the thigh was parallel to the ground and then return to a standing position. Subjects then recovered for 3-5 minutes and performed five single-legged squats. These squats were completed while standing on a 17inch high bench with the dominant leg only. Participants were instructed to lower themselves until their non-dominant leg touched the floor, then return to a standing position using only the dominant leg. This movement was repeated 5 times at a cadence of 2 seconds per single-leg squat. All EMG activity was recorded, transformed, and reported as root mean square (RMS) activity.

**RESULTS:** Mean RMS EMG activity for the hamstring (.024 mV, 121% increase,  $p<0.01$ ) and gastrocnemius (.022 mV, 108% increase,  $p<0.01$ ) was significantly higher during the single leg squat compared to the dual-leg squat. There was also a trend for greater quadriceps activation (.013 mV, 29%,  $p=0.07$ ) with the single-leg movement. No differences were detected in adductor activity (.009 mV, 25%,  $p=0.42$ ) or tibialis anterior activity (.008 mV, 6%,  $p=0.48$ ).

**CONCLUSION:** These results suggest that single-leg squats result in greater lower limb activation for the same number of repetitions. These findings may be useful for developing rehabilitation or training techniques that focus on lower limb activation.

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1858 Board #266 MAY 30 2:00 PM - 3:30 PM

### Comparison Of Unilateral Versus Bilateral Resistance Training On Absolute And Relative Strength

Kevin McCurdy<sup>1</sup>, George Langford<sup>2</sup>, Michael Doscher<sup>2</sup>, John Walker, FACSM<sup>1</sup>. <sup>1</sup>Texas State University, San Marcos, TX. <sup>2</sup>Valdosta State University, Valdosta, GA.

(No relationships reported)

**PURPOSE:** The purpose of this study was to determine whether a bilateral versus unilateral strength training program improved absolute and relative 1RM bilateral and unilateral squat performances in young adult males and females.

**METHODS:** Subjects were young adults ranging in age from 18-26. Subjects' 1RM bilateral and unilateral (each leg) squat were measured both prior to and following an 8 week resistance training program. Subjects were randomly assigned to either a bilateral or unilateral, lower-body training program utilizing the back and front squat and Romanian deadlift. The resistance training consisted of a linear periodization program with intensity increasing weekly from 60-95% while decreasing the volume.

**RESULTS:** A trial-by-gender interaction was also observed for both left- and right-leg squat, both absolute and relative to lean body mass. For left-leg squat ( $p=.002$ ), males improved from 174.7 to 220.3 lbs, while females only improved from 95.8 to 113.3 lbs. For left-leg squat strength/lbm ( $p=.01$ ), males improved from 2.55 to 3.34 lbs/lbm, while females only improved from 2.02 to 2.35 lbs/lbm. For right-leg squat ( $p=.002$ ), males improved from 174.6 to 220.4 lbs, while females only improved from 95.0 to 111.7 lbs. For right-leg squat/lbm ( $p=.01$ ), males improved from 2.55 to 3.34 lbs/lbm, while females only improved from 2.00 to 2.30 lbs/lbm. For bilateral squat, no gender difference in improvement was observed ( $p=.89$ ). Males improved from 296.8 to 331.8 lbs, while females demonstrated similar improvement, from 142.3 to 175.8 lbs. For bilateral squat/lbm, a trial-by-group interaction was observed ( $p=.004$ ). The bilateral-training group improved from 3.81 to 4.76 lbs/lbm, while the unilateral-training group only improved from 3.82 to 4.23 lbs/lbm.

**CONCLUSIONS:** These data suggest that bilateral resistance training is more effective for improving bilateral 1RM squat relative to lean body mass than unilateral resistance training; however, for unilateral 1RM squat performance, males show greater improvement than females, and bilateral training is equally effective compared to unilateral training.

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1859 Board #267 MAY 30 2:00 PM - 3:30 PM

### Progression Of Core Muscle Activation During The Performance Of Exercises With Different Types Of Stability

Julio Martin, Sebastien Borreani, Juan Carlos Colado, Joaquin Calatayud, Fernando Martin, Joao Alves. *University of Valencia, Valencia, Spain.*

(No relationships reported)

Nowadays there is a lack of knowledge about the correct progression and application of the exercises during the core training, especially if it is necessary to choose between different devices.

**PURPOSE:** To compare core muscular activity during nine exercises performed in stable and unstable conditions using Thera-Band® devices. **METHODS:** 18 physically fit and healthy male subjects took part in a randomized, within-subject design assessment. The maximum isometric voluntary contraction (MIVC) was evaluated for the purpose of normalization. Lumbar erector spinae (LES), thoracic erector spinae (TES), lumbar multifidus (LM), thoracic multifidus (TM) and gluteus maximus (GM) muscular activities were recorded, and then the average root mean square values of all of them were calculated for each condition. Surface electromyography activity was analyzed during the central 16 seconds of 20 of the 9 isometric standing postures (140° and 60° of knee and hip flexion respectively), with the arms flexed parallel to the floor and always above the Thera-Band Exercise Station. Three positions: (a) bipodal, (b) unipodal and (c) unipodal with Thera-Band elastic tubings were performed in three conditions: (a) stable, (b) Thera-Band Soft Stability and (c) Thera-Band Rocker Board.

All values were expressed as the mean of the 5 muscles regarding %MIVC, they were compared using a mixed-model MANOVA with a post-hoc analysis of Bonferroni. Significance level was set at  $p\leq 0.05$ .

**RESULTS:**

Table 1. Average muscular activation comparisons between conditions (n=18).

| Device/conditions                           | Mean    | SEM  |
|---|---------|------|
| Stable/bipodal                              | 12.48   | 0.79 |
| Soft Stability/bipodal                      | 13.08   | 0.76 |
| Rocker Board/bipodal                        | 14.02   | 0.87 |
| Stable/unipodal                             | 14.28‡  | 0.95 |
| Soft Stability/unipodal                     | 15.08‡  | 0.89 |
| Rocker Board/unipodal                       | 15.15‡  | 0.93 |
| Stable/unipodal with elastic tubing         | 21.82*  | 1.30 |
| Soft Stability/unipodal with elastic tubing | 22.78*  | 1.40 |
| Rocker Board/unipodal with elastic tubing   | 23.38*† | 1.43 |

Data is expressed as a mean (SEM) in percentage of the MIVC.  
 \* indicates significant differences (p<0.05) related to bipodal and unipodal conditions without elastic tubings.  
 † indicates significant differences (p<0.05) related to stable condition.  
 ‡ indicates significant differences (p<0.05) related to bipodal condition.

**CONCLUSION:** In the evaluated exercises, the use of elastic tubings always provokes in a statistically significant way a higher level of muscular activation in the CORE independently of the unstable device used and/or of the modification of the support.

**1860 Board #268 MAY 30 2:00 PM - 3:30 PM**  
**Electromyographic Activation Of 3 Back Muscles During Pronated, Supinated, And Behind The Neck Pull-ups**

Vincent C. Marsh, Kelly Kirby, Cameron Allmandinger, Anthony Caterisano, FACSM. *Furman University, Greenville, SC.*  
 (No relationships reported)

Hand placement during upper back exercises is often varied to target or enhance recruitment of specific muscles and or muscle groups. However, little research has been published regarding the validity of these practices and claims.

**PURPOSE:** To analyze and compare the activation of three back muscles while performing three sets of pull-ups in different variations.

**METHODS:** Eleven resistance-trained, college males performed randomized trials of three different varieties of pull-ups for five repetitions each: supinated (SP), pronated (PP), and behind the neck pull-ups (BP). Electromyography (EMG) was used through the use of silver silver chloride surface electrodes positioned on the upper trapezius (TR), upper latissimus dorsi (UL), and lower latissimus dorsi (LL). EMG data were filtered, then quantified by integration, and expressed as a percentage of the total electrical activity of the three muscles.

**RESULTS:** A mixed design analysis of variance (ANOVA) and Tukey post hoc tests indicated no significant difference between total muscle activation and pull-up orientation (p = 0.992), the muscle activation consistently remained LL (45% MVC), UL (39%), and TR (16%MVC) throughout the trials.

**CONCLUSION:** While the results suggested that the latissimus dorsi provided a greater relative contribution than the trapezius throughout the three variations of pull-ups (p< 0.05), there were no significant changes to that ratio when hand placement was altered (p=.396).

**1861 Board #269 MAY 30 2:00 PM - 3:30 PM**  
**Lumbopelvic Muscular Activation During Push-ups Performed Under Different Unstable Surfaces**

Martin Fernando, Sebastien Borreani, Joao Alves, Juan Carlos Colado, David Gramage, Julio Martin. *University of Valencia, Valencia, Spain.*  
 (No relationships reported)

Suspension devices for physical conditioning have increased the work possibilities of the professionals that use devices that generate instability. Suspension training devices seem to have the same possibilities as the rest of the unstable devices during the performance of global exercises, as for example the push-ups. However, there is no agreement in the current studies.

**PURPOSE:** To compare lumbopelvic muscular activation during push-ups performed in five different unstable conditions.

**METHODS:** 30 physically fit and healthy subjects took part in a counterbalanced, within-subject design assessment. Muscular activation was evaluated in muscles Multifidus Lumbar (MFL), Erector Espinae Thoracic (EED), External Oblicue (OE), and Rectus Femoris (RF), during execution of 5 push-ups in different stability conditions: TRX Suspension Training (TRX), Fitness Dome (FD), Thera-Band® Stability Disc (SD), Thera-Band® Wobble board (WBR) and floor (CE). Surface electromyography was recorded and then the peak root mean square values were calculated for each condition and execution. The maximum isometric voluntary contraction (MIVC) was evaluated for the purpose of normalization. All values, expressed as the %MIVC, were compared using a mixed-model MANOVA with a post-hoc analysis of Bonferroni. Significance level was set at p<0.05.

**RESULTS:** Table 1. Peak muscular activation between conditions (n= 30).

|     | OE              | MFL           | EED          | RF            |
|-----|-----------------|---------------|--------------|---------------|
| CE  | 154.16(26.59)   | 8.01(1.64)    | 79.11(26.61) | 23.17(2.36)   |
| WBR | 144.24(20.90)   | 9.78(2.73)    | 80.86(28.94) | 21.49(1.89)   |
| SD  | 212.18(36.98)†  | 8.70(1.88)    | 64.09(20.86) | 27.96(3.16)†  |
| FD  | 192.69(40.78)   | 8.64(2.28)    | 65.71(22.81) | 25.75(2.68)   |
| TRX | 331.56(40.60)†‡ | 16.76(3.37)†‡ | 58.09(11.64) | 38.80(3.41)†‡ |

\*Data is expressed as mean (standard error) regarding the % of maximum voluntary isometric contraction.  
 TRX= TRX Suspension Training; FD=Fitness Dome; SD= Stability Disc; WBR= Wobble board;  
 CE= floor.  
 OE= External Oblicue; MFL= Multifidus Lumbar; EED= Erector Espinae Thoracic; RF= Rectus Femoris.  
 † indicates significant differences (p<0.05) related to WBR.  
 ‡ indicates significant differences (p<0.05) related to CE, SD, FD.

**CONCLUSION:** Push-ups performed with TRX provoke more lumbopelvic muscular activation than employing other unstable devices and/or stable condition. There were no differences between the other conditions (unstable and stable) except in the OE and RF where the muscular activation was higher with the SD versus the WBR.



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1862 Board #270 MAY 30 2:00 PM - 3:30 PM

**Effects of Stance Width on Hip Displacement during Parallel Squat in Women**

Leeanna Woodworth, Kyra Marshall, George J. Davies, Bryan L. Riemann, *Armstrong Atlantic State University, Savannah, GA.* (Sponsor: T. Jeff Chandler, FACSM)  
(No relationships reported)

While sagittal plane kinematics and kinetics have been compared between squats of varying stance widths, limited research has considered the frontal and transverse planes.

**PURPOSE:** To examine effects of stance width on frontal and transverse plane hip kinematics, total body center of mass (COM) vertical displacement and to examine the relationships between hip kinematics and hip abductor (AB)/external rotator (ER) isometric muscle strength (IsoM).

**METHODS:** 18 healthy, physically active young women (21.6±2.6 yrs) performed 8 repetitions of squats using both neutral stance (NS) and wide stance (WS) using a load equal to each subject's 8 repetition maximum. Neutral stance was 1.5x anterior superior iliac spine (ASIS) distance and wide stance was 2.5x ASIS distance. Dominant limb frontal and transverse plane hip kinematic data was collected using an extended range electromagnetic motion analysis system (Motion Monitor, IST, Inc). Starting, peak and start to peak displacement abduction/adduction and internal/external rotation angles were computed. Dependent t-tests ( $\alpha=.05$ ) were used to compare dependent variables between NS and WS. Hip AB and ER IsoM strength was evaluated using hand held dynamometry. Pearson correlational analyses were conducted between peak/displacement angles and AB/ER IsoM strength.

**RESULTS:** COM vertical displacement was significantly ( $P<.001$ ) greater for NS. During WS, both starting ( $P<.001$ ) and peak ( $P<.001$ ) AB angles were significantly greater, however, no difference for angular displacement ( $P=.332$ ). Additionally, during WS, the hip started with significantly greater ER ( $P=.047$ ). The peak internal rotation angle ( $P<.001$ ) and displacement ( $P<.001$ ) were also significantly greater for WS. No significant correlations ( $r=.016$  to  $.183$ ) were noted between peak and displacement angles and IsoM strength.

**CONCLUSION:** Despite greater squat depth based on the COM displacement for NS, the hip joint experienced increased abduction/internal rotation during WS squats. Thus, NS squats should be considered when less abduction and internal rotation is warranted. As evidenced by no significant relationships, IsoM strength of hip AB and ER do not appear to be a contributing factor to frontal and transverse plane hip movement during squats.

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1863 Board #271 MAY 30 2:00 PM - 3:30 PM

**Isometric Rapid Torque Characteristics As Predictors Of Playing Status In Division I Collegiate Football Players**

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(No relationships reported)

**INTRODUCTION:** Rapid torque characteristics are an important measure of muscle performance and may provide a sensitive measure for talent identification in collegiate football players.

**PURPOSE:** To examine the effectiveness of maximal isometric strength and rapid torque characteristics to discriminate among football playing ability in elite Division I collegiate football players.

**METHODS:** Sixteen starters (age=20.81±1.28 yr) and 15 non-starters (20.40±1.68) volunteered to participate in the study. Participants performed two isometric maximal voluntary contractions (MVCs) with the leg flexor and extensor muscle groups with one minute of recovery between each contraction and three minutes of recovery between muscle groups. Peak torque (PT; Nm) was calculated as the highest 0.5 s epoch of the torque - time curve. Rate of torque development (RTD; N·sec<sup>-1</sup>) and contractile impulse (IM; N·m·s) were determined from the time intervals of 0-30, 0-50, 0-100, and 100-200ms of the torque - time curve. Peak rate of torque development (PRTD), time to PRTD (TTPRTD) and absolute torque (TORQUE at 30,50,100 and 200ms) were also calculated. 2-way mixed factorial ANOVAs were used to analyze all torque - time variables. Follow up analyses included independent samples t-tests and paired samples t-tests with Bonferroni-corrected post-hoc comparisons.

**RESULTS:** For the leg flexors, RTD30, IM30, IM50 and TORQUE30 were greater ( $P=0.02-0.03$ ) and TTPRTD was shorter ( $P=0.02$ ) for the starters when compared to the non-starters. There were no significant differences between starters and non-starters for maximal isometric PT, RTDpeak, and later rapid torque characteristics (>100 ms from onset of contraction) of the leg flexors and all isometric torque and torque - time variables for the leg extensors ( $P=0.06-0.33$ ). In addition, the leg extensors were greater ( $P<0.001$ ) for all torque and rapid torque variables and less for TTPRTD when compared to the leg flexors for all players.

**CONCLUSIONS:** These findings showed that early rapid torque - time variables of the leg flexor muscle group may effectively discriminate among playing ability in Division I collegiate football players. Strength coaches may consider designing strength programs aimed at maximizing early rapid muscle contraction characteristics, specifically for the leg flexors.

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1864 Board #272 MAY 30 2:00 PM - 3:30 PM

**Neuromuscular and Metabolic Responses to Power Training: Effects of Different Rest Intervals**

Saulo Martorelli<sup>1</sup>, André Martorelli<sup>1</sup>, Rafael Cunha<sup>1</sup>, Maria Cláudia Pereira<sup>1</sup>, Diego Jesus<sup>1</sup>, Valdinar Rocha Júnior<sup>2</sup>, Lee E. Brown, FACSM<sup>3</sup>, Martim Bottaro<sup>1</sup>. <sup>1</sup>University of Brasília, Brasília, Brazil. <sup>2</sup>National Academy of Police (Federal Police), Brasília, Brazil. <sup>3</sup>California State University, Fullerton, Fullerton, CA.

(No relationships reported)

The between-set rest interval (RI) is an important factor in the resistance training prescription. The American College of Sports Medicine (ACSM) recommends at least 2-3 min of RI for individuals who perform power training for core exercises. However, according to the ACSM (2009) this recommendation is based on poor scientific evidence (evidence category D).

**PURPOSE:** To compare the effects of three different RI on mean power output (PW), blood lactate concentration (BLa), and electromyography (EMG) in trained men.

**METHODS:** Fourteen healthy men (22.43 ± 3.01 years) performed six sets of six repetitions of squat exercise at 60% of 1RM on a Smith machine. Each volunteer performed three different RI protocols (1, 2 and 3 min) on three different days in counterbalanced order, separated by at least 72 h. PW was measured every set using a velocity transducer. BLa concentration and vastus medialis (VM) EMG (maximum isometric voluntary contractions) were measured before and after the 6 sets of each RI.

**RESULTS:** No significant differences were observed between RI protocols on PW. However, the 1min RI protocol showed a significant ( $p \leq 0.05$ ) reduction (9.90%; 488.05 ± 112.48 to 439.75 ± 91.60 W) in PW from 1<sup>st</sup> to 6<sup>th</sup> set. In contrast, no significant reduction was observed between the 1<sup>st</sup> and 6<sup>th</sup> sets for 2 min (0.04%; 477.83 ± 123.44 to 477.62 ± 97.60 W) or 3 min (4.32%; 488.69 ± 118.67 to 467.59 ± 98.82 W) RI protocols. BLa was significant greater ( $p \leq 0.05$ ) after 1 min (5.67 ± 1.71 mmol/L) when compared to 2 min (4.59 ± 1.51 mmol/L) and 3 min (4.00 ± 2.47 mmol/L). Only the 3 min RI presented a significant reduction in root mean square (RMS) values of the VM EMG (27.10 ± 4.06 to 21.64 ± 3.31).

**CONCLUSION:** Our data suggest that 1 min RI showed greater decline in muscular performance and greater levels of fatigue metabolic by products. Also, after 3 min, muscle activation was less at the end of the training session. In summary, if an individual wants to maintain power output with less fatigue and greater muscle activation during power training, 2 min RI should be used. These results concur with ACSM (2009) recommendations that a RI of at least 2 min should be used when young individuals are training muscle power using multi-joint exercise.

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1865 Board #273 MAY 30 2:00 PM - 3:30 PM

**The Effect of Remote Voluntary Muscle Contractions on Strength and Power Performance**

Daniel Haughney, Nabil Boutagy, Robert M. Otto, FACSM, John W. Wygand, *Adelphi University, Garden City, NY.*

(No relationships reported)

In an effort to maximize muscular performance from a specific muscle group, the simultaneous recruitment of ancillary muscle groups has been proposed. This theory of remote voluntary contractions (RVC) suggests that concurrent activation of remote muscle groups, in addition to the prime movers, may stimulate enhanced sympathetic drive in proximity to the control center of the brain and potentially improve performance. Several studies (Hiroshi, et al., Ebben et al. and Ebben) have demonstrated improvements in time to peak force and rate of force development when using jaw clenching to activate RVC.

**PURPOSE:** This study was designed to examine the effects of RVC by jaw clenching with a mouthpiece (MP) and with the jaw in a relaxed state without a mouthpiece (R-noMP) on acute muscular performance.

**METHODS:** Thirteen subjects (10 males and 3 females, age  $22.9 \pm 1.9$  yrs, ht  $174.2 \pm 9.1$  cm, body mass  $77.3 \pm 14.6$  kg) volunteered to perform a grip dynamometer test with a Jamar Grip Dynamometer (Gr), a Vertical Jump Test (VJ), a 6 repetition maximum (RM) chest press (CP) and a 6 RM leg extension (LE) on Nautilus equipment. Subjects performed familiarization trials and the MP and R-noMP trials were conducted in a random design. A paired-samples t-test ( $p < 0.05$ ) was applied to these data.

**RESULTS:** Statistical analysis revealed no significant difference between MP vs R-noMP for grip strength (35.6 vs 35.5 kg), vertical jump (40.6 vs 40.9 cm), 6 RM chest press (47.5 vs 47.4 kg) and 6RM leg extension (44.4 vs 44.1 kg), respectively.

**CONCLUSION:** The use of RVC by jaw clenching failed to amplify the outcome measures of four acute muscular strength and power measures. Therefore the use of RVC to enhance acute anaerobic performance is not supported.

**1866** Board #274 **MAY 30** **2:00 PM - 3:30 PM**

### Upper Extremity And Core Muscle Activation During An Aquatic Resistance Exercise Performed At Different Depths

Sebastien Borreani, Juan Carlos Colado, Josep Furio, Fernando Martin, Juan Benavent, Joaquin Madera. *University of Valencia, Valencia, Spain.*

(No relationships reported)

It is positive to train the strength of the limb and core to improve the physical performance. The aquatic medium has been shown as an efficient tool, however nowadays there is a lack of knowledge about the influence of the level of immersion on muscle activation.

**PURPOSE:** To compare upper extremity and core muscle activation during a shoulder extension performed at maximal velocity at different depths (xiphoid vs clavicle). **METHODS:** 24 physically fit and healthy subjects took part in a counterbalanced, within-subject design assessment. Maximum isometric voluntary contraction (MIVC) was evaluated for the normalization. Agonist: latissimus dorsi (LD); and core: rectus abdominis (RA) and lumbar erector spinae (LES) muscular activities were recorded, and then the peak root mean square values of all of them were calculated for each condition. Surface electromyography was isolated and the activity was analyzed during the shoulder extension of 3 repetitions performed with an aquatic device that increases drag force moved at maximal velocity. All values, expressed as the %MIVC, were compared using a mixed-model MANOVA with a post-hoc analysis of Bonferroni. Significance level was set at  $p \leq 0.05$ .

#### RESULTS:

|                | LD           | RA            | LES         |
|----------------|--------------|---------------|-------------|
| Xiphoid depth  | 73.0 (10.3)* | 114.9 (30.3)* | 36.0 (12.1) |
| Clavicle depth | 61.9 (9.9)*  | 92.8 (27.3)*  | 41.5 (11.6) |

Data is expressed as a mean (SEM).  
\* indicates significant differences between conditions ( $p \leq 0.05$ )  
LD= Latissimus Dorsi, RA=Rectus abdominis, LES=Lumbar Erector Spinae

**CONCLUSION:** Xiphoid depth condition generates significantly a higher LD and RA activation than clavicle depth. This shows that a lower level of immersion provokes a higher muscular activation because the body stability is increased during the performance of the movement. However, this fact is not relevant for the LES due to the direction of the movement of the upper extremity. These results are similar to previous studies in dry land. Consequently, monitoring the level of immersion is very important during the aquatic resistance exercises.

**1867** Board #275 **MAY 30** **2:00 PM - 3:30 PM**

### Effects of Squat Flywheel Training on Strength, Muscle Structure and Performance.

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(No relationships reported)

**PURPOSE:** Inertial flywheel device (YoYo Technology) is well known to induce strength adaptations and increase muscle mass after short term training. (Norrbrand 2011, Tesch 2004). Changes in muscle architectural parameters appropriate to improve peak torque has been described (Seynnes, 2007). However these adaptations were not directly related to specific performances like jump, velocity and change direction ability. Aim of the study is to evaluate quadriceps strength and architecture, lower limb fat free mass, and performance parameters after short term YoYo squat training.

**METHODS:** 31 healthy young males has been randomly assigned at training (TR) or control (CON) group. TR underwent 16 training sessions in 9 weeks each consisting in 60 maximal reps at YoYo squat. Maximal Voluntary Contraction (MVC), Fat Free Mass (FFM), Fascicle length and thickness, Squat Jump (SJ) and Countermovement Jump (CMJ) Height and time on 30m dash and 20m shuttle have been measured pre and post training. Analysis of covariate has been done after log transformation.

**RESULTS:** Compare to CON, TR showed higher MVC isometric (avg 25%, CI 95 13% to 38%), concentric (10%, 2% to 19%), eccentric (9%, 2% to 17%) extension (for each parameters,  $p < 0.01$ ). In TR, FFM (4%, 1% to 7%), fascicle length (8%, 1% to 16%), fascicle thickness (6%, 1% to 15%) increased compare to CON ( $p < 0.01$ ). SJ (9%, 2% to 16%), CMJ (8%, 1% to 14%), 20m shuttle (-4%, -7% to -1%) significantly improve ( $p < 0.05$ ) in TR compare to CON. 30m dash did not improve significantly compare to CON (-1%, -4% to 2%,  $p = 0.445$ ), indicating that 20m shuttle performance is specially due by an augmented control of decreasing and increasing speed.

**CONCLUSION:** Augmented strength and changed muscle structure are in agreement with previous study. Longer fascicle is correlated with higher velocity of sarcomere contraction (Blazevich 2006). Outcomes show positive transfers in sport performance tasks, like jumping or braking and change sprinting direction. Flywheel device can be successfully used to improve performance in sport in which jumping or speed are key factors.

Blazevich A.J., et al. *J Anat* 2006, 209:289-310

Norrbrand L, et al. *Aviat Space and Environ Med* 2011, 82(1):13-9.

Seynnes OR, et al. *J. Appl Physiol* 2007, 102(1):368-73.

Tesch PA, et al. *Acta Physiol Scand* 2004, 180(1):89-98.

**1868** Board #276 **MAY 30** **2:00 PM - 3:30 PM**

### Effect of Exercise with Blood Flow Restriction Depends on Total Work Regardless of Mechanical Intensity

Shingo Takada<sup>1</sup>, Koichi Okita<sup>2</sup>, Masashi Omokawa<sup>2</sup>, Tadashi Suga<sup>1</sup>, Noriteru Morita<sup>3</sup>, Masahiro Horiuchi<sup>4</sup>, Tomoyasu Kadoguchi<sup>1</sup>, Takashi Sato<sup>2</sup>, Masashige Takahashi<sup>1</sup>, Arata Fukushima<sup>1</sup>, Tsuneaki Homma<sup>1</sup>, Yoshihiro Masaki<sup>1</sup>, Shintaro Kinugawa<sup>1</sup>, Hiroyuki Tsutsui<sup>1</sup>. <sup>1</sup>Hokkaido University Graduate School of Medicine, Sapporo, Japan. <sup>2</sup>Hokusho University, Ebetsu, Japan. <sup>3</sup>Hokkaido University of Education, Iwamizawa, Japan. <sup>4</sup>Northern Regions Lifelong Sports Research Center (SPOR), Ebetsu, Japan.

(No relationships reported)

**BACKGROUND:** Resistance exercise with blood flow restriction (BFR) is a new training method providing significant training effects despite the use of low-intensity mechanical loads. We previously demonstrated that BFR remarkably enhances muscular metabolic stress in resistance exercise (*J Appl Physiol* 2009) and that the metabolic stress was effectively enhanced by increasing mechanical intensity but not BFR pressure (*J Appl Physiol* 2010). However, because of blocking the metabolic recovery by BFR, it is possible that even with low intensity, metabolic stress might gradually increase with respect to increased repetitions and reach sufficient level.

**PURPOSE:** Therefore, we compared muscular metabolic stress during multiple intensity resistance exercise with BFR adjusted by totally the same work volume (load  $\times$  repetitions).

**METHODS:** Twenty-six young subjects (male/female, 13/13,  $21 \pm 1$  yrs, means  $\pm$  SE) were recruited and performed unilateral plantar-flexion at 30 repetitions/min in a whole body magnetic resonance system. The exercise protocols were as follows: (A) exercise with 10% of one repetition maximum (1-RM) for 6 min, (B) 15% 1-RM for 4 min, (C) 20% 1-RM for 3 min, (D) 30%

1-RM for 2 min, and (E) 40% 1-RM for 1.5 min. All protocols were same in total work volume (load × repetitions=1800). Muscular metabolic stress in the calf muscle, defined as phosphocreatine and intramuscular pH decrease were evaluated by using 31P-magnetic resonance spectroscopy.

**RESULTS:** Phosphocreatine depletion (A: 15.6±0.7, B: 14.8±0.8, C: 15.2±0.6, D: 14.3±0.6, E: 10.9±0.5 mM, ns) and intramuscular pH decrease (A: 6.82±0.02, B: 6.84±0.01, C: 6.83±0.02, D: 6.83±0.02, E: 6.77±0.02, ns) at the end of each exercise protocol were statistically similar.

**CONCLUSIONS:** If the total exercise volume calculated as a product of mechanical load multiplied by repetitions were equal, metabolic stress in exercising muscle might achieve the similar level at the end of exercise with BFR and could provide similar training effects.

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**1869** Board #277 **MAY 30** **2:00 PM - 3:30 PM**

### Optimizing Resistance During Multiple-set Weight Training to Increase Training Volume in Women

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(No relationships reported)

We previously reported that a greater training volume is attained using descending resistance (DR) method than using a constant resistance (CR) method in men.

**PURPOSE:** When a resistance-trained person performs multiple sets with short or incomplete rest periods between sets, the resistance must be reduced to maintain the same number of reps until fatigue or, the number of reps will be reduced if the same resistance is used. There is no benchmark method for optimizing resistance to maximize training volume in women when training with multiple sets with short rest periods. In this study we hypothesized that a greater training volume (sets × reps × resistance) would be produced using a training protocol where resistance is decreased with each training set (DR) based on the subject's fatigue ratio (using an individualized regression equation) vs. during a training protocol where subjects use a constant resistance (CR), and the number of repetitions declines with each set in women.

**METHODS:** Ten female subjects (mean±SD, age = 26±6 yr, height = 164±7 cm, body mass = 59±7 kg, weight training experience = 6±2 yr) completed 4 sets of 65% 1RM leg press, 75% 1RM bench press and 85% 1RM seated row exercise to failure, with 30 second (for 65%), 90 second (for 75%) and 180 second (for 85%) rest intervals. Data were analyzed using paired sample t-tests.

**RESULTS:** There was a greater training volume ( $p < 0.01$ ) when subjects exercised with decreased load sets compared to training with same load sets at all three exercises (table 1).

**CONCLUSIONS:** In women as previously shown in men, a greater training volume is also attained using this DR method based on subject's fatigue ratio than when using a CR training method suggesting this may be a more effective training method.

Table 1. Training volumes (kg, sets × reps × resistance) completed during 4 set exercises.

| Training Method | 65% Leg Press | 75% Bench Press | 85% Seated Row |
|-----------------|---------------|-----------------|----------------|
| CR              | 11908 ± 1452  | 1330 ± 365      | 400 ± 79       |
| DR              | 13754 ± 1403  | 1621 ± 376      | 472 ± 50       |
| Significant     | < 0.01        | < 0.01          | < 0.01         |

**1870** Board #278 **MAY 30** **2:00 PM - 3:30 PM**

### The Influence of Body Weight and Strength Fitness Status on Markers of Cardiometabolic Health

Mary M. Lee, Christopher S. Oh, Michael Katirae, Christian K. Roberts, FACSM. UCLA, Los Angeles, CA.

(No relationships reported)

**PURPOSE:** We have previously demonstrated that overweight untrained (OU), overweight trained (OT) and lean trained (LT) young men with differing muscle strength levels exhibit differences in body composition and indices of vascular health, independent of body weight. We examined the influence of body weight vs. training status on blood markers of cardiometabolic health including blood lipids, steroid hormones, inflammation and adipokines in this cohort.

**METHODS:** 90 young adult males were categorized into 3 groups: OU (n=30, BMI 30.8±2.1 kg/m<sup>2</sup>), OT (n=30, BMI 29.2±2.2, ≥4 d/wk resistance training (RT)) and LT (n=30, BMI 23.7±1.4, ≥4 d/wk RT). Subjects were assessed for serum glucose, lipids (including total-cholesterol, LDL, HDL, TG, oxLDL), hormones (testosterone, SHBG, free androgen index (FAI), cortisol), inflammation (CRP, TNF-α, IL-8, MCP-1), and adipokines (amylin, leptin, adiponectin).

**RESULTS:** BMI and body weight were similar in OT and OU and both higher than LT (all  $P < 0.0001$ ). Fasting glucose was lowest in LT and significantly different from OU and OT (all  $P < 0.007$ ). LT and OT exhibited higher HDL, lower TG, and lower oxLDL than OU (all  $P < 0.001$ ). LDL was significantly lower in LT vs. OU and OT showed a trend of lower LDL ( $P = 0.08$ ) vs. OU. Similarly, both trained groups had elevated SHBG (OT: 30.0±13.5, LT: 35.0±10.8 nmol/L) and lower FAI (OT: 71.2±29.0, LT: 64.2±20.0) compared to OU (15.6±5.6 nmol/L; 116.0±45.6) (all  $P < 0.0001$ ). Testosterone was highest in LT (622.8±194.9 ng/dL) and significantly different from OU (476.6±112.6,  $P < 0.002$ ) while values for OT (544.1±160.6) were nominally higher than OU ( $P < 0.09$ ). CRP (OT: 1.3±2.8, LT: 1.3±3.7 mg/L) was lower in the trained groups compared to OU (2.5±3.5, all  $P < 0.02$ ), while IL-8 was lower in LT (65.1±82.4 pg/mL) but not OT (49.3±46.3) compared to OU (67.7±173.7,  $P = 0.02$ ). Additionally, amylin (23.3±13.4 pM) and leptin (766.5±731.9 pM) were significantly higher in OU compared to OT (13.4±8.6; 311.0±406.1) and LT (9.7±3.4; 90.3±91.0, all  $P < 0.004$ ), while adiponectin was significantly lower in OU (3.2±1.4 ng/mL) compared to OT (5.7±3.4) and LT (6.0±3.3, all  $P < 0.003$ ).

**CONCLUSION:** These results provide further evidence that fitness, in this study as assessed by muscular strength, is a better predictor of metabolic health compared with body weight *per se* in young men.

**1871** Board #279 **MAY 30** **2:00 PM - 3:30 PM**

### Acute Effects Of Lower Body Aerobic Exercise On Lower And Upper Body Resistance Exercise Workouts

Jeremy G. Tan, Jared W. Coburn, FACSM, Daniel A. Judelson, FACSM, Lee E. Brown, FACSM, Bryan Barsaga, Joseph R. Morales, Andrea M. Du Bois, Garrett C. Nelson, Vanessa L. Cazas, Leah Truong. California State University Fullerton, Fullerton, CA.

(No relationships reported)

**PURPOSE:** It's been suggested that performance of an acute lower body aerobic exercise bout negatively affects a subsequent lower body resistance exercise workout. The effects of lower body aerobic activity on an upper body resistance exercise workouts is unknown. Therefore, the purpose of this study was to compare lower and upper body resistance exercise workout responses following acute bouts of lower body aerobic exercise on an elliptical machine.

**METHODS:** Twelve men (mean ± SD age = 24.1 ± 2.3 y, height = 180.8 ± 6.9 cm, body mass = 91.9 ± 16.4 kg) volunteered for this study and completed four trials in random order. Two trials consisted of thirty minutes on the elliptical machine at 70% of age-predicted maximum heart rate prior to either a back squat (ES) or bench press (EB) workout, consisting of three sets to failure performed at 75% 1RM. The other two trials consisted of only the back squat (SO) or bench press (BO) resistance workouts.

**RESULTS:** The results indicated that an acute bout of aerobic exercise on an elliptical machine significantly reduced the number of repetitions completed for the back squat (ES = 24.8 ± 5.0 repetitions; SO = 28.5 ± 5.1 repetitions), but not bench press (EB = 25.6 ± 5.2 repetitions, BO = 26.0 ± 6.3 repetitions) exercise.

**CONCLUSIONS:** The performance of an acute bout of lower body aerobic exercise reduces the number of repetitions completed during a subsequent lower body, but not upper body, resistance training workout. These results suggest that in order to optimize the quality of a resistance training workout, the workout should not be preceded by an aerobic exercise bout using the same muscle groups.

1872 Board #280 MAY 30 2:00 PM - 3:30 PM

**The Effects of Load on Lower-Body Joint Power Output during Jump Squats**

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(No relationships reported)

Previous researchers have investigated the loads that maximize power output of the system ( $PO_{system}$ ) during jump squats (JS). However, it is unclear how different loads affect the power output at the lower-body joints ( $PO_{joint}$ ) during JS.

**PURPOSE:** The purpose of this study was to investigate the effects of different loads on  $PO_{system}$  and lower-body  $PO_{joint}$  during JS.

**METHODS:** Twelve men ( $21.2 \pm 2.7$  yr;  $1.83 \pm 0.06$  m;  $97.7 \pm 12.5$  kg; back squat 1RM:  $181.8 \pm 40.4$  kg) performed JS under seven different loading conditions: 0, 12, 27, 42, 56, 71, 85% of maximal dynamic strength (MDS). The order of the loads was counterbalanced and the loads were achieved by having the subjects jump with a plastic bar (0% MDS) or a loaded barbell held on the shoulders. JS were performed on two force platforms synchronized with a 3D motion analysis system, both sampling at 200 Hz. Instantaneous  $PO_{system}$  was calculated as the product of the vertical component of the ground reaction force and the vertical velocity of the bar during its ascent. Instantaneous  $PO_{joint}$  was calculated as the product of the joint moment and joint angular velocity during bar ascent for the hip, knee and ankle joints in the sagittal plane. Both  $PO_{system}$  and  $PO_{joint}$  were averaged during bar ascent to provide average power output. The data were analyzed using a one-way ANOVA with repeated measures.

**RESULTS:**  $PO_{system}$  was maximized at 0% MDS ( $p < 0.001$ ) with polynomial contrasts showing a significant linear trend ( $p < 0.001$ ) caused by  $PO_{system}$  decreasing as the load increased. Similar findings were found for the knee and ankle power output, with  $PO_{joint}$  being maximized at 0% MDS ( $p < 0.001$ ) and decreasing with increasing load producing a significant linear trend ( $p < 0.001$ ).  $PO_{joint}$  at the hip was maximized at 42% MDS ( $p = 0.016$ ), producing a significant quadratic trend ( $p = 0.030$ ).

**CONCLUSIONS:**  $PO_{system}$  during JS reflects the  $PO_{joint}$  at both the knee and ankle joints, being maximized with loads equivalent to 0% MDS and decreasing with increasing load. However,  $PO_{joint}$  at the hip does not correspond to  $PO_{system}$  during loaded JS. Practitioners may need to vary the loads used during phases of resistance training that focus on power output to ensure that  $PO_{joint}$  is maximized at the lower-body joints.

1873 Board #281 MAY 30 2:00 PM - 3:30 PM

**Effects Of Resistance Training With Maximal Voluntary Co-contraction On Neuromuscular Function**

Sumiaki Maeo, Yasuhide Yoshitake, Yohei Takai, Tetsuo Fukunaga, Hiroaki Kanehisa. *National Institute of Fitness and Sports in Kanoya, Kanoya, Japan.*  
(No relationships reported)

Simultaneous contractions of antagonistic muscles (co-contraction) produce resistive force which acts against each other. We hypothesized that a training mode with maximal voluntary co-contraction would be a novel form for improving the strength capability of the muscles within antagonistic pairs without any apparatuses or external loads.

**PURPOSE:** The present study aimed to examine neuromuscular adaptations following maximal voluntary co-contraction training.

**METHODS:** Sixteen healthy young men (training group: TG,  $n = 9$ ; control group: CG,  $n = 7$ ) participated in this study. TG performed a 12-wk training program (3 days / week) for elbow flexors (EF) and extensors (EE), which consisted of a 4-s maximal co-contraction of EF and EE at 90 degrees of the elbow joint, followed by a 4-s muscle relaxation (10 repetitions / set, 5 sets / day). The torque during isometric maximal voluntary contraction (MVC) of each of EF and EE, the electromyogram (EMG) activities of EF and EE during MVC and maximal co-contraction, and the muscle thickness of the EF and EE (by ultrasound) were determined before (Pre), at the ends of 4 weeks (4-wk), and at the end of 12 weeks (12-wk) of the intervention.

**RESULTS:** The EMG activities of EF and EE during maximal co-contraction, expressed relative to those during the MVC of the corresponding muscle group, were 43% and 60%, respectively, and were unchanged through the intervention period. CG did not show any significant changes in all measured variables. For TG, MVC torque was significantly increased in both EF (+12.5% at 4-wk,  $P < 0.01$ , +15.4% at 12-wk,  $P < 0.01$ ) and EE (+27.4% at 4-wk,  $P < 0.01$ , +46.0% at 12-wk,  $P < 0.001$ ) as compared to Pre. Muscle thickness for TG was also significantly increased in both EF (+1.2 mm,  $P < 0.001$ ) and EE (+1.2 mm,  $P < 0.001$ ) at 12-wk compared to Pre. In addition, TG showed significant gains in agonist EMG activities during MVC in both EF (+31.1% at 4-wk,  $P < 0.05$ , +44.0% at 12-wk,  $P < 0.01$ ) and EE (+27.3% at 4-wk,  $P < 0.01$ , +39.8% at 12-wk,  $P < 0.01$ ), without change in antagonist involuntary coactivation level in each of the two muscle groups.

**CONCLUSION:** Maximal voluntary co-contraction can be a resistance modality which increases the strength capability of both of the antagonistic muscles, without any increases in involuntary coactivation level during MVC. No funding was granted for this study.

1874 Board #282 MAY 30 2:00 PM - 3:30 PM

**Blood Flow Restriction Enhances Oxidant Stress and Anti-oxidant Capacity during Aerobic Exercise in Healthy Subjects**

Toshiaki Nakajima<sup>1</sup>, Miwa Kurano<sup>1</sup>, Haruhito Takano<sup>1</sup>, Tomohiro Yasuda<sup>1</sup>, Nami Takano<sup>1</sup>, Haruko Iida<sup>1</sup>, Taira Fukuda<sup>1</sup>, Kazuya Fukumura<sup>1</sup>, Yoshiaki Sato<sup>2</sup>, Toshihiro Morita<sup>1</sup>, Tatsuya Yamasoba<sup>1</sup>. <sup>1</sup>University of Tokyo, Tokyo, Japan. <sup>2</sup>Kaatsu International University, Rajagiriya, Sri Lanka.  
(No relationships reported)

**PURPOSE:** Moderate intensity-exercise induces transient oxidant stress, and stimulates redox-sensitive signals, and then increases antioxidant defense system. However, extremely heavy exercise induces excessive oxidant stress, resulting in tissue injury. Aerobic interval training (AIT) and low-load resistance exercise with blood flow restriction (BFR), named as Kaatsu training, are promising methods for promoting aerobic power and increasing muscle mass, respectively. In addition, low-intensity aerobic exercise (AE) such as walking under BFR, enhance muscle strength and muscle size. We examined the effect of BFR on markers of oxidant stress during aerobic exercises in healthy subjects, and compared it with AIT.

**METHODS:** Six male healthy subjects ( $25 \pm 3$  years old) performed three types of ergometer exercise. 1) AIT (work load at 60% of  $VO_{2peak}$  10 min, and 4 sets at 80% 4 min and 60% 3 min), 2) Moderate continuous training (MCT, work load at 40% of  $VO_{2peak}$  40 min), 3) AE-BFR (work load at 40% of  $VO_{2peak}$  20 min) under BFR of 220-250 mmHg. Plasma level of derivatives of reactive oxidative metabolites (DROM), an index of oxidative stress, and BAP, an index of anti-oxidant capacity, were measured before, immediately, and after exercise.

**RESULTS:** The mean maximal HR reached to 156/min (AIT), 100 (MCT) and 110 (AE-KAATSU). The mean Borg scale reached to 16 (AIT and AE-KAATSU) and 11 (MCT). Both AIT and AE-KAATSU significantly increased dROMs (AIT;  $273.8 \pm 22.4$  CARR units (pre) to  $299.3 \pm 18.2$  (peak exercise,  $P < 0.05$ ); AE-KAATSU ( $276.3 \pm 14.3$  (pre) to  $300.5 \pm 6.9$  (peak exercise,  $P < 0.05$ ), while MCT did not change dROMs significantly. Both AIT and AE-KAATSU also significantly increased BAP (AIT;  $1900 \pm 123$  ( $\mu$ M/l) (pre) to  $2175 \pm 100$  (peak exercise,  $P < 0.05$ ); AE-KAATSU;  $1870 \pm 65.8$  (pre) to  $2153.8 \pm 142.0$  (peak exercise,  $P < 0.05$ )). However, MCT did not change it significantly.

**CONCLUSIONS:** The present study shows that BFR enhances oxidant stress and anti-oxidant capacity during low-intensity aerobic exercise as AIT. The transient nature of oxidant stress may contribute to stimulate antioxidant defense system, and subsequently promote the health. But, to avoid the excessive oxidant stress, the use of low level of BFR may be safe at the start of training, especially in older subjects and patients with high-oxidant stress.

1875 Board #283 MAY 30 2:00 PM - 3:30 PM

**Characterization Of The Electromyographic Activity Of Ten Muscles Participants In Four Different Pullover Exercises.**

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(No relationships reported)

**PURPOSE:** Pullover exercises are common in athletes' training routines. There is a great uncertainty about the pattern of muscle activity when performing different types of exercise. The purpose of this study was to quantify and compare the activity of ten muscles in four pullover exercises (PEX).

**METHODS:** 15 healthy men with at least two years of experience in resistance training, executed in a random order, 6 repetitions with 60% of 1RM, for 4 different PEX: lying down on a step with a bar and grip 100% biacromial (bial), lying on a step with a bar and grip 150% bial, lying on a fitball and grip 100% bial and lying on a step with a cable, grip 100% bial. Surface EMG was recorded from the anterior deltoid (AD), clavicular (PC) and sternal (PE) portions of the pectoralis major, serratus anterior (SA), rectus abdominis (RA), internal oblique and transverse abdominal (IO/T), posterior deltoid (PD), infraspinatus (IF), long head of triceps brachii (TB) and latissimus dorsi (LD). EMG normalization was performed for each muscle using the EMG of

the maximum voluntary isometric contraction MVC. (MVIC). The data normality was tested through the Shapiro-Wilk test. The normalized mean values of EMG, during the each exercise, were compared between muscles on each exercise and between exercises, using Anova for repeated measures. The significance level was set at  $p < 0.05$ .

**RESULTS:** EMG activity was very similar among the 3 bar exercises. For those exercises, AD(33-36% MVC), SA(36-39% MVC) and RA(35-42% MVC) muscles registered significant less activation than the other muscles. Most requested muscles were IF(51-53% MVC) and PD(49-51% MVC). For the cable exercise, PC(47% MVC) and PD(49% MVC) were the muscles that registered less activation. The most requested muscles were IF(60% MVC) and TB(63% MVC). When comparing muscles between bar and cable exercises, AD(33-36% vs 57% MVC), PE(43-47% vs 52% MVC), SA(36-39% vs 57% MVC), RA(35-42% vs 53% MVC), PO/T(45-47% vs 57% MVC), IF(51-53% vs 60% MVC), TB(46-47% vs 63% MVC) and LD(44-46% vs 55% MVC) muscles registered significant superior activation in the cable exercise. For PC(46-49% vs 47% MVC) and PD(49-51% vs 49% MVC) muscles, there were no significant differences. **Conclusion:** Pullover with cable stimulates higher muscle activation, compared to other types of pullover, for 60% MVIC of 1RM.

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1876 Board #284 MAY 30 2:00 PM - 3:30 PM

**Varying Muscle-Specific Exercise Between Consecutive Training Sessions does not Diminish the Repeated Bout Effect**

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(No relationships reported)

Repeated high-intensity contractions produce significant myofiber damage leading to a period of decreased force production, soreness, and edema. However, the repeated bout effect (RBE) indicates that if the same exercise is repeated within six months, the magnitude of muscle damage is attenuated compared to that ensuing the initial exercise bout. Myofiber damage has been previously considered a key stimulus for muscle hypertrophy. However, it has been recently shown that muscle growth may manifest independent of myofiber damage. Thus, invoking the RBE may be advantageous to minimize undue fatigue during muscle hypertrophy training. However, it remains undetermined if varying muscle-specific exercise selection between consecutive training bouts diminishes the RBE.

**PURPOSE:** To determine if muscle-specific exercise variation between successive training sessions alters the magnitude of the RBE.

**METHODS:** Twenty healthy, untrained males (age=21 ± 2 yrs) were assigned to one of two groups: 1) two sessions of dumbbell incline curls (DIC, n=10) or 2) one session of dumbbell incline curls and one session of dumbbell preacher curls (DIC/DPC, n=10). The two training sessions for each group were separated by seven days. Both groups performed 5 sets of 6 repetitions of each exercise at ~50% of maximal isometric elbow flexor strength in both training sessions. Muscle damage indices, which included range of motion (ROM), muscle soreness, maximal voluntary isometric contraction (MVIC), and serum creatine kinase (CK) and lactate dehydrogenase (LDH), were measured at pre, and immediate post (IP), 24, 48, 72, and 96 hours after each training session.

**RESULTS:** Following the first session, ROM decreased and muscle soreness increased significantly up to 72 hours, while MVIC significantly declined by 15% IP. Serum CK was significantly elevated by 28% 48 hours post while LDH increased IP. There were no significant differences in these responses between groups. After the second session, both groups demonstrated similar damage responses (RBE) with MVIC declining only 7.5% IP.

**CONCLUSION:** Variation of muscle-specific exercise between consecutive training sessions does not alter the magnitude of the RBE. Further research is necessary to determine chronic adaptations to training implementing varied or repeated exercise selection.

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1877 Board #285 MAY 30 2:00 PM - 3:30 PM

**Influence Of Rest Intervals On Knee Extension Flexibility And Mechanical Properties**

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(No relationships reported)

**PURPOSE:** It is common in stretching and flexibility training the use of a certain number of repetitions to induce flexibility gains. However, there are different recommendations for number of repetitions and it has never been tested the influence of rest intervals in the range of motion and acute mechanical adaptations. The aim of the present study was to understand the acute effect of rest intervals in flexibility and mechanical behavior of passive knee extension (PKE).

**METHODS:** A PKE protocol (velocity of 2°/s, and 90 seconds in the static phase) was applied in asymptomatic adults (n=22; 21.8±2.9 years, 73.9±8.9 kg 1.75±0.07 meters) in two randomized experimental conditions: a maximum number of repetitions (rep) with no rest intervals (NRI) and five repetitions with 15 seconds rest interval (RI). Knee passive range of motion (ROM) and torque (PT), semitendinosus and vastus lateralis electromyographic surface activity (EMG), and stretching perceptual intensity (SPI) at maximum knee range of motion (using a Visual Analog Scale) were assessed during the protocols. Subjects were instructed to produce maximum range of motion without feeling pain or discomfort in all repetitions. Data was processed in MatLab® routines and statistically analyzed with a p-value set at 0.05.

**RESULTS:** No differences were found between the first repetition of the RI and NRI protocols in knee 'PT-ROM' in different angles, as well as in SPI at maximum ROM. In all repetitions EMG stayed lower than 3% of MVC. In NRI condition, subjects ranged in the number of maximum REP from 2 to 5 (2, n=4; 3, n=9; 4, n=8; 5, n=1). Subjects obtained a higher end ROM in NRI compared to RI condition, having a superior relative ROM increase in the NRI second rep compared to the RI fifth rep (112.8% vs. 110.4%). Viscoelastic stress relaxation amplitude tended to be lower over the repetitions and was statistically different between the first and last rep in NRI condition, but in RI condition was only different between the first and second rep. All previous results were statistically significant ( $p < 0.05$ ).

**CONCLUSION:** Rest intervals between repetitions influences considerably range of motion and joint mechanical parameters. The use of rest intervals should be questioned in flexibility programs when the goal is to increase flexibility by manipulating intensity.

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1878 Board #286 MAY 30 2:00 PM - 3:30 PM

**Power Output of the Clean Complex**

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(No relationships reported)

It has been well established that in-season training is crucial for the maintenance of power and strength throughout a college football season. Strength and conditioning coaches typically prescribe variations of Olympic weightlifting exercises, such as the clean complex, to develop and maintain power. However, due to the physical toll of collisions in practice and games, the selection of in-season resistance training exercises that maintain explosiveness while minimizing additional orthopedic stress can be very challenging.

**PURPOSE:** To determine differences in power output of the clean complex.

**METHODS:** A total of 8 NCAA Division I collegiate football players were recruited for this study. A Tendo Weightlifting Analyzer unit was used to measure the average power generated during the power clean (PC), hang clean (HC), clean pull (CP) and hang clean pull (HCP) exercises. Load assignments for all varieties of the clean complex were based on each participant's 1-repetition maximum (1RM) PC. After completing a 5-minute dynamic warm-up, participants performed a warm-up set at 50% of 1RM on the PC. The barbell was then loaded to 75% of 1RM, the Tendo unit was attached to the barbell, and the PC was performed for 3 repetitions with the average power in watts (W) for each repetition recorded for data analysis. After a 3-minute rest period, the above procedure was performed for the HC, CP, and HCP. For the CP and HCP, 3 repetitions at 85% of 1RM were performed to adjust for the lack of the catch phase.

**RESULTS:** Repeated measures ANOVA indicated no significant difference in power output between PC, HP, CP and HCP (1814, 1766, 1831, 1831 W, respectively;  $F = .402$ ,  $p = .753$ ).

**CONCLUSIONS:** No one exercise of the clean complex variations resulted in significantly greater power output. As such, exercises that produce less orthopedic stress on wrists, elbows, and shoulders such as the CP or HCP, may be beneficial to an athlete during in-season workouts.

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1879 Board #287 MAY 30 2:00 PM - 3:30 PM

**The Acute Effect of Isometric Maximal Voluntary Contractions on Sprint and Jump Performance**

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(No relationships reported)

Post-activation potentiation (PAP) is a phenomenon in which contractile performance improves following a conditioning stimulus. Maximal voluntary contractions (MVC) can be used as a conditioning stimulus to elicit PAP, which may increase speed of contraction. This phenomenon may result in increased power performance.

**PURPOSE:** To examine the effect of a maximal effort isometric dead-lift exercise on vertical jump and 40 yard dash performance.

**METHODS:** Ten male collegiate varsity track athletes participated as subjects. A randomized crossover design was used where each subject served as his own control. The treatment consisted of a standardized warm-up followed by three, 3 second MVC of static dead lifts separated by one minute of rest. The control condition performed the warm-up but not the MVC's. The dependent measures were two vertical jump height trials separated by 30 seconds and two 40 yard dash times separated by 1 minute.

**RESULTS:** The control group 40 yard dash time decreased .41% from attempt 1 to attempt 2 (5.152 +0.197 to 5.131 +0.173 seconds) while the treatment group decreased run time by .73% (5.189 +0.197 to 5.151 +0.179 seconds). The main effect for this result approached significance ( $p = .052$ ) however the interaction between groups was not significantly different ( $p = .54$ ) suggesting that the result was not due to the treatment. The control group vertical jump height increased 1.98% from attempt 1 to attempt 2 (64.07 +5.17 to 65.34 +5.17 cm) while the treatment group decreased jump height by .29% (64.96+5.12 to 64.77+5.13). The main effect for this result approached significance ( $p = .10$ ). The interaction between the groups was significant ( $p = .02$ ) suggesting that there was a significant increase in jump height for the control group compared to the treatment group.

**CONCLUSIONS:** The main trend identified in this data is an increase in performance for second attempts compared to first attempts for all 40 yard dash times and for the control condition in the vertical jump height. It may be that the first attempt for vertical jump and 40 yard dash time in the control condition acted as a conditioning stimulus to improve performance. The MVC's treatment may have had a dampening effect on both run and jump performance, therefore isometric exercise should not be used prior to performance in this population.

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**B-38 Free Communication/Poster - Sport Performance**

MAY 30, 2012 1:00 PM - 6:00 PM

ROOM: Exhibit Hall

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1880 Board #288 MAY 30 2:00 PM - 3:30 PM

**Metabolic & Psychological Adaptations In Jamaican Athletes**

Tanielle Beckford<sup>1</sup>, Kerith Golden<sup>1</sup>, Melanie Poudevigne, FACSM<sup>2</sup>, Rachael Irving<sup>1</sup>. <sup>1</sup>*University of West Indies, Kingston, Jamaica.* <sup>2</sup>*Clayton State University, Morrow, GA.*  
(No relationships reported)

The systematic culture of Jamaica's approach to athletics has led to the "Jamaican sprinting phenomenon". Hence an exploration of the physiological systems and psychological skill sets in young Jamaican athletes will provide insight into the "trainability" of these variables and a foundation for future research.

**PURPOSE:** To differentiate diverse sprint performance by the investigation of psychological skills and serum levels of lactate, creatine kinase (CK) and lactate dehydrogenase (LDH) among young Jamaican sprinters.

**METHODS:** Subjects were divided into two groups based on results of previous athletic achievement: elite (EG; n=7) and sub-elite (SEG; n=9) sprinters. Blood lactate levels at baseline and following a 350m sprint (3, 8 and 15 minutes) were measured using a portable lactate meter (~ 0.7  $\mu$ l) under passive recovery mode. Subjects provided blood at baseline and 30 minutes post 350m run via venipuncture in a seated position for CK and LDH determination. The Athletic Coping Skills Inventory-28 (ACSI-28) and the Mental Toughness Questionnaire-48 (MTQ-48) were completed at 35 minutes post exercise.

**RESULTS:** Mean age was 17( $\pm$  1.20) and 16.8( $\pm$  1.60) years for the EG and SEG respectively. Mean sprint velocity and anaerobic capacity were positively correlated for both the EG ( $r=0.8$ ,  $p<0.05$ ). Recovery indicators as measured by the change in lactate levels between 8 and 15 minutes showed a greater recovery of 2.5mmol/L  $\pm$  6.6 (11.6%) for the EG with the versus - 1.8 mmol/L  $\pm$  4.3, (-22.9%) for SEG. No statistically significant correlation was found between sprint velocity and post exercise CK and LDH serum levels for either group.

Levene's independent t-test showed no statistically significant difference between groups for scores of coping and mental toughness. Regression analysis showed that personal coping resource (57%) and subscales Coping with Adversity (34%), Concentration (47%), Freedom from worry (45.8%) were statistically significant predictors of mental toughness. Mean mental toughness was higher in the EG (5.86  $\pm$  1.95) versus (5.33  $\pm$  2.55) SEG; mean coping showed a similar trend (52.86  $\pm$  8.67 vs. 49.56  $\pm$  13.21).

**CONCLUSIONS:** Findings of this study indicate that at the youth level metabolic profiling and psychological skills may distinguish Jamaican elite from average athletes.

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1881 Board #289 MAY 30 2:00 PM - 3:30 PM

**On-hill Delayed Video Enhances Skill Development in Alpine Skiers during a Single Week of Summer Camp Training**

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(No relationships reported)

**INTRODUCTION:** Using a delayed video system in alpine ski race

training over 10 weeks has shown to have a moderate correlation ( $r=.84$ ) to skill acquisition in skiers age 9-15 years (Bacharach & Berg, 2011). What remains unknown is whether a similar portable system can enhance skill acquisition of junior alpine skiers during a single week of summer camp training and if age might influence such a system's effectiveness.

**PURPOSE:** 1.) Collect data during one week of ski training addressing the impact of a delayed video feedback system on ski skill improvements by junior alpine ski racers.

**METHODS:** Racers (N=30, 17 females, 13 males, ages 9-18) trained in groups of six, each with an assigned coach at Red Lodge International Summer Race Camp in June 2011. Video was provided five of the six training days. Skiers viewed their performance on the monitor ad libitum. On the last day, athletes were given a survey that asked them to put a mark along a 100 mm line with anchor phrases "Not useful" and "Extremely useful" indicating how useful the on-hill video system was for their training. The midpoint of the line was marked as zero to allow the data to range from -50 to +50. A similar 100 mm line using anchors "Got worse" and "Got better" with a zero mark in the middle was given to the coaches to rate each athlete s/he coached during the week as to the level of improvement each skier made. Simple regressions and correlations were performed on the data as a whole and split by age groups (9-12 yrs and 13-18 yrs).

**RESULTS:** The overall regression equation ( $y=.86x + 0.15$ ,  $r=.85$ ) yielded a significant correlation as did each of the age group regression models (9-12 yrs:  $y=.76x + 2.4$ ,  $r=.89$ ; 13-18 yrs:  $y=.93-1.6$ ,  $r=.84$ ). Athletes who felt video helped improve their ski skills more so, were also rated higher in skill improvement by their coach.

**CONCLUSIONS:** Young alpine skiers appear to improve their skills when they are given the chance to receive on-hill delayed video feedback of their performance. Age did not appear to impact this relationship suggesting young alpine ski racers can enhance their skill development more in one week of training when a delayed video system is available to them.

Acknowledgements: Thank you to Red Lodge International Summer Ski and Snowboard Camp, Roger Bay and his coaches and all the athletes.

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1882 Board #290 MAY 30 2:00 PM - 3:30 PM

**Maintaining Ball Serving Performance Against Psychological Stress from Tennis Court Spectator**

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(No relationships reported)

**PURPOSE:** This study compared ball serving performance for ordinary and national-level tennis players under surveillance by famous tennis star.

**METHODS:** Subjects were informed that their ball serving performance test will be watching by a well-known tennis star (world rank: 30, 2007, silver medal in Australia Open) or a normal court spectator (baseline) 1 h later. Heart rate variability was then recorded quietly after 5-min rest to reflect autonomic nervous activity under the anticipatory stress. Subjects reported their profile of mood states (POMS) followed by blood sample collection for cortisol analysis before the performance test. Performance score was the sum of the product of velocity (km per hr) and accuracy (targeted area, 2; inside, 1; outside, 0) after 10 ball servings.

**RESULTS:** Overall mood disturbance was increased when court spectator was famous tennis star compared to normal spectator. Interestingly, the fatigue subscale and cortisol were elevated significantly only in elite tennis players. However, ball serving performance in the elite tennis players was unaffected under surveillance by famous tennis star. In contrast, performance score was substantially elevated for ordinary tennis players without cortisol change. In addition, vagal power (ln HF of HRV) was reduced when famous tennis player is watching.

**CONCLUSIONS:** Our result demonstrated that surveillance by famous tennis star can elicit psychological stress for athletes. Intriguingly, such stress has no effect for elite players but appears to be stimulatory in ball serving performance for the ordinary tennis players. The result of the study found that ordinary and elite athletes can respond differently in coping against stress from court spectator.

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1883 Board #291 MAY 30 2:00 PM - 3:30 PM

**Self-Efficacy Effect on Anaerobic Performance and Perceived Exertion during a Wingate Bike Test**

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(No relationships reported)

**PURPOSE:** This study examined the effect of self-efficacy (SE) on perceived effort (RPE) and performance using a maximal effort anaerobic task.

**METHODS:** A repeated measures experimental design was employed, with male and female collegiate athletes ( $N = 36$ ) randomly assigned to one of three groups; (a) high-efficacy (HE); (b) low-efficacy (LE), or (c) control group. Efficacy expectations were manipulated via false performance feedback. A manipulation check confirmed that this method successfully impacted SE in the intended direction ( $p < .01$ ). Before and after the SE intervention, participants completed a 30-second Wingate bike test to fatigue. During the task participants provided differentiated ratings of perceived exertion at 15s intervals. Effort tolerance was determined by the length of time the participant could maintain the task. Differences in peak power (PKPWR), mean power (MPWR), maximum heart rate (MHR), and RPE were analyzed using a RM MANOVA.

**RESULTS:** Results revealed that the HE participants found the task less strenuous and more enjoyable than the LE or control group following the manipulation. Furthermore HE resulted in significantly greater tolerance of the task than either the LE or control conditions. Compared to the control group PKPWR increased significantly ( $p < .05$ ) in both intervention groups.

**CONCLUSIONS:** Changes in SE, regardless of direction, appear to positively influence anaerobic performance. However, this positive impact appears to affect only the initial burst of anaerobic exercise, since no significant results were found for MPWR or MHR. We further conclude that athletes tend to perform better with any feedback at all, whether positive or negative, than no feedback. The maximal nature of this task was such that the manipulation did not affect RPE, as might be expected (c.f. Tenenbaum, 2001). Such findings may have important implications for the role played by self-efficacy in enhancing physical activity participation.

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1884 Board #292 MAY 30 2:00 PM - 3:30 PM

**Contextual Interference Effects On The Acquisition Of Strength And Skill Of The Bench Press**

Marshall Naimo<sup>1</sup>, David W. Eccles<sup>1</sup>, Jacob M. Wilson<sup>2</sup>, Michael C. Zourdos<sup>1</sup>, Jeong-Su Kim<sup>1</sup>, Lynn B. Panton, FACSM<sup>1</sup>. <sup>1</sup>The Florida State University, Tallahassee, FL. <sup>2</sup>University of Tampa, Tampa, FL.

(No relationships reported)

It is well known that resistance exercise training (RET) causes increases in muscular strength through neural and morphological adaptations. Previous studies of contextual interference (CI) have shown that practicing several motor skills randomly [high CI (HCI)] facilitates learning in comparison to practicing the same tasks in a blocked order [low CI (LCI)]. This effect has not been investigated in regards to RET. If HCI can enhance the learning of complex RET tasks, HCI could lead to increased strength and decreased risk of injury.

**PURPOSE:** To test if HCI is superior to LCI for the acquisition of (a) movement skill and (b) strength of the bench press (BP).

**METHODS:** Twenty four healthy, college-aged males ( $n=15$ ) and females ( $n=9$ ) were randomly assigned to a control (C), LCI, or HCI group. LCI and HCI were shown proper BP form and performed this exercise for 4wks, 3 times/wk for 4 sets, separated by 90 s, 10-12 reps at 50-55% of one repetition maximum (1RM). Both groups also completed 4 dart-throw sets (4 throws per set). HCI undertook one dart-throw set following each BP set. LCI simply stood between BP sets and carried out all 4 dart-throw sets after completing their 4 sets of BP. C only did testing. 1RM tests were filmed; using the film, BP movement technique (BPMT) was scored using a 13-point movement checklist by a CSCS expert blinded to the groups. Measurements were taken at pre, 1 wk, 2 wks, post, and at a retention test 9 days after post. Alpha was set at 0.05.

**RESULTS:** LCI had a significantly greater increase in %1RM than C at post (LCI: 23.5±2.9; HCI: 14.8±2.9; C: 10.2±2.9%). At retention, LCI and HCI had a greater increase in %1RM than C (LCI: 21.1±2.6; HCI: 17.9±2.6; C: 11.1±2.6%), but LCI and HCI were not different from each other. The %1RM increase from wks 1 and 2 to retention was significant for the HCI group only. In LCI and HCI, BPMT scores were significantly higher than C at 1 (LCI: 12±1; HCI: 11±2; C: 9±2) and 2 wks (LCI: 12±2; HCI: 12±1; C: 8±3). HCI had significantly greater BPMT scores than C at post (13±1 vs. 9±3) and retention (12±1 vs. 9±3); there were no differences between LCI and C at post or retention.

**CONCLUSION:** HCI led to better retention of the BP movement after training compared to the other conditions. Thus, HCI may augment strength and movement skill on the BP since proper technique is an important component of strength-based tasks.

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1885 Board #293 MAY 30 2:00 PM - 3:30 PM

**The Effect Of Stretching And Motor Imagery On Anaerobic Performance In Trained Cyclists**

Hannah Claeys<sup>1</sup>, Rebecca Zakrajsek<sup>2</sup>, Maria Martinson<sup>3</sup>, Kaci Smith<sup>3</sup>, Sara Hochgesang<sup>3</sup>, Andrea Brewer<sup>3</sup>, Michelle Ritchey<sup>3</sup>, Adam Edwards<sup>3</sup>, Tom Nesser<sup>3</sup>, Matt Gage<sup>3</sup>, J. Derek Kingsley<sup>3</sup>. <sup>1</sup>Ball State University, Muncie, IN. <sup>2</sup>University of Tennessee, Knoxville, TN. <sup>3</sup>Indiana State University, Terre Haute, IN. (Sponsor: Lynn Panton, FACSM)

(No relationships reported)

Stretching has been suggested to decrease force and power production while motor imagery (MI) may improve it. MI is the visualization of simple or complex motor activities in the absence of physical movement. However, the effects of static stretching (SS) compared to MI on anaerobic performance in trained cyclists are currently unknown.

**PURPOSE:** To examine the effects of SS compared to MI and quiet rest (QR; sitting and reading the student newspaper) on anaerobic performance in trained cyclists.

**METHODS:** Thirteen trained cyclists (9 males; 4 females; aged: 21±2 yrs) were assessed for height (1.76±0.07m), weight (73.4±13kg), % body fat (10.8±6.2%) and maximal oxygen consumption (VO<sub>2</sub>max: 42.0±5.6 ml/kg/min). Participants performed 3 randomized sessions, separated by at least 72 hours, consisting of cycling for 30 minutes at 65% of VO<sub>2</sub>max before undergoing 15 minutes of SS, MI or QR, followed by an anaerobic performance test. SS consisted of 3 sets of 30-second stretches for the knee flexors/extensors, hip flexors/extensors and the piriformis. Imagery was based on the physical, environmental, task, learning, emotion, and perspective (PETTLEP) and was conducted by a trained technician. The physical nature of the imagery included wearing the same clothing and positioning themselves on the bike as when they are performing. The environmental component included performing imagery in the physical

environment that the task was actually performed. Both relative and absolute powers, as well as peak rpm, were quantified using the 30-second Wingate anaerobic threshold test. Significance was set a priori at  $p \leq 0.05$ .

**RESULTS:** No significant interactions existed among SS, MI and QR for relative peak power, absolute peak power or peak rpm.

**CONCLUSION:** In disagreement with current literature, the present study suggests that neither SS nor MI affect anaerobic performance in trained cyclists. This may be explained by the influence of several variables such as the length of the exercise bout, the duration of the stretching and the participants' experience with imagery and/or quality of imagery.

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**1886** Board #294 **MAY 30** **2:00 PM - 3:30 PM**

**Irritable Bowel Syndrome Disrupts Mental and Physical Function in Female Endurance Athletes**

Emily Crohare<sup>1</sup>, Samantha Rhodes<sup>1</sup>, Trevor Gillum<sup>2</sup>, Matthew Kuennen<sup>1</sup>. <sup>1</sup>West Texas A&M University, Canyon, TX. <sup>2</sup>California Baptist University, Riverside, CA.  
(No relationships reported)

Gastrointestinal distress is a common complaint among female endurance athletes. Irritable bowel syndrome (IBS), characterized by recurrent abdominal pain, inflammation and disturbed bowel function, is a common diagnosis. IBS also causes severe anxiety, depression and fatigue; the combination of these physical and psychological symptoms severely hinders athletic performance. While quercetin's analgesic and anti-inflammatory properties have been extensively studied in healthy male athletes, the efficacy of this supplement in diseased female athletes is unknown.

**PURPOSE:** To determine whether quercetin improves the mental and physical health of female endurance athletes with IBS.

**METHODS:** 6 female endurance athletes (age:  $21.2 \pm 0.5$  yrs; weight:  $54.8 \pm 2.2$  kg; bodyfat:  $18.1 \pm 1.6$ %;  $VO_{2max}$ :  $49.9 \pm 1.7$  ml/kg/min) consumed 1g/d quercetin for 21 consecutive days. 3 had been previously diagnosed with IBS (Rome III criteria); the other 3 served as controls. Subjects completed questionnaires (Medical Hospital Anxiety & Depression Scale, Fatigue Impact Scale, IBS-Symptom Severity Scale, IBS Quality of Life) and exercise (45 minutes at 70% of  $VO_{2max}$ ) on the 1<sup>st</sup> and 21<sup>st</sup> days of supplementation to assess changes in mental and physical health. Saliva, collected before, immediately after and 1hr after exercise was assayed for cortisol using ELISA.

**RESULTS:** IBS-associated fatigue, anxiety, depression, symptom severity and quality of life was worse in athletes with IBS than those without ( $p < .05$ ); these issues did not improve with quercetin supplementation ( $p > .05$ ). Athletes with IBS exhibited an increase in salivary cortisol from pre to post-exercise on the 1<sup>st</sup> ( $13.5 \pm 4$ %;  $p < .05$ ) and 21<sup>st</sup> ( $38.3 \pm 4$ %;  $p < .05$ ) days of supplementation; each day cortisol values returned to baseline by 1hr after exercise. Surprisingly, control subjects did not exhibit an increase in salivary cortisol with exercise on either the 1<sup>st</sup> or 21<sup>st</sup> days of supplementation ( $p > .05$ ). **DISCUSSION:** Our results suggest female endurance athletes with IBS suffer from greater fatigue, anxiety, depression, and gastrointestinal distress than their non-afflicted counterparts. This likely has a significant impact on athletic performance and warrants further investigation. Preliminary data do not support a role of quercetin in diminishing the stress response.

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**B-39** Free Communication/Poster - Sport Psychology

MAY 30, 2012 1:00 PM - 6:00 PM

ROOM: Exhibit Hall

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**1887** Board #295 **MAY 30** **2:00 PM - 3:30 PM**

**Educational Achievement And Career Transition Among Chinese Elite Athletes After Retirement**

Fan Zhang<sup>1</sup>, Flavia Andrade<sup>2</sup>, Weimo Zhu, FACSM<sup>2</sup>. <sup>1</sup>Qsinghua University, Beijing 100084, China. <sup>2</sup>University of Illinois at Urbana-Champaign, Champaign, IL.  
(No relationships reported)

**PURPOSE:** This study investigated the factors associated with attending college and career transition among the Chinese elite athletes who have retired.

**METHODS:** The sample focused on retired elite athletes who had registered in the Beijing Sports Administration. These athletes (N=212, mean age=24.7, 55% female) had formally played professional sports on the national or provincial teams. Data were collected in 2010. Former athletes received the questionnaires through their former coaches. Descriptive statistics and logistic regressions were used to explore whether educational achievement and career transitions differed across sports. We also explored whether these associations varied by gender and social background.

**RESULTS:** In multivariate analyses, higher age of retirement was associated with a higher likelihood of getting a job versus going to college (OR=1.31, 95% CI 1.13-1.52). Other variables such as sex, parental background and type of sport in which they competed as athletes were not statistically significant. However, only 26% were satisfied with their jobs after the retirement. When athletes were asked about who have played a role in their decision to go to college, 56% highlighted the role of their parents as important (or very important). Most categorized the help of their friends/trainers (64%) as neutral. Their own self-efforts were also mostly seen as neutral in the decision to attend college (59%).

**CONCLUSIONS:** The retirement transition of Chinese elite athletes is affected by their retirement age. Those retiring at older ages were less likely to attend college which may reduce their career options in the future. Most retired athletes seem dissatisfied with their jobs. Further implications are discussed.

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**1888** Board #296 **MAY 30** **2:00 PM - 3:30 PM**

**Motivation In Soccer - A Comparison Between Professionals, Semi-professionals And Amateurs Soccer Players**

Hugo M. Sarmiento<sup>1</sup>, Adilson Marques<sup>2</sup>, Joao F. Martins<sup>2</sup>, Luis M. Catita<sup>1</sup>, António M. Fonseca<sup>1</sup>. <sup>1</sup>University of Porto, Porto, Portugal. <sup>2</sup>Technical University of Lisbon, Lisboa, Portugal.  
(No relationships reported)

In spite of the existence of a significant quantity of studies that examine motivation in context to physical and leisure activities, very few coincide in contexts of a natural competitiveness, especially in what concerns adult competition.

**PURPOSE:** To compare the achievement goal, self-determination and beliefs about the nature and determinants of sport competence according to the competitive level: Professionals (PF), Semi-Professionals (SP) and Amateurs (AM).

**METHODS:** 105 professional soccer players (I and II Professional Leagues), 156 semi-professionals (II and III National Leagues) and 78 amateurs (Regional Leagues), completed the following tools: Task and Ego Orientation in Sports Questionnaire; Self-Regulation Questionnaire; Questionnaire relative to Beliefs about the Nature and Determinants of Sports Competency. ANOVA was used to analyse the differences between the three groups, post hoc comparisons were done using the Tukey test ( $p < 0.05$ ).

**RESULTS:** The analysis of results shows that the three groups were predominantly task oriented and significant differences were not found between them. The professionals, when compared with the amateurs, reported significant higher levels in respect to the introjected regulation (PF,  $3.53 \pm 0.82$ ; AM,  $3.19 \pm 0.76$ ;  $p = 0.015$ ), identified regulation (PF,  $4.38 \pm 0.66$ ; AM,  $4.10 \pm 0.69$ ;  $p = 0.012$ ) and for the beliefs that the sports competence was a result to learning (PF,  $4.47 \pm 0.57$ ; AM,  $4.25 \pm 0.71$ ;  $p = 0.030$ ) and subject to improvement (PF,  $4.14 \pm 0.68$ ; AM,  $3.89 \pm 0.85$ ;  $p = 0.47$ ). The amateurs showed significant higher levels of amotivation (PF,  $1.42 \pm 0.60$ ; AM,  $1.69 \pm 0.93$ ;  $p = 0.003$ ) and believe more than the professionals that sport competence is stable (PF,  $2.39 \pm 0.63$ ; AM,  $2.66 \pm 0.80$ ;  $p = 0.021$ ). On the other hand, the semi-professionals, when compared with the amateurs, also tended to report significant higher levels of introjected regulation (SP,  $3.52 \pm 0.85$ ; AM,  $3.19 \pm 0.76$ ;  $p = 0.015$ ) and to believe that sport competence for playing football results from learning (SP,  $4.56 \pm 0.42$ ; AM,  $4.25 \pm 0.71$ ;  $p = 0.000$ ) and is subject to improvement (SP,  $4.25 \pm 0.61$ ; AM,  $3.89 \pm 0.85$ ;  $p = 0.001$ ).

**CONCLUSION:** The differences found concerning the several motivation determinants in function of the competitive level, underline the existence of a relation between the competitive level and motivation.



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1889 Board #297 MAY 30 2:00 PM - 3:30 PM

**Contextual Analysis Of Soccer Clubs**

Artur J. Santos, Carlos E. Gonçalves. *Faculty of Sport Sciences and Physical Education - University of Coimbra, Coimbra, Portugal.* (Sponsor: Carl Foster, FACSM)  
(No relationships reported)

From an ecological approach it's believed that the context can influence the individual development. Sport clubs are important, since they provide conditions for individual involvement. To induce or promote sport involvement is needed to better understand sport organizations and how they're organized, their culture and relationship with the local environment.

**PURPOSE:** The aim of this study is to identify the soccer clubs model of organization, their culture, goals and answers to the demands of the surrounding environment.

**METHOD:** Three Portuguese soccer clubs from different contexts were analyzed. One professional club (PC) and two amateur (AC) of regional level, one of a rural area (RAC), other of an urban area (UAC). The criteria to select the clubs were: a) belong to the same district, b) experience in collaboration with research studies. Field observations and guide tour to club infrastructures were registered. And semi-structured interviews were recorded, followed by text transcription and respectively speech analysis.

**RESULTS:** Comparative to the AC's the PC is more complex, formalized, specialized and is more orientated to performance goals. The volunteers in the PC that work with the youth athletes receive compensation (e.g., monetary, merchandising, tickets).

The AC's present a simple structure, lack of formal training and bureaucracy, suggesting high centralization. The goals declared are related to promotion of sport practice. Volunteers' involvement is based on friendship and relationships. The protocols established with local authorities seem to be an important factor that helps UAC to have better capacity to obtain income than the RAC.

**CONCLUSIONS:** The PC is more prepared and capable to provide better conditions for soccer skills development, but the orientation to performance goals could promote anti-social and anti-ethical attitudes and values in the athletes. The AC's are more dependent from the local authorities, but their function could be improve if they develop good partnerships with local authorities. These can see in the clubs an opportunity to promote social capital, provide informal education and promote active citizenship. It's possible that these organizational differences promote different values and skills of youth athletes.

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1890 Board #298 MAY 30 2:00 PM - 3:30 PM

**Cognitive Function of Retired Professional Football Athletes**

Gregory W. Stewart, FACSM, Roberta A. Bell, Jenifer J. Sudkamp. *Tulane Institute of Sports Medicine, New Orleans, LA.*  
(No relationships reported)

**BACKGROUND:** Exposure to repeated head injuries can alter the expected cognitive recovery course, increasing the risk of long-term neuropsychological problems over the lifespan. Due to age associated memory decline and the prevalence of multiple concussions in professional football players, clinicians are often concerned about the cognitive status of retired professional football athletes.

**PURPOSE:** To examine the cognitive function of retired professional football players during a health screening event

**METHODS:** Twenty-three retired professional football players (ranging in age from 32 to 70 years, with a mean age of 54 years) participated in a health screening event and reported multiple "bell ringers" during their athletic careers. All participants were independent with mobility and ambulation. The Montreal Cognitive Assessment (MoCA) and a self-report Likert scale of memory function were administered to 21 of the 23 participants. MoCA total scores, MoCA Memory subtest scores and self-reported total memory scores were calculated. Age comparisons of those fifty years of age or older versus those under 50 years will be made using regression analysis.

**RESULTS:** Thirteen (62%) participants scored below 26 on the MoCA (mean score= 23.62), 18 participants (86%) scored below 3.73 on the memory subtest (mean memory score=1.76) and 13 (62%) participants reported functional impairment in daily living activities associated with memory deficits.

**CONCLUSION:** Cognitive screenings should be routine for annual health examinations of retired professional football players. Future research is needed to examine additional factors contributing to cognitive decline among these individuals, including medical conditions and psychosocial factors.

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1891 Board #299 MAY 30 2:00 PM - 3:30 PM

**The Mental Health Of Apprentice Horse Racing Jockeys: Is There A Need For Risk Assessment?**

Justine Stynes. *Australian Catholic University, Sydney, Australia.* (Sponsor: Mike Climstein, FACSM)  
(No relationships reported)

The life of the apprentice horse racing jockey is grueling. There is no 'off' season. The 4-year apprenticeship involves early morning track work (3 to 4 hours a day, 5 to 6 days a week), daily stable work (e.g., feeding and grooming horses), weekly trial meetings, and at least one race meeting a week (up to 8 rides per meeting). Injuries can be debilitating and life threatening. Jockeys constantly battle with meeting weight for competition. Evidence in other sports suggests that meeting weight can be psychologically debilitating, impacting the performance, longevity and well-being of the athlete. Despite the physical and psychological demands of the sport, there is limited research on the mental health of the apprentice jockey.

**PURPOSE:** To determine whether apprentice jockeys experience distress. To identify potential risk and protective factors for mental health in apprentice jockeys.

**METHODS:** Male (n=13) and female (n=1) apprentice jockeys with a mean age of 20.00 (SD=3.01) and mean weight of 49.89 kg (SD=7.91) were assessed using structured questionnaires and open ended questions. Distress was assessed using the Depression, Anxiety and Stress Scale and the Athlete Burnout Questionnaire. The potential risk and protective factors for mental health assessed were: resiliency (Resiliency Scales for Children and Adolescents), coping strategies (Adolescent Coping Scale), social support, and stressors.

**RESULTS:** The jockeys reported levels of depression (range=0-36, M=11.14, SD=10.69), anxiety (range=0-34; M =7.43, SD=8.28) and stress (range=0-40, M=12.74, SD=10.45) in the normal to severe range. Levels of burnout were reported in the low to high range for reduced accomplishment (M=2.52, SD= 0.74), emotional and physical exhaustion (M =2.43, SD=1.03), and sport devaluation (M=1.94, SD=0.81). Potential risk factors identified included: lack of social support, poor coping strategies (e.g., ignore the stressor, wishful thinking) and various sport related stressors (e.g., weight restrictions, getting rides). Potential protective factors identified included: social support (e.g., emotional) and constructive coping strategies (e.g., problem solve).

**CONCLUSION:** There is evidence of distress and burnout in apprentice jockeys. A risk assessment of mental health in apprentice jockeys is recommended.

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1892 Board #300 MAY 30 2:00 PM - 3:30 PM

**Personality Variables And Barefoot Running**

Janet Buckworth, FACSM, Nicholas Hanson, Heather Preston. *The Ohio State University, Columbus, OH.*  
(No relationships reported)

Interest in barefoot running has grown in recent years, although many runners have not attempted or implemented barefoot running into their training. It is hypothesized that personality characteristics may be a factor in this decision.

**PURPOSE:** To determine if there are differences in personality between barefoot and shod runners.

**METHODS:** An online survey was administered to both male and female runners who had completed a footrace of at least 13.1 miles in the last two years [Project ULTRA (Understanding Long-distance Training and Runners' Affect)]. The runners were asked, "Have you ever run barefoot?" and were classified as either barefoot (BF) or shod (SH) runners by their response. The Big Five Inventory was used to assess five main dimensions of personality traits: Extraversion, Agreeableness, Openness, Conscientiousness and Neuroticism. This is a 44-item inventory that utilizes a 5 point Likert-style scale for each question. The subjects were asked to answer from 1 "disagree strongly" to 5 "agree strongly" regarding statements about their personality. Independent samples t-tests were used to compare the means of the two groups on the five personality dimensions.

**RESULTS:** Runners from 46 of the 50 states were represented in the sample. The mean age of the respondents was 39.86 yrs (range 18-80, SD 10.99 yrs). Of the 601 runners who completed the survey, 217 reported they had run barefoot. The barefoot runners scored significantly higher on the personality trait Agreeableness (BF mean 3.90 ± 0.57 SD vs SH mean 3.86 ± 0.66 SD, p<.01) and lower on Extraversion (BF mean 3.18 ± 0.85 SD vs SH mean 3.26 ± 0.85 SD, p<.01). There were no significant differences on Openness, Conscientiousness or Neuroticism. Additionally, 45% of shod runners were women (n=174) while only 30% of barefoot runners were women (n=65).

**CONCLUSION:** Our results show that runners who have at least attempted barefoot running tend to be more introverted (low-key, deliberate, quiet) and agreeable (sympathetic, cooperative, kind, affectionate). Very little is known about the participation of women in barefoot running, or personality factors that may distinguish them from shod female runners or male runners; therefore, further research is warranted on the extent of barefoot running and psychological factors in men and women.

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**1893** Board #301 MAY 30 2:00 PM - 3:30 PM

**Mood State And Pre-performance Anxiety In Cirque Du Soleil Artists: Similar Yet Different From Competitive Athletes**

John S. Raglin, FACSM<sup>1</sup>, Janet Powell<sup>2</sup>, Ian Shier, FACSM<sup>3</sup>. <sup>1</sup>Indiana University, Bloomington, IN. <sup>2</sup>Cirque du Soleil, Las Vegas, NV. <sup>3</sup>Centre for Clinical Epidemiology and Community Studies, Lady Davis Institute for Medical Research, Jewish General Hospital, McGill University, Montreal, QC, Canada.  
(No relationships reported)

**PURPOSE:** To contrast mood state profiles and pre-performance anxiety trends between circus artists and competitive sport athletes.

**METHODS:** In a pilot study on injury prediction, 33 (17F, 16M) modern circus artists performing acts related to sport or music completed the Profile of Mood States (POMS) and State-Trait Anxiety Inventory (STAI) (Spielberger et al., 1993) under baseline and recalled best performance using methods based on Hanin's Individual Zones of Optimal Functioning (IZOF) model. POMS results were compared to published values for athletes (Raglin et al., 1991; Terry, 2000) with independent t-tests and the distribution of IZOF values contrasted with compiled athlete values (Raglin & Hanin, 2000) via Z-score transformations.

**RESULTS:** Mean POMS subscale values were: Tension; 14.7 (6.7), Depression; 8.0 (9.3), Anger; 8.9 (8.0), Vigor; 20.1 (5.4), Fatigue; 9.0 (5.8) and Confusion; 12.3 (4.4). Circus artists' scores for Anger, Vigor, Fatigue were similar to athletes ( $p > .05$ ), whereas Tension and Confusion were similar to non-athletes ( $p > 0.05$ , i.e. higher than athletes  $p < .05$ ). Baseline anxiety values did not differ from published norms for State: 37.2 (12.5) or Trait: 38.8 (10.8) anxiety. The mean score for optimal pre-performance anxiety was 31.9 (10.1). Compared to athletes, a greater proportion of circus artists (57.6% vs 21.6%) reported their optimal performance occurring at a lower anxiety range (T-score  $< 35$ ), but the proportions of artists with optimal performances at moderate (T-score 35-45) and high (T-score  $> 45$ ) anxiety levels were less than athletes (moderate: 27.3% vs. 44.2%; high: 15.1% vs 34.2%).

**CONCLUSIONS:** The mood state profiles of modern circus artists in this pilot study were similar to typical athlete profiles except for higher yet normal values for POMS tension and confusion, consistent with the tenets of Morgan's (1980) mental health model of sport performance. As predicted by the IZOF model, we found considerable variation on self-reported optimal pre-performance anxiety level ( $R = 20-55$ ). Finally, a greater proportion of circus artists appear to perform optimally at a lower level of anxiety compared to athletes, perhaps because of differences in performance context (e.g., competitive vs. non-competitive) or scheduling (occasional competition vs. 10-12 shows weekly).

Email: raglinj@indiana.edu (FACSM sponsor)

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**1894** Board #302 MAY 30 2:00 PM - 3:30 PM

**Motivations to Participate in Sport at the 2010 Pan Pacific Masters Games**

Kent J. Adams, FACSM<sup>1</sup>, Joe Walsh<sup>2</sup>, Stephen Burke<sup>2</sup>, Ian T. Heazlewood<sup>3</sup>, Jyrki Kettunen<sup>4</sup>, Mark DeBeliso<sup>5</sup>, Mike Climstein, FACSM<sup>6</sup>. <sup>1</sup>California State University Monterey Bay, Seaside, CA. <sup>2</sup>Australian Catholic University, Sydney, Australia. <sup>3</sup>Charles Darwin University, NT, Australia. <sup>4</sup>Arcada University of Applied Sciences, Helsinki, Finland. <sup>5</sup>Southern Utah University, Cedar City, UT. <sup>6</sup>Bond University, Gold Coast, Australia.  
(No relationships reported)

The Pan Pacific Masters Games are based on a philosophy that promotes and encourages mature athletes to compete in sport throughout life. Participating athletes have either pursued a sport for an extended period of time or have initiated sport involvement in later life. Pan Pacific Game's philosophy advocates competition, participation, and socialization in an environment rich in camaraderie. Due to health and functional implications, it is important to understand why this unique cohort of masters athletes participate in sport.

**PURPOSE:** To investigate athletes' motivations for participation in their sport at the 2010 Pan Pacific Masters Games held in Gold Coast, Australia.

**METHODS:** As part of an online survey, over 10,000 participants from 34 sports were asked to rate on a scale of 1 thru 7 the importance of 56 different reasons as to why they participate in their sport (1 = item is not a reason, 7 = item is a very important reason).

**RESULTS:** A total of 1,824 participants responded (response rate = 18%) with a mean age of 49.1 yrs (range 25 to 83 yrs). Competitors from 14 countries completed the survey. On a scale of 1-7 the top three reasons to participate were (mean (SD)): to socialize with other participants = 5.91 (1.41); to become more physically fit = 5.25 (1.76); and to improve my health = 5.25 (1.82). ANOVA revealed a significant difference ( $p = 0.000$ ) in reasons to participate. Post hoc analysis showed that socializing with other participants was a stronger reason for participation ( $p = 0.000$ ) than either improving health or developing fitness, and that no difference existed between the motivators of health and fitness. Participation with family and friends (5.22 (1.89)) and competition (5.20 (1.66)) were the 4<sup>th</sup> and 5<sup>th</sup> most important reasons to participate in the Games. All other reasons to participate scored less than 5 on average. The least important motivators to compete were to have time alone with the world (2.14 (1.6)) and to solve problems (2.21 (1.6)).

**CONCLUSIONS:** Socialization with other participants was the most important personal motivation for sport participation in the 2010 Pan Pacific Masters games. Health and fitness were less important motivators than socializing to these masters level athletes, but still stronger than competition.

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**1895** Board #303 MAY 30 2:00 PM - 3:30 PM

**Characteristics of Elite Table Tennis Athletes' Brains Activity in Spin-Serve Judging Process**

Anmin Li, Male, Yuhui Zhang, female. Shanghai University of Sport, Shanghai, China.  
(No relationships reported)

**PURPOSE:** This study compared the brain activity of Chinese Olympic table tennis athletes and Chinese National League table tennis athletes when they executed a spin-serve judging tasks. The reactions of the cerebral areas involved with perception and response times were measured during the tasks. The purpose of the study was to examine differences in cognitive processing activities in the central nervous systems of athletes with different table tennis skill levels during the judging the spin of table tennis serves.

**METHODS:** Six female athletes from the Chinese Olympic table tennis team and 12 female athletes from the Shanghai University of Sports with National League table tennis participated in the study. All the participants were instructed to watch a video in which four kinds of serve spins. The participants' task was to identify the type of serve spin and to react by pressing one of four buttons to indicate which type of serve was. The participants' event-related potentials, response times, and accuracy were recorded at the same time.

**RESULTS:** The latency to the greatest activation in the occipital region of Olympic group was 200 ms shorter than that of the National League group. The ending of parietal cortex activation of the Olympic group was 270 ms earlier than the National League group. Positive waves were observed in the frontal lobes of the Olympic group, while negative ones appeared in the National League group 550-760 ms after the stimuli. The Olympic group had longer P3 latency and lower amplitude in occipital and parietal areas compared with the National League group. Further, P3 amplitudes in the left and right occipitals were significantly larger than that of the Olympic group.

**CONCLUSIONS:** (1) The transformation from occipital activation to parietal activation occurred more quickly in the Olympic group relative to the National League group. This faster transfer between the regions provided more time for making correct decisions.

(2) The Olympic group showed hemispheric asymmetry in the processing of visual stimuli by utilizing primarily the right occipital resources, whereas the National League group showed bilateral occipital activation.

(3) The Olympic Group showed a resource-saving mode with fewer occipital and parietal resources, allowing them to perform cognitive tasks more efficiently.

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1896 Board #304 MAY 30 2:00 PM - 3:30 PM

**Effects of Transcranial Direct Current Stimulation on Performance, Autonomic Nervous System, and Rating of Perceived Exertion during Incremental Exercise**

Alexandre Hideki Okano<sup>1</sup>, Rafael Ayres Montenegro<sup>2</sup>, Edilson Serpeloni Cyrino<sup>3</sup>, Paulo De Tarso Veras Farinatti<sup>2</sup>, Eduardo Bodnariuc Fontes<sup>4</sup>. <sup>1</sup>Federal University of Rio Grande Do Norte, Natal/RN, Brazil. <sup>2</sup>State University of Rio De Janeiro, Rio De Janeiro/RJ, Brazil. <sup>3</sup>State University of Londrina, Londrina, Brazil. <sup>4</sup>State University of Campinas, Campinas/SP, Brazil.  
(No relationships reported)

Alexandre H. Okano, Rafael Ayres Montenegro, Edilson Serpeloni Cyrino, Paulo de Tarso Veras Farinatti, Eduardo Bodnariuc Fontes. Federal University of Rio Grande do Norte, State University of Campinas.

**PURPOSE:** We investigated the effects of transcranial direct current stimulation (tDCS) on heart rate variability, rating of perceived exertion (RPE) and time to exhaustion (TE) during in a maximal incremental exercise test to exhaustion in trained cyclists.

**METHODS:** Ten male national-level road cyclists volunteered to participate in this study (32.9±8.5 years; 171.5±5.8 cm; 72.8±9.5 kg; 24.8±3.2 kg/m<sup>2</sup>; 10.2±10.7 training years). The cyclists performed two maximal incremental exercise test: (a) anodal tDCS; (2) or sham for 20 minutes. Heart rate (HR), R-R interval (HRV), and RPE were recorded continuously through all stages of the experiment. From the data collected during the incremental test, the peak power output (PPO), HRV determined every minute and estimated HRV threshold (HRV<sub>TH</sub>) were determined. The testers and the cyclists were blinded to the test condition.

**RESULTS:** HRV<sub>TH</sub>, PPO and TE were all significantly higher for anodal tDCS than the SHAM condition (HRV<sub>TH</sub> anodal: 147.5 ± 53.3W vs sham: 125.0 ± 35.4, p=0.04; PPO anodal: 313.2 ± 29.9W vs sham: 301.0 ± 19.8, p=0.043; TE anodal: 751.4 ± 71.5s vs. sham: 723.7 ± 45.0s, p=0.05). RPE are significantly more slowly during the first six stages of the test in subjects received anodal tDCS.

**CONCLUSION:** We conclude that tDCS decreased RPE and improved performance and cardiac autonomic control.

Supported by FAPESP, CNPq, and CAPES.

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1897 Board #305 MAY 30 2:00 PM - 3:30 PM

**The Stress and Depression Questionnaire as a Screening Tool for Depression and Suicide Risk in Collegiate Athletes.**

Katherine Rutherford, William Dexter, FACSM. *Maine Medical Center, Portland, ME.*  
(No relationships reported)

**BACKGROUND:** Collegiate and high school athletes, despite lower depression rates, are at equal risk for suicide behaviors and greater risk for self harm from suicide attempts compared with non-athletes. Athletes are thought to be less likely to seek psychiatric care than non-athletes due to social stigma. A tool that removes this barrier may increase athletes' utilization of psychiatric services.

The Stress and Depression Questionnaire (SDQ) is an anonymous online questionnaire, used at 50 universities in the U.S., which identifies and offers services to college students at highest risk for suicide. The current national average rate of response to email invitations to answer the SDQ is 8%. The SDQ's anonymity may reduce social stigma, encouraging utilization of this increasingly available tool by collegiate athletes.

**PURPOSE:** To determine whether collegiate athletes respond to the SDQ at the same rate as collegiate non-athletes.

**METHODS:** A retrospective review was performed of SDQs at the University of Southern Maine (USM) from September 22, 2010 to May 15, 2011. A question prompting self identification as varsity athlete (yes/no answer) was added to the USM SDQ at the beginning of this time period. 2850 members of the general student population were invited by email to answer the SDQ over this time period. Focused invitation to all 454 athletes was issued by the same email process in the spring semester. Self-identification as athlete or non-athlete on SDQ response and the total number of each population invited to answer the SDQ were used to calculate response rates of the two populations. These rates were compared using a chi-square test.

**RESULTS:** 98 students responded to the SDQ online survey in the study period. Six self-identified as athletes and 91 as non-athletes; there was one non-response. The athletes had a significantly lower response rate (6/494, 1.3%) compared with non-athletes (91/2850, 3.2%) (chi-square test = 4.179, p= 0.04) Both groups at USM had significantly lower response rates than the national average response rate of 8%.

**CONCLUSION:** At USM, athletes responded to the SDQ at a significantly lower rate than non-athletes. Both populations were well below the national average, suggesting that there may be something unique to USM's student population causing overall decreased utilization of this tool.

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1898 Board #306 MAY 30 2:00 PM - 3:30 PM

**Pilot Normative Data for Verbal Fluency and Perseverative Errors among High School Athletes**

Jenifer W. Sudkamp, Roberta A. Bell, Gregory W. Stewart, FACSM. *Tulane Institute of Sports Medicine, New Orleans, LA.*  
(No relationships reported)

**BACKGROUND:** Sport related concussion is serious and often challenging to diagnose and manage. Sideline health care providers are the first responders to concussion in athletics, but currently have limited access to brief, portable, and reliable cognitive screenings of acute concussion in the absence of loss of consciousness.

Evidence suggests that phonemic and semantic verbal fluency and frequency of perseveration errors during verbal fluency tasks are sensitive to brain injury. Despite their potential as portable measures of cognitive dysfunction, systematic study of the relationships of perseveration errors and verbal fluency to pre- and post-concussion cognitive status has been slighted.

**PURPOSE:** To establish normative data for verbal fluency and perseveration errors in high school athletes

**METHODS:** 42 athletes completed pre-participation phonemic and semantic verbal fluency tasks. Age ranged from 14 to 18 years, while education varied from eight to 11 years. Perseverative frequency, words generated in one minute for the letter "m" (phonemic fluency), and animal names generated in one minute (semantic fluency) were documented.

**RESULTS:** Means and standard deviations for the two fluency tasks and perseveration errors will be calculated for each of four levels of education (zero to eight, nine, ten, and eleven years). The effects of education level on verbal fluency (phonemic and semantic) and perseveration frequency will be determined by regression analyses. Finally, a correlational analysis of animals named and words with the initial "m" will be completed.

**CONCLUSIONS:** Results of this study will provide pilot norms for two verbal fluency tests and perseveration frequency in high school athletes. Further research with a larger sample is warranted to establish more valid norms. These norms will increase the potential for sideline health care providers to accurately and quickly assess post-concussion cognitive function.

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1899 Board #307 MAY 30 2:00 PM - 3:30 PM

**The Influence of a Collegiate Soccer Season on Perceived Stress and Recovery Scores**

Stephen J. Rossi, Jim McMillan, Thomas Buckley. *Georgia Southern Univ, Statesboro, GA.*  
(No relationships reported)

The pre-season for collegiate men's soccer is short and requires athletes to participate in a heavy training load to get ready for the upcoming season. It is important that these athletes are able to recover mentally and physically during training to prevent injuries and mental fatigue during the upcoming competitive season.

**PURPOSE:** The intent of the present study was to examine the influence of a competitive collegiate men's soccer season on perceived stress and recovery (RESTQ-Sport).

**METHODS:** Nine male NCAA Division I soccer players filled out a RESTQ-Sport questionnaire before the start of the pre-season (T1), three times during the season (T2, T3, T4), and post-season (T5). Participants were given the same instructions at each time point on how to properly answer the questionnaire. Repeated Measures ANOVA was run on all general and sport specific stress and recovery scale means and significance was set at p<0.05.

**RESULTS:** Repeated measures ANOVA revealed a significant time effect for the general stress scale ( $p = 0.015$ ) and a simple contrast using T1 ( $0.94 \pm 0.39$ ) as a baseline revealed significant difference at T2 ( $1.92 \pm 1.20$ ;  $p = 0.017$ ), T3 ( $1.56 \pm 0.61$ ;  $p = 0.009$ ), T4 ( $1.31 \pm 0.54$ ;  $p = 0.038$ ), and T5 ( $1.67$  vs.  $0.86$ ;  $p = 0.010$ ). Social stress showed a significant time effect ( $p = 0.02$ ) and a simple contrast using T1 ( $1.34 \pm 0.65$ ) as a baseline revealed significant difference at T2 ( $2.44 \pm 0.92$ ;  $p = 0.003$ ), T3 ( $2.10 \pm 0.98$ ;  $p = 0.042$ ), and T5 ( $2.10 \pm 0.73$ ;  $p = 0.011$ ). Fatigue showed a significant time effect ( $p = 0.001$ ) and a simple contrast using T1 ( $1.34 \pm 0.65$ ) as a baseline revealed significant difference at T3 ( $3.11 \pm 1.12$ ;  $p = 0.011$ ) and T5 ( $2.40 \pm 0.94$ ;  $p = 0.008$ ).

**CONCLUSION:** These data indicate general stress, social stress, and fatigue were negatively influenced by a collegiate soccer season. Higher scores on the three general stress scales have been associated with complaints of being stressed, depressed, having conflicts with others, and feeling over fatigued, and having problems sleeping. The RESTQ-Sport may provide useful information about an athlete's recovery status and readiness to train and compete. This information could be beneficial when designing an athletes' training program.

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**1900** Board #308 MAY 30 2:00 PM - 3:30 PM

**Athletic Perseverance: Assessing Perseverance Attributes Of Athletes And Non-athletes**

Matthew C. Wagner<sup>1</sup>, Judy L. Sandlin<sup>2</sup>, Rosanne S. Keathley<sup>1</sup>. <sup>1</sup>Sam Houston State University, Huntsville, TX. <sup>2</sup>Texas A&M University, College Station, TX.  
(No relationships reported)

**PURPOSE:** The purpose of this study was to gather baseline data on athletic perseverance of college students and student-athletes.

**METHODS:** Participants ( $n = 75$ ) were selected university students and a matched sample of Division 1 student-athletes. Each was given the 30-item Mental Toughness Scale (Goldberg, 2006). The instrument contains five subscales - Reboundability, Ability to Handle Pressure, Concentration, Confidence, and Motivation - these are summed to yield an overall Athletic Perseverance Score. The maximum score for each subscale is 6 thereby producing an over all maximum score of 30.

**RESULTS:** A one-way MANOVA was utilized to determine if significant differences were observed between the athletes and non-athletes on the five subscales. Significant differences were found between athletes and non-athletes, Wilks lambda = .69,  $F(5, 68) = 6.09$ ,  $p = .000$ . Analyses of variances were conducted as follow-up tests to the MANOVA. The ANOVA for Pressure,  $F(1, 72) = 13.21$ ,  $p = .001$ , Concentration,  $F(1, 72) = 17.12$ ,  $p = .000$ , Confidence,  $F(1, 72) = 11.49$ ,  $p = .001$ , and Motivation,  $F(1, 72) = 10.57$ ,  $p = .002$  were each significant. For each significant subscale, the athletes scored higher when compared to students.

**CONCLUSIONS:** Athletes demonstrated higher levels of athletic perseverance than non-athletes. Further research could investigate the effectiveness of different aspects of mental training for both student-athletes and students.

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**1901** Board #309 MAY 30 2:00 PM - 3:30 PM

**Psychological Determinates of Injury: Expanding the Mechanical Model**

Diane L. Elliot, FACSM, Esther L. Moe, Linn Goldberg, FACSM, Chondra M. Lockwood. Oregon Health & Science University, Portland, OR.  
(No relationships reported)

Adolescent female athletes are at increased risk for sport injuries, especially knee trauma. To date, the focus of understanding knee injuries' pathophysiology and prevention has been on anatomy and neuromuscular control. Identifying other determinants of injury might allow for a more comprehensive prevention paradigm.

**PURPOSE:** Define an injury model for female high school athletes that uses psychological dimensions as predictors of sport trauma.

**METHODS:** A 45-minute anonymous survey using validated indices of psychological traits/states was administered to female athletes from a range of sports and a spectrum of high schools. Reliable constructs were assessed as predictors in both an 'any injury' and 'knee injury' model.

**RESULTS:** Data were collected from 490 female (soccer, volleyball, cross country) athletes from 9 high schools. Any injury (prevalence 41% total) was related to aggression (OR=1.44 [1.05-1.97]), hypercompetitive attitude (OR 1.30 [1.06-1.60]), and home stress (OR 1.38 [1.14-1.66]), each  $p < .05$ . Knee injury (prevalence 10.6%) related to win-at-all-costs (OR 1.31 [1.07-1.60]) and perfectionism (OR 1.28 [1.08-1.51]), both  $p < .05$ .

**CONCLUSION:** Expanding existing injury prevention models to include psychological determinants might better prevent injury and provide young female athletes with mental resilience that would benefit them on and off the playing field.

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**1902** Board #310 MAY 30 2:00 PM - 3:30 PM

**Independent And Interactive Effects Of Mother, Father, And Coach Autonomy Support On Athletes' Self-determined Motivation**

Anthony J. Amorose<sup>1</sup>, Lindley McDavid<sup>2</sup>, Allison Riley<sup>3</sup>, Aidyn Iachini<sup>4</sup>. <sup>1</sup>Illinois State University, Normal, IL. <sup>2</sup>Purdue University, West Lafayette, IN. <sup>3</sup>Ohio State University, Columbus, OH. <sup>4</sup>University of South Carolina, Columbia, SC. (Sponsor: Kristen M. Lagally, FACSM)  
(No relationships reported)

Given the numerous achievement-related benefits associated with athletes' adoption of a more self-determined motivational orientation toward sport, understanding the processes that impact the development of athletes' motivation is critical for those working to promote youth sport participation. While many factors may affect athletes' motivation, the degree of autonomy support provided by parents and coaches are assumed to be particularly important according to self-determination theory. Studies have shown that coach autonomy support is predictive of athletes' motivation; however, limited research exists on the effect of parents' autonomy support, particularly in relationship to how each of these social influences may impact motivation separately. Scholars also have shown the value of considering how multiple social influences combine to influence athletes' motivational outcomes, yet this has not been tested when considering parent and coach autonomy support.

**PURPOSE:** The purpose of this study was to examine the independent and interactive influences of athletes' perceptions of autonomy support from their mothers, fathers, and coaches on athletes' self-determined motivation.

**METHODS:** Athletes ( $N=335$ ; M age=15.75 years; 62.4% female; 84.2% Caucasian) from a variety of school-sponsored sport teams completed survey measures near the end of their competitive season assessing their level of self-determined motivation and their perception of autonomy support provided by their coach, mother, and father.

**RESULTS:** Hierarchical regression analysis results showed that autonomy support from all three social agents significantly and positively predicted the athletes' self-determined motivation ( $R^2 = .32$ ). The addition of the two-way and three-way interactions between coach, mother, and father autonomy support significantly added to the overall prediction (total  $R^2 = .35$ ). The pattern of results showed that relatively high levels of perceived autonomy support from any two of the social agents was associated with higher levels of self-determined motivation.

**CONCLUSIONS:** The findings of this study demonstrate how the combination of perceived autonomy support from these three influential social agents (i.e. coaches, mothers, fathers) can add to the understanding of athletes' sport motivation.

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**1903** Board #311 MAY 30 2:00 PM - 3:30 PM

**The Effect Of Growth And Maturation On Mental Skills Of Junior Elite African Soccer Players**

Linda Van den Berg<sup>1</sup>, Julius Jooste<sup>2</sup>. <sup>1</sup>Tshwane University of Technology, Eldoraigne, South Africa. <sup>2</sup>Tshwane University of Technology, Pretoria, South Africa.  
(No relationships reported)

**Abstract:** Physical characteristics associated with superior performance in soccer favor males who are advanced in their biological maturity status. Players who are successful at senior level, can mostly be identified by their psychological approach to their sport. Research indicates that early developers are usually chosen at a young age above late developers due to their advantage in size and power. Despite this, the impact of biological growth and maturation on the psychological development of young athletes has received relatively little attention.

**PURPOSE:** The study investigated if a difference exist in mental skills of junior elite African players of different maturity levels.

**METHODS:** A total of 155 male soccer players with an average age of 16.3 years, representing 11 countries in Africa formed part of this study. A Biological maturation questionnaire was compiled to ascertain biological maturation, and accordingly classified the group into early (ED,  $n = 29$ ), average (AD,  $n = 77$ ) and late developers (LD,  $n = 46$ ). Sport psychological skills (Coping with adversity, Peaking under pressure, goal-setting and mental preparation, concentration, freedom from worry) as determined by the Athletic coping Skills inventory-28 and

(imagery ability, mental preparation, goal setting, self-confidence, anxiety and worry management, concentration ability, relaxation ability, and motivation) as determined by the Bull's Mental Skills Questionnaire (MSQ) were measured. The results for each group were expressed as percentage values.

**RESULTS:** Descriptive results indicated that for most of the sub components, the LD showed better results than the ED and the AD. Despite this tendency, statistically significant differences could only be found for Imagery ability ( $p=0.00$ ), relaxation ( $p=0.36$ ), Coping with adversity ( $p=0.01$ ) and goal setting and mental preparation (0.007), with LD showing better results than the ED.

**CONCLUSION:** According to this study late developers showed a bigger advantage regarding mental skills abilities above ED and this might have contributed to them being selected for national teams. This study delivered insightful results, which proves the important role that mental skills should play in the talent identification process in specifically young soccer players.

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**1904** Board #312 MAY 30 2:00 PM - 3:30 PM

**Comparison of Exercise and Eating in Collegiate Athletes vs. Non-Athletes Active in High School Sports**

Laura Blair, Melinda W. Valliant, Kathy Knight, Yunhee Chang, John C. Garner. *The University of Mississippi, University, MS.* (Sponsor: Mark Loftin, FACSM)

(No relationships reported)

Numerous studies have been conducted on eating disorders (ED) in collegiate athletes. Many studies conclude that collegiate athletes are more at risk of developing an ED compared to non-athletes, while some report the opposite.

**PURPOSE:** To determine if collegiate athletes are more likely to exhibit ED characteristics compared to those who only participated in high school sports. **Method:** Each participant completed The Eating Attitude Test-26 (EAT), The Eating Disorder Inventory subscales Body Dissatisfaction (EDIBD), Drive for Thinness (EDIDFT), and Bulimia (EDIBUL) and The Body Shape Questionnaire-34 (BSQ).

Group differences were examined for males ( $N=101$ ), females ( $N=189$ ), collegiate athletes ( $N=107$ ), non-athletes who played sports in high school (high school athletes) ( $N=183$ ), and those who did not play sports in high school (non-athletes) ( $N=31$ ).

**RESULTS:** Two-tailed independent T tests for equality of means were computed to examine group differences. In comparison to males, females scored significantly higher on the EAT ( $t=3.186$ ,  $p=.002$ ), the EDIDFT ( $t=-4.897$ ,  $p=.000$ ), EDIBD ( $t=-4.075$ ,  $p=.000$ ), and BSQ ( $t=-6.618$ ,  $p=.000$ ). No significant differences were found regarding EDIBUL. Combined collegiate athletes and high school athletes ( $N=259$ ), showed no significant differences in comparison to non-athletes in EAT, EDIDFT, and EDIBUL. However, non-athletes scored significantly higher on the EDIBD ( $t=-2.629$ ,  $p=.013$ ) and BSQ ( $t=-2.617$ ,  $p=.013$ ) compared to collegiate athletes and high-school athletes. Compared to collegiate athletes, high school athletes scored significantly higher on the EAT ( $t=3.570$ ,  $p=.000$ ) EDIDFT ( $t=-2.983$ ,  $p=.003$ ), EDIBD ( $t=-4.750$ ,  $p=.000$ ), and BSQ ( $t=4.308$ ,  $p=.000$ ). No significant differences were found between these two groups regarding EDIBUL.

**DISCUSSION:** Compared to collegiate athletes, high school athletes scored significantly higher on the EAT, EDIDFT, EDIBD, and BSQ, indicating they are at a greater risk of an ED. The mixed results found when combining collegiate athletes and high school athletes in comparison to non-athletes suggest that more research is needed to determine if one group is at a greater risk than the other. Overall, this study suggests high school only athletes are more at risk of developing an eating disorder compared to collegiate athletes.

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**1905** Board #313 MAY 30 2:00 PM - 3:30 PM

**Self Reported Alcohol Consumption and its Effect on Fatigue and Hydration**

David D. Dziedzicki, Lindsey E. Eberman, Leamor Kahanov, Heather Mata. *Indiana State University, Terre Haute, IN.*

(No relationships reported)

Research suggests that collegiate students athletes are at an increased risk for binge drinking behaviors. Alcohol has numerous negative physiological effects. For collegiate athletes these effects may lead to decreased performance.

**PURPOSE:** The purpose was to identify the relationship between self reported alcohol consumption and fatigue and hydration existed.

**METHODS:** We used a correlational design to determine the relationship between the dependent measures. We acquired IRB approval to evaluate 5 Division I athletic teams from one educational institution (ages of 18-26; football=15, baseball=25, softball=11, soccer=25, volleyball=15; men=40, women=51). We measured hydration status using a clinical refractometer, self reported alcohol consumption using the alcohol use disorders identification test (AUDIT) questionnaire, and fatigue using the visual analog scale for fatigue (VAS-F). During the initial team meeting we acquired informed consent and measured baseline fatigue. Athletic Training Services performed baseline hydration status testing during pre-participation physicals (PPEs). Each team participated separately on an "off day" post competition and again 3 days following. During the follow-up data collection sessions, we assessed hydration status, VAS-F, and AUDIT.

**RESULTS:** We identified no significant or strong relationships between our dependent variables (Spearman's rho correlation range=0.003-0.079,  $p$  range=0.192-0.973). We identified significant differences in hydration status over time ( $F_{2,269}=5.226$ ,  $p=0.006$ ,  $\eta^2=0.037$ ) between baseline hydration status (1.017±0.001) and follow-up day 1 (1.021±0.001) as well as follow-up day 3 (1.020±0.001). We also identified a significant difference between sports on the AUDIT score ( $F_{4,86}=4.279$ ,  $p=0.003$   $\eta^2=0.166$ ) with significant differences between this highest risk athletes from softball (9.73±1.22) and the lower risk athletes in soccer (4.36±0.81) and baseball (4.36±0.81).

**CONCLUSIONS:** Although we were unable to identify strong correlations between dependent measures, our results may indicate alcohol consumption has an impact on hydration status and ultimately performance. Although other factors may have influenced hydration, we did identify significant dehydration following alcohol consumption.

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**B-40** Free Communication/Poster - Sports Biomechanics

MAY 30, 2012 1:00 PM - 6:00 PM

ROOM: Exhibit Hall

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**1906** Board #314 MAY 30 3:30 PM - 5:00 PM

**The Relations Between sEMG and Knee Angles Of 24 Style Tai Chi (TC)**

Dong Zhu<sup>1</sup>, Li Li, FACSM<sup>2</sup>, Hongguang Hua<sup>1</sup>, Shan Luo<sup>1</sup>, Song Wang<sup>1</sup>, Guohai Cheng<sup>1</sup>. <sup>1</sup>Shanghai University of Sport, Shanghai, China. <sup>2</sup>Louisiana State University, Baton Rouge, LA.

(No relationships reported)

Many studies indicate that the TC practice has the positive effect on participants' health. However, a few studies have negative reports for Taichi practitioners' knee health after TC practice. These reports focus on incorrect skills might cause practitioners' knee pain. One of incorrect skills is excessive knee internal rotation when TC practitioner shifts their center of gravity.

**PURPOSE:** To investigate the relationship between knee angles and surface electromyography (sEMG) among TC practitioners' lower extremity muscles.

**METHODS:** Sixteen female subjects participated in 24 styles TC practices (age: 21.3±1.9 yrs, height: 162.6±4.2 cm, mass: 53.6±4.4 kg). Subjects were divided into two groups, advanced (AL) and beginner (BL) levels, respectively. Surface electromyography (sEMG) was collected from vastus medialis (VM), rectus femoris, vastus lateralis (VL), and tibialis anterior at 1500Hz. Electric goniometer (2D) was attached to subjects' right knee. sEMG signals were rectified and smoothed using the root square mean with a 50ms smoothing window. Independent-Samples T test was used for statistical analysis.

**RESULTS:** Mean knee joint flexion-extension range of motions (ROM) were 48.7±7.2 and 48.6±8.6 deg, for AL and BL, respectively. Mean knee joint internal-external rotation ROMs were 2.8±8.8 and 0.4±8.6 deg, for AL and BL, respectively. Meanwhile, the peak knee joint flexion angle for AL group was 99.9±24.6 deg, 22 degrees higher than that in the BL group. The peak knee joint internal rotation angle was 23.7±14.2 deg for AL, and 14.6±14.2 deg for BL. There was significant correlation ( $r=-0.39$ ,  $P<0.01$ ) between mean sEMG values of VL and knee internal-external rotation ROM with AL group. In comparison, there was significant correlation ( $r=0.42$ ,  $P<0.001$ ) between mean sEMG values between VM and knee internal-external rotation ROM with BL group.

**CONCLUSIONS:** The knee joint ROM and peak angles were different between groups. Moreover, knee joint internal-external rotation was correlated with VL activity among the AL group whereas with VM among the BL group. Further investigation should focus on the differential effect of knee rotation on different muscle groups among different TC practice levels.

Supported by Shanghai Key Discipline Construction: S30803

**1907** Board #315 **MAY 30** **3:30 PM - 5:00 PM**

**The Evaluation Of Active Drag: A New Proposal**

Bruno Mezêncio<sup>1</sup>, João G O Claudino<sup>1</sup>, Pollyana P. Takao<sup>1</sup>, Rafael Soncin<sup>2</sup>, Jacielle C. Ferreira<sup>2</sup>, Leszek A. Szmuchrowski<sup>2</sup>, Rudolf Huebner<sup>2</sup>, Alberto C. Amadio<sup>1</sup>, Júlio C. Serrão<sup>1</sup>. <sup>1</sup>USP, São Paulo, Brazil. <sup>2</sup>UFMG, Belo Horizonte, Brazil.

(No relationships reported)

The active drag has a strong influence on swimmers performance, but it is a controversial issue because of complexity of the flow around the swimmer. Used methods for estimating this variable need greater specificity or accuracy.

**PURPOSE:** Measure the mean drag active of swimmers through the difference between the net force in dynamometry testing with (WD) and no displacement (ND).

**METHODS:** In a ND test the active drag is approximately zero due to drag-speed relationship. Thus, the strength difference between ND and WD tests is the drag active experienced by the swimmer on test speed with displacement. Twelve tests were conducted to measure the propulsive force ND and WD, the minimum time of rest between attempts was five minutes. A unidirectional load cell, with sampling rate of 1000Hz, measured net force in both situations. The sequence of tests was randomized and balanced. The study included eight swimmers with performance equivalent to 81.9 ± 6.4% of the world record of 50 meters freestyle and height of 1.74 ± 0.06 m. The stroke rate and kick count, per cycle, was used to evaluate the technical differences between the tests. A camcorder with 1000 fps was used to recorder the underwater motion of swimmer. The measurement errors were calculated by the method of propagation of uncertainties considering the individual variability and characteristics of the measuring equipment.

**RESULTS:** There was no significant difference between the technique evaluated from the stroke rate (ND = 1.083 ± 0.069 and WD = 1.088 ± 0.075 s, p> 0.05), and kick count (ND = 6 ± 0 and WD = 6 ± 0, p> 0.05) of the different tests. The mean drag active was evaluated 153.74 ± 9.75 N with associated error estimated at 12.44%.

**CONCLUSION:** The estimated active drag values are within the range of values previously reported for swimmers of similar performance (42 to 167 N). However, the associated error of estimate was lower than was showed in other methods (30%). Thus, the proposed method is a practicable alternative to assess the active drag of swimmers.

**1908** Board #316 **MAY 30** **3:30 PM - 5:00 PM**

**Kinematic Comparison Of Different Step Lengths In A Swimming Incremental Protocol**

Ricardo J. Fernandes<sup>1</sup>, João Ribeiro<sup>1</sup>, Ana Sousa<sup>1</sup>, Marisa Sousa<sup>1</sup>, Arturo Abraldes<sup>2</sup>, Carmen Ferragut<sup>3</sup>, Pedro Figueiredo<sup>1</sup>, J. Paulo Vilas-Boas<sup>1</sup>. <sup>1</sup>CIFIZD and LABIOMEPE, University of Porto, Porto, Portugal. <sup>2</sup>Faculty of Sport Sciences, University of Murcia, Murcia, Spain. <sup>3</sup>Faculty of Physical Activity and Sport, University of Alcalá de Henares, Madrid, Spain. (Sponsor: Carlo Baldari, FACSM)

(No relationships reported)

Swimming incremental protocols are frequently used for swimming aerobic performance assessment. Nevertheless, different step lengths might impose differences in swimming technique.

**PURPOSE:** To determine and compare the stroke rate (SR) and length (SL), arm coordination (IdC) and propelling efficiency (np) during an intermittent incremental protocol with different step lengths.

**METHODS:** Eight long distance swimmers (25.6±8.8yrs, 69.9±5.5kg, 1.78±0.49m) performed 7x200, 300 and 400m (0.05m/s increments; 30s rest between steps and 24h between protocols) in front crawl until exhaustion; the velocity of each step was common to the three protocols. Two arm stroke cycles of the last 50m lap of each step were digitized (APASystem). SL was assessed using the right hip point, and SR was measured as the ratio of velocity to SL. np was considered as: (velocity\*0.9/2π\*SR\*shoulder to hand distance)\*2/π. IdC was determined by the lag time between propulsive inter-arm phases. Comparison between protocols was done using Friedman test (p≤.05).

**RESULTS:** In Table 1 it is possible to observe a SR increase and a SL decrease throughout the protocols, with a tendency to lower SL values in the last steps of the 400m protocol. The IdC values expressed a catch-up coordination mode, similar in all step lengths, increasing at higher velocities. The np decreased throughout the steps of each protocol, without significant differences between protocols.

| Variables         | Protocol/Steps | 1<br>(Mean±SD) | 2<br>(Mean±SD) | 3<br>(Mean±SD) | 4<br>(Mean±SD) | 5<br>(Mean±SD) | 6<br>(Mean±SD) | 7<br>(Mean±SD) |
|-------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| SR<br>(HZ)        | 7x200          | 0.35±0.04      | 0.40±0.03      | 0.41±0.05      | 0.43±0.05      | 0.44±0.04      | 0.54±0.08      | 0.68±0.09      |
|                   | 7x300          | 0.35±0.05      | 0.38±0.06      | 0.40±0.06      | 0.44±0.07      | 0.46±0.06      | 0.54±0.09      | 0.67±0.10      |
|                   | 7x400          | 0.37±0.06      | 0.38±0.04      | 0.39±0.06      | 0.43±0.06      | 0.48±0.10      | 0.56±0.07      | 0.65±0.08      |
| SL<br>(m.cycle-1) | 7x200          | 2.55±0.14      | 2.47±0.21      | 2.49±0.20      | 2.36±0.22      | 2.44±0.23a     | 2.27±0.34      | 2.00±0.22      |
|                   | 7x300          | 2.58±0.23      | 2.49±0.17      | 2.59±0.14      | 2.39±0.15      | 2.42±0.16a     | 2.24±0.25      | 2.12±0.26      |
|                   | 7x400          | 2.51±0.06      | 2.45±0.07      | 2.41±0.15      | 2.38±0.10      | 2.24±0.12b     | 2.05±0.14      | 1.94±0.13      |
| IdC<br>(%)        | 7x200          | -16.42±0.75    | -16.30±6.38    | -17.25±6.06    | -15.65±5.86    | -16.66±5.27    | -10.48±5.26    | -5.42±3.90     |
|                   | 7x300          | -15.05±0.95    | -19.82±5.27    | -17.34±5.64    | -14.00±5.10    | -14.77±5.06    | -11.32±5.64    | -8.26±4.56     |
|                   | 7x400          | -18.42±1.25    | -16.85±3.66    | -17.29±2.69    | -14.91±3.98    | -14.41±4.77    | -7.56±3.95     | -5.59±2.22     |
| np                | 7x200          | 0.44±0.08      | 0.39±0.09      | 0.41±0.09      | 0.35±0.03      | 0.38±0.08      | 0.34±0.05      | 0.31±0.03      |
|                   | 7x300          | 0.41±0.05      | 0.40±0.04      | 0.37±0.02      | 0.36±0.03      | 0.36±0.04      | 0.33±0.03      | 0.32±0.04      |
|                   | 7x400          | 0.43±0.02      | 0.38±0.07      | 0.39±0.07      | 0.36±0.03      | 0.33±0.05      | 0.33±0.04      | 0.30±0.04      |

a-significant different from 7x400  
b-significant different from 7x200 and 7x300

**CONCLUSIONS:** The different step lengths of progressive swimming steps seem not to significantly affect the swimming technique, reinforcing the use of the 7x200m in training diagnostics due to pragmatic reasons.

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**1909** Board #317 **MAY 30** **3:30 PM - 5:00 PM**

**The Effect of a Dynamic and Static Start on Snatch Pull Technique and Performance**

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(No relationships reported)

The start and "first pull" phase of the snatch lift is important for weightlifting success, however, two styles are often displayed. The variations are a "static" and "dynamic" movement of the hips just prior to barbell liftoff. The differences in these technique variations have yet to be assessed in elite weightlifting athletes.

**PURPOSE:** To assess the differences between a static and dynamic start on snatch pull technique and performance at various loads.

**METHODS:** Eight male and three female weightlifters (Mean  $\pm$  SD; Age = 20.18  $\pm$  1.40 yrs; Mass = 77.89  $\pm$  17.12 kg; Ht = 169.55  $\pm$  11.37 cm; Snatch 1RM = 99.09  $\pm$  32.35 kg) competing at the national or international level performed two snatch pulls at 90, 100 and 110% of their 1RM in the snatch using a static and dynamic starting technique, which were counterbalanced. Performance was assessed by maximum vertical ground reaction force (VGRFmax), barbell displacement (Ymax), and velocity (Vmax) while technique was assessed by maximum horizontal barbell displacement (Hmax) and mean angle of the resultant GRF vector during the first pull (GRFang). A two-way repeated measures ANCOVA was used to compare differences between a static and dynamic starting technique across loads while controlling for the athlete's preferential starting technique.

**RESULTS:** Five athletes preferred the static whereas six preferred the dynamic technique. Significant main effects for load condition were displayed for VGRFmax (110>100, 110>90), Ymax, and Vmax (Both: 90>100>110%) regardless of starting technique ( $p < 0.01$ ). No significant main effect or interaction for starting technique were displayed for any of the performance: VGRFmax (dynamic = 2801.89  $\pm$  691.02 N, static = 2784.69  $\pm$  689.85 N), Ymax (dynamic = 1.15  $\pm$  0.09 m, static = 1.14  $\pm$  0.09 m), and Vmax (dynamic = 1.72  $\pm$  0.18 m/s, static = 1.72  $\pm$  0.19 m/s); or technique: Hmax (dynamic = 0.074  $\pm$  0.029 m, static = 0.073  $\pm$  0.021 m) and GRFang (dynamic = 89.35  $\pm$  0.58°, static = 89.23  $\pm$  0.51°) variables ( $p > 0.05$ ).

**CONCLUSIONS:** Snatch pull performance and technique at various high intensities remains unaffected by a dynamic or static starting technique. Thus, coaches may teach either starting technique based on individual athlete needs.

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**1910** Board #318 **MAY 30** **3:30 PM - 5:00 PM**

**Simulation Of Micro-fracture In Skiers**

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(No relationships reported)

**PURPOSE:** To simulate and quantify the micro-fracture in skiers.

**METHODS:** Paramed Datalogger® was used to measure insole plantar pressures to simulate micro-fractures in ski jumping during take-off. For heel and big toe maximum pressures measured were 221 $\pm$ 99.45 N.cm<sup>-2</sup> and 558 $\pm$ 234.36 N.cm<sup>-2</sup> respectively. These data were used in model to simulate the micro-fractures in skiers. Number of cycles to cause failure of bone due to repetitive take-offs were obtained using the following equations: The crack growth model is taken as  $a \propto a_i (1)$  Where  $a_i$  is initial plan size and  $a$  is crack growth increment associated with  $i$ th applied load and the process continues until a terminal flaw size is obtained. The fatigue crack propagation rate (FCPR) is defined as the length (or area) propagated during one stress/strain cycle,  $da/dN$ . FCPR model provides a functional relationship between the crack growth rate  $da/dN$  and the stress intensity factor range  $\Delta K$ , i.e.,  $da/dN = C(\Delta K)^m (2)$  Where  $a$  is the crack length,  $N$  is the number of cycles and  $C$  and  $m$  are material constants that characterize the crack propagation rate. From Equation # 2 obtains number of cycles of repetitive jumps to cause failure ( $N_f$ ) of bone follows: where,  $a_i$  and  $a_f$  are initial and final crack length respectively. Using  $a_i = 10.0 \times 10^{-8}$  m,  $\Delta K = 1.0 \times 10^{-6}$  m,  $m = 1.25$ , and  $\Delta K = 1.12$ , integrated numerically with an increment of  $10 \times 10^{-6}$  m to the final value of the crack length ( $a_f$ )  $10 \times 10^{-6}$  m. Rate of change of crack length with the number of cycles ( $da/dN$ ) was obtained.

**RESULTS:** Typical behavior of crack growth rate characteristics for a plantar pressure of 792 N.cm<sup>-2</sup> and  $m$  being 1.25, reveals that 6 take-offs were sufficient to initiate micro-fracture of big toe bone in skiers. Similarly for a plantar pressure of 321 N.cm<sup>-2</sup> and  $m$  being 1.25, reveals that 15 take-offs were sufficient to initiate micro-fracture in heel bone of skiers. The results of this study also indicate that the number of take-offs for micro-fracture of skier bone decreases as the value of  $m$  increases.

**CONCLUSIONS:** These data predicted development of an in vivo micro-fracture in skiers even before it occurred and micro-fracture was sensitive to number of take-offs. Model was of significance in bone remodeling, fracture fixation of bone, prosthetic and shoe design, etc. It showed that shoes, and other supports can reduce the propagation of bone crack or injury prevention.

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**1911** Board #319 **MAY 30** **3:30 PM - 5:00 PM**

**Cycling on Rollers: Motion Characteristics for Dynamic Stability**

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(No relationships reported)

During off-season, cyclists maintain or improve fitness and technique by training on rollers or stationary trainers. Because of the balance required on a narrow riding surface, rollers are often recommended as a means of training cycling technique.

**PURPOSE:** Compare bike and rider motion characteristics on a stationary trainer with those on rollers at similar power outputs.

**METHODS:** Experienced cyclists ( $n = 5$ ) rode at similar power outputs on a CycleOps Supermagneto trainer and CycleOps aluminum rollers with magnetic resistance. Power was measured with an instrumented rear wheel (Powertap SL+) and targeted to demand 70% of peak oxygen uptake. A Vicon motion analysis system was used to record bike and rider 3D positions at 100 Hz. Bike lean, yaw, steering, and pedaling angles were calculated along with rider relative motion during 60 seconds of stable riding.

**RESULTS:** Similar power outputs were obtained for both conditions (275  $\pm$  42 W). Considerable fluctuation of crank angular velocity was evident during a pedaling cycle with peak rotation rate near mid-downstroke and minima with pedals near top or bottom of the rotation. Some riders exhibited shifts of timing for peak angular velocity from trainer to rollers. While bike motion on the stationary trainer was minimal as expected, medio-lateral motion on the rollers was about 22 mm (SD about midpoint). Lean angles (SD of 0.8°) were coordinated with pedaling and displayed lean to the left during right downstroke and to the right during left downstroke. Similar coordination with pedaling was observed for yaw and steering angles (SDs of 0.6 and 0.8°, respectively) during riding on rollers. Relative motion of trunk to bike exhibited unique individual patterns that were very repeatable but for some riders were different for the two conditions.

**CONCLUSIONS:** Subtle differences of rider motion and pedaling characteristics were observed for cycling on rollers compared to a fixed position trainer. Due to balance requirements, bike motion with each pedaling cycle on rollers involved a complex angular interplay which is likely a closer approximation to overground riding than is a stationary trainer.

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**1912** Board #320 **MAY 30** **3:30 PM - 5:00 PM**

**Strength Ratios of Hip Musculature in Male and Female Collegiate Soccer Players**

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(No relationships reported)

Weak hip musculature has been identified as a factor in lower extremity injury which affects women at a rate 2-6 times greater than men. Gender differences in muscular strength ratio (agonist:antagonist) may exist; in turn, affecting injury disproportionality.

**PURPOSE:** The purpose of this study was to determine if strength ratio differences existed between male and female collegiate soccer players.

**METHODS:** Peak isometric hip strength was measured for 144 male (179.6  $\pm$  6.7 cm, 76.6  $\pm$  7.8 kg, 19.5  $\pm$  1.3 years) and 157 female (167.4  $\pm$  6.0 cm, 62.7  $\pm$  7.1 kg, 19.3  $\pm$  1.1 years) collegiate soccer players using a portable load cell (BTE Technologies, Hanover, MD). Frontal and sagittal plane motions were measured in the standing position, transverse plane rotations were measured in the seated position. Peak strength values were arranged into three strength ratios: Hip flexion:extension (FLX:EXT), hip abduction:adduction (ABD:ADD), hip external:internal rotation (ER:IR). Ratio values were obtained by dividing peak strength of the agonist muscle by peak strength of the antagonist. A 2 (gender) x 3 (strength ratio) MANOVA was conducted, with an alpha level of 0.05, in order to determine the existence of gender differences in strength ratios.

**RESULTS:** No significant differences were seen between genders for any of the three strength ratios (FLX:EXT  $p = .139$ , ABD:ADD  $p = .890$ , ER:IR  $p = .424$ ). Average (mean  $\pm$  sd) strength ratios were: FLX:EXT - 110.4%  $\pm$  36.9% for males and 116.6%  $\pm$  36.0% for females, ABD:ADD - 82.1%  $\pm$  35.1% for males and 81.6%  $\pm$  24.0% for females, ER:IR - 111.4%  $\pm$  31.2% for males and 108.7%  $\pm$  28.6% for females.

**CONCLUSIONS:** There is no difference in hip strength ratios between male and female collegiate soccer players. These findings warrant further research of strength measures and the possible impact they may have on predicting injury.

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1913 Board #321 MAY 30 3:30 PM - 5:00 PM

**Ground Reaction Forces and Osteogenic Index of the Sport of Cyclocross**

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(No relationships reported)

Increasing weight-bearing activity has been suggested to improve bone health and minimize fracture risk. Cyclocross, in contrast to conventional cycling, demands bouts of weight-bearing activity as cyclists dismount and remount their bicycles to jump over barriers and run pitched terrain.

**PURPOSE:** To measure peak and mean vertical ground reaction forces (vGRF) during cyclocross-specific activities and calculate their osteogenic index (OI).

**METHODS:** Twenty-five healthy cyclocross athletes (18 M, 7 F) participated: 35.5(8.3) yrs old, 73.3(10.2) kg, 3.8(2.5) yrs of competition. vGRF was measured with pressure sensitive insoles (Novel Inc.) during seated cycling and four activities: barrier flat, barrier uphill, uphill run-up, downhill run-up. Peak vGRF and mean vGRF (%BW) across loading cycles were determined for each activity. OI of each activity was computed using:  $OI = \text{peak vGRF (\%BW)} \times \ln(\text{loading cycles} + 1)$ . vGRF and OI comparisons were made using repeated measure ANOVA. Relationship between cycling speed and vGRF was assessed with Pearson correlation coefficient.

**RESULTS:** Number of loading cycles per activity was 11.9(2.3) for barrier flat, 17.0(3.0) barrier uphill, 14.2(2.5) uphill run-up, 23.8(5.1) downhill run-up. All activities had significantly ( $p < 0.05$ ) higher peak vGRF, mean vGRF and OI than seated cycling. The barrier flat condition had the significantly ( $p < 0.05$ ) highest peak vGRF (2.9 (0.4) %BW) and mean vGRF (2.3 (0.3) %BW). Downhill run-up had the significantly ( $p < 0.05$ ) highest OI of 6.5(1.1). During barrier flat and barrier uphill conditions the peak vGRF occurred during a jumping or landing maneuver, while the peak vGRF during uphill run-up and downhill run-up occurred on the initial foot strike following cycle dismount. Mean vGRF was positively correlated with maximum cycling speed for all activities except uphill run-up.

**CONCLUSIONS:** Peak vGRF generated during the barrier flat activity measured in this study is similar in magnitude to previously reported GRFs during running and soccer. vGRFs during all four activities were significantly higher than seated cycling. OI of the barrier flat condition alone is higher than seated cycling for an equivalent number of loading cycles. Cyclocross-specific activities may be more beneficial to bone health than seated road cycling.

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1914 Board #322 MAY 30 3:30 PM - 5:00 PM

**Analysis of Upper Limbs Dynamometry in Two Variants of Backstroke Start Technique**

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(No relationships reported)

The measurement of lower limbs force has been assessed in studies including individual swimming start techniques for ventral and dorsal events. Concerning the contribution of the upper limbs for the total impulse, the number of studies is rather scarce, and none of which has yet dealt with the technical adjustments allowed by the new international rules for backstroke start.

**PURPOSE:** To compare upper limbs horizontal impulse during backstroke start variants performed with the feet parallel and entirely submerged and with the feet parallel and entirely above the water surface.

**METHODS:** Five high level swimmers (age:  $21.40 \pm 3.36$  years, weight:  $74.54 \pm 8.28$  kg of body mass, height:  $1.78 \pm 0.05$  m, training experience:  $13.60 \pm 6.06$  years) performed two sets of four maximal repetitions of each backstroke start variant over a distance of 15 m. An iron handgrip instrumented with a load cell (Globus, Italy), recording at 100Hz, was fixed to the starting block and was connected to a Globus Ergometer data acquisition system (Globus, Italy). The handgrip system was adapted to comply with the swimming rules: 0.30 to 0.60 m above the water surface both horizontally and vertically. Data obtained from the load cell were low-pass digital filtered (20Hz Butterworth). Data were normalized for body weight. The backstroke start variants were divided into three phases: initial starting position, trunk lifting and release of the hands. The reference instants determined to assess the three phases were characterized in each individual force-time curve. Descriptive statistics, Student's t-test for paired samples ( $p < 0.05$ ) and effect size ( $d$ ) were calculated.

**RESULTS:** Similar values were observed for the horizontal impulse between backstroke start variant performed with the feet parallel and immersed and the feet parallel and emerged at initial starting position phase ( $0.055 \pm 0.023$  s vs  $0.056 \pm 0.026$  s,  $d = -0.02$ ,  $p > 0.05$ ), at trunk lifting phase ( $0.026 \pm 0.007$  s vs  $0.029 \pm 0.011$  s,  $d = -0.26$ ,  $p > 0.05$ ) and, at release of the hands phase ( $0.101 \pm 0.022$  s vs  $0.097 \pm 0.022$  s,  $d = 0.13$ ,  $p > 0.05$ ).

**CONCLUSION:** Despite the task constrain provided for the new rules for backstroke start, high level swimmers were able to apply similarly horizontal impulse throughout hands-off phases in both starting variants.

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1915 Board #323 MAY 30 3:30 PM - 5:00 PM

**Trunk Rotation During the Delivery Phase of Shot Put in Elite Male Trans-femoral Amputee Athletes**

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(No relationships reported)

The rotational movement of the body is considered to be important for high power production during the delivery phase of the shot put in nonamputee athletes. Trans-femoral amputee athletes (TF) are more likely to adapt their throwing technique due to their loss of musculature and motions about the knee and hip joints.

**PURPOSE:** To investigate how elite male TF use rotation of the body during the shot put and its relationship to throwing distance.

**METHODS:** A 3D-kinematic analysis was made of the shot put technique in seven athletes competing in the final of the mens F42 shot put competition at the 2008 Paralympic Games. The athletes (mean  $\pm$  SD:  $35.0 \pm 2.9$  yrs) were all right handed. They were left leg amputated and using a trans-femoral prosthesis with a locked or absent knee component. All TF throw performances were recorded using two digital cameras (100 Hz) and the best official result by each athlete was used for analysis. The athlete, shot and throwing circle were manually digitized, reconstructed and filtered. The delivery phase was defined as the time from left leg touch-down to release of the shot. The hip flexion-extension angle defined as the angle between the line from mid way between shoulder joints to mid way between hip joints and the right thigh, and trunk rotation defined as the difference in angle between the shoulder joints and the hip joints in the transverse plane were calculated. Pearson correlation coefficients were calculated between the measured parameters and the official result.

**RESULTS:** The hip angle at the start of the delivery phase was significantly and inversely correlated to the hip angle at release ( $R = -0.891$ ,  $p = 0.007$ ). Hip angle velocity at the start of delivery ranged between 54 and 489 °/s and was significantly correlated with put distance ( $R = 0.817$ ,  $p = 0.025$ ). The trunk rotation velocity was significantly correlated with the resultant release velocity ( $R = 0.774$ ,  $p = 0.041$ ).

**CONCLUSION:** The fast hip extension during the delivery phase of elite male TF caused a trunk rotation with high angular velocity, which resulted in a high release velocity of the shot. During this trunk rotation, upper body muscles are delivered thereby possibly increasing rate of force development during the following contraction. The TF adapted their technique due to the prosthesis and depended highly on a fast trunk rotation.

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1916 Board #324 MAY 30 3:30 PM - 5:00 PM

**Muscle Activation and Co-contraction Patterns in Healthy Older Adults Performing Hatha Yoga**

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(No relationships reported)

Knee osteoarthritis (OA), a disorder that is affected by joint loading forces, is associated with a reduction in quality of life and independence in older adults. Yoga requires motor coordination and joint stability and is commonly suggested as a strengthening exercise for seniors. Since joint loading at the knee may be altered during exercise and magnified by co-contraction, we examined the muscular activation and co-contraction patterns of senior participants during Yoga performance.



**PURPOSE:** To examine muscle activation and co-contraction patterns of the knee joint in Chair (CH), Tree (TR), Warrior I (W1), and Warrior II (W2) Yoga poses performed by healthy older adults.

**METHODS:** 20 healthy older adults (70.6 ± 3.8 yrs) participated in a 16-week Yoga program. After intervention, the participants were instrumented for biomechanical analysis and performed the Yoga poses with guidance from an instructor. Surface electromyographic (EMG) signals of the hamstrings (HAM) and vastus lateralis (VL) were collected at 1560 Hz for a 3-s interval during the pose. The EMG raw data were full-wave rectified and smoothed with a 75-ms constant window. The processed EMG signals were further integrated over the collected interval (iEMG) to quantify muscle activation. The average co-contraction value (CV) was calculated as  $iEMG_{HAM} / iEMG_{VL}$  times the summation of  $iEMG_{HAM}$  and  $iEMG_{VL}$ . It reflects the level of muscle co-contraction and takes the overall activation level into account. Repeated measures ANOVA and Tukey's HSD of post hoc tests were used to examine the difference in muscle activation and CV across the poses.

**RESULTS:** Both HAM and VL muscle activation during TR were significantly less than during CH, W1, and W2 ( $p < .05$ ). There was no significant difference between poses among CH, W1 and W2. CV during W1 and W2 was significantly greater than during CH and TR ( $p < .05$ ). No significant difference was observed between W1 and W2; or between CH and TR.

**CONCLUSION:** Comparing the target poses, TR placed less demands on both knee flexors and extensors. High muscle co-contraction values at the knee in W1 and W2 indicate higher joint loading when performing these poses. These findings suggest that senior practitioners with knee OA should reduce or avoid Warrior I and II poses to prevent exacerbation of their OA.

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1917 Board #325 MAY 30 3:30 PM - 5:00 PM

### Gender Differences In Heave And Pitch Phase Relationships In Maximal Undulatory Underwater Swimming (UUS).

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(No relationships reported)

The phase relationship between the heaving and pitching motions of the end-effector in UUS is critical to the production of an effective propulsive force and simultaneous minimisation of active drag, as it determines the formation and the timing of the shedding of the vortices from the leading edge of the end-effector (Anderson et al., 1998, *Jnl Fluid Mech*, 360, 41-72). A phase angle difference of approx. 75° has been shown to represent the optimal phase difference between heaving and pitching motions in oscillating foils with high propulsive efficiency (Anderson et al., 1998).

**PURPOSE:** Examine gender differences in the relationship between the mean absolute relative phase of the heaving and pitch (MARP HnP) movements of the end-effectors with the production of maximal UUS velocity in skilled swimmers.

**METHODS:** 17 (Male=8; Female=9) national age-group swimmers (Age 16.9±1.3yrs, Ht 171.2±9.4cm, Wt 63.2±11.4kg) were recorded using a single underwater video camera swimming 3 trials of maximal UUS to collect 6 cycles of data. 2D kinematics were analysed from the digitised motions of the wrist, shoulder, hip, knee ankle and 5th metatarsal phalangeal joint (MPJ) centres. Continuous Relative Phase (CRP) was determined from the phase angles of vertical heave motions and pitch angle of the end-effector. The MARP was calculated from the CRP using circular statistics. The relationships between the cycle frequency (Hz) of the end-effector (5th MPJ), cycle length (CL-distance travelled by the hip marker per cycle) and the average velocity of the hip marker per cycle (VEL) to the MARP HnP were determined using Pearson's correlation coefficient.

**RESULTS:** No sig. differences in Hz, CL, or VEL by gender. MARP HnP (female 117.4±4.5; male=118.9±4.4;  $p=0.088$ ) also showed no difference by gender. Correlation coefficients showed moderately large relationship between MARP HnP and Hz (female  $r=-0.553$ ,  $p=0.003$ ; Male  $r=0.597$ ,  $p=0.002$ ). Female swimmers showed a large correlation with CL ( $r=0.704$ ,  $p=0.001$ ) compared to males ( $r=0.182$ ,  $p=0.395$ ). All correlations between MARP HnP and VEL were small and not sig.

**CONCLUSION:** MARP HnP was considerably different to the suggested 75° optimal phase relationship. The differences in the correlation coefficients suggest males and females adopt different coordination patterns to achieve maximal UUS.

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1918 Board #326 MAY 30 3:30 PM - 5:00 PM

### 100-m Freestyle Race Analysis of the 5th World Down Syndrome Swimming Championship

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(No relationships reported)

Down syndrome (DS) is a common genetic cause of intellectual disability but there is a lack of knowledge on factors leading to sport success in these persons.

**PURPOSE:** To analyze 100-m freestyle race from the 5<sup>th</sup> World DS Swimming Championships.

**METHODS:** The event was videotaped with two side view cameras, and 34 swimmers (17 men and 17 women) from the preliminary heats were analyzed for start, turn and swim times and stroke length (SL) and rate (SR). Mean and SD were obtained, Student t-tests and repeated measures ANOVA were computed to compare gender groups. Correlation analysis was performed between race components, stroking variables and end results ( $p \leq 0.05$ ).

**RESULTS:** There were significant differences between male and female swimmers in start time (6.07±0.47 & 7.37±.99s), swim time (34.45±2.90 & 44.18±4.49s), turn time (32.36±2.64 & 37.94±3.85s), finish time (9.08±1.32 & 10.25±1.33s), final time (81.97±6.44 & 99.74±9.63s), speed (1.18±0.09 & 0.92±.09m/s), and SL (1.65±.16 & 1.38±.17m); no differences between genders were observed for SR (43.16±4.87 & 40.78±5.45st/min). Differences within laps can be observed on Figure. The higher  $r$  values were obtained for swim time and final time (men: .97 & women: .91) and final time and turn time (men: .94 & women: .95). Inverse correlations were observed between stroke rate and stroke length (men: -.67 & women: -.76).

**CONCLUSIONS:** Male DS swimmers are significantly faster than female counterparts in the 100-m freestyle event. For a similar number of strokes per min, men are able to attain higher stroke lengths than woman. For this specific event, swim and turn times are most determinant for the final time and SL is determinant for swimming speed and not SR.

Supported by FCT SFRH/BD/78513/2011

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1919 Board #327 MAY 30 3:30 PM - 5:00 PM

### Spatio-temporal Coordination in High Intensity Swimming

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(No relationships reported)

Rhythmic inter-limb behavior in humans is characterized by intrinsic coordination modes: in-phase, the simultaneous contraction of homologous muscles (e.g. flexing or extending the arms simultaneously), and anti-phase, the simultaneous activation of non-homologous muscle groups (e.g. flexing one arm and extending the other one). The inter-limb coordination emerges due to changes in the constraints imposed on action. In swimming, temporal changes have been used to characterize coordination changes. However, its use could be completed with spatial data to enable spatio-temporal analysis.

**PURPOSE:** To assess the spatio-temporal coupling in front crawl upper limbs performed at high intensity swimming.

**METHODS:** Ten front crawl male competitive swimmers (21.6±2.4 yrs, 1.85±0.7 m, and 76.4±6.1 kg) swam 200 m front crawl at race pace. The swimming test was recorded by two above water and four underwater cameras operating at 50 Hz. The 21 body landmarks digitized (APASystem) underwent a three-dimensional direct linear transformation to yield the three-dimensional anatomical points position of one complete stroke cycle per each 50 m lap. The mean swimming velocity was calculated as the horizontal displacement of the whole body center of mass over its total duration. The spatio-temporal relationship between the upper limbs was quantified by the continuous relative phase. A one-way repeated measures ANOVA (Bonferroni post-hoc) and effect size (f) were used to analyze changes between the four moments over the 200 m ( $p < 0.05$ ).

**RESULTS:** Swimming velocity decreased significantly from the first (1.57±0.08 m.s<sup>-1</sup>) to the last 50 m lap (1.35±0.08 m.s<sup>-1</sup>) (F(3,27)=24.58, p<0.001, f=1.26). The mean continuous relative phase angles were 188.1±7.5, 186.8±8.5, 190.1±7.1, and 190.7±4.8°, respectively for the first, second, third and fourth 50 m lap, remaining constant throughout the effort (F(3,27)=1.88, p<0.16, f=0.15).

**CONCLUSION:** Front crawl swimming inter-limb relationship is strongly preserved in an anti-phase coordination mode despite the changes in velocity due to fatigue development.

Supported by SFRH/BD/38462/2007 and PTDC/DES/101224/2008 (FCOMP-01-0124-FEDER-009577) FCT grants.

**1920** Board #328 MAY 30 3:30 PM - 5:00 PM

**A Simple Instruction Increases Relative Contribution of Hip Extension Action during Concentric Cycling**

Ernest G. Rimer, Camden S. Marshall, Kyle W. Wehmanen, Jedidiah R. Farley, James C. Martin, FACSM. *University of Utah, Salt Lake City, UT.*

(No relationships reported)

Previous authors have suggested that cycling performance can be improved by increasing relative contribution of the large, hip extension musculature. Hip extension torque functions to extend both the torso and the thigh.

**PURPOSE:** Determine the effect of torso extension on the relative contribution of hip extension during cycling.

**METHODS:** Four, recreational cyclists (75.7 ± 7.9 kg, 175 ± 5 cm) performed two submaximal cycling trials at approximately 250 watts and 80 rpm. During each trial, the participants were instructed to pedal with either their self selected technique, or to maintain the same torso position while reducing pressure on the handlebars by extending the torso. Pedal forces and limb kinematics were recorded. Joint moments were calculated using a sagittal plane, inverse dynamics model. Work produced during hip extension was determined from hip moment and hip angle data and was normalized to work delivered to the pedals. Normalized hip extension work from the self selected pedaling technique and the torso extension trials were compared with a paired Students t test.

**RESULTS:** During the self selected and torso extension trials, hip extension contributed to 33 ± 8% and 48 ± 8% of total work, respectively (p < .01).

**CONCLUSION:** In cycling, the contribution of hip extension action to total work increased with a simple instruction to reduce handlebar pressure. Previous authors have suggested that experienced cyclists attempt to recruit greater involvement from the large hip extensor muscles, posing that such action may reduce localized metabolic stress. The current investigation demonstrated that a simple instruction caused a transfer of work so that the large muscles responsible for hip extension action made a greater contribution toward a given, submaximal workload. More research is needed to determine if these findings can contribute to a reduction in metabolic stress during a given workload, or to an enhancement in cycling performance. Additionally, understanding how to change the relative contribution of joint actions at the hip, knee, and ankle may have implications in rehabilitation settings, in which clinicians may want to specifically target hip extensors.

**1921** Board #329 MAY 30 3:30 PM - 5:00 PM

**Insight To Muscle Activity During The Lacrosse Shot.**

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(No relationships reported)

An advanced lacrosse player typically has the ability to shoot both left- and right-handed. When shooting right-handed, the right arm is the top arm and the left the bottom arm. When shooting left-handed, the arms are switched. There is a lack of research on muscle activity of the top and bottom arms during shooting.

**PURPOSE:** The purpose of this study was to compare upper extremity muscle activity patterns during shooting right- and left-handed.

**METHODS:** Experienced high school male players (n=8; 1.7±0.1 m; 69.6±9.4 kg; 16.3±0.9 y) had the dominant instrumented with electromyography (EMG) leads to measure muscle activity of the flexor carpi radialis (FCR), extensor carpi radialis (ECR), biceps brachii (BB), triceps brachii (TB), anterior deltoid (AD), and latissimus dorsi (LD). The top arm elbow flexion/extension was recorded using an electrogoniometer. Subjects were instructed to shoot with maximal velocity using approach steps. Each subject shot 5 times right-handed and 5 times left-handed. When shooting right-handed, muscle activity was recorded on the top arm. When shooting left-handed, muscle activity was recorded on the bottom arm. All data were collected at 1000 Hz and EMG data band passed filtered (20-50 Hz). Ball release was approximated by identifying maximal elbow extension velocity. EMG data were extracted 0.5 s before (1st phase) and after (2nd phase) this point and average EMG was calculated for each 0.5 s data set for each shooting side. A 2 (top, bottom arm) x 2 (1st phase, 2nd phase) repeated measures ANOVA was used to compare EMG for each muscle.

**RESULTS:** FCR, ECR, and BB were not different between sides or phases (p>.05). AD was 57% more active as a top vs. bottom arm (p<.05). TB and LD were both influenced by the interaction of arm and phase (p<.05) with TB being 144% more active during the 2nd phase for top vs. bottom arm. LD was 73% more active during the 1st phase on the bottom vs. top arm.

**CONCLUSIONS:** There was substantial variability in muscle activity patterns between subjects suggesting level of skill and/or experience likely influences muscle patterns. The main observation was that the LD was more active on the contralateral vs. ipsilateral side in the preparatory movements. For the other muscles, coordination of muscle activity is likely more important than magnitude of activity.

**1922** Board #330 MAY 30 3:30 PM - 5:00 PM

**The Effect On Swimmer's Hydrodynamic Drag Wearing Two Swimsuits**

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(No relationships reported)

The popularization of polyurethane swimsuits has got a large media and sports attention around the pools in the past couple of seasons. However, little scientific evidence was reported in main literature about such relationship in this type of high-tech swimsuits.

**PURPOSE:** To analyze the effect of wearing a swimsuit on swimmer passive drag.

**METHODS:** A computational fluid dynamics analysis was carried-out to determine the hydrodynamic drag of a female swimmer's model: (i) wearing a textile swimsuit (ii) wearing a last generation high-tech swimsuit and; (iii) with no swimsuit, wearing light underwear. The three-dimensional surface geometry of a female swimmer's model with different swimsuit/underwear was acquired through standard commercial laser scanner. Passive drag force and drag coefficient were computed with the swimmer in a prone position at a depth of 0.75 m for a steady flow velocity of 2.0 m/s.

**RESULTS:** Higher hydrodynamic drag values were determined when the swimmer was with no swimsuit in comparison when the swimmer was wearing textile or a high-tech swimsuit. The high-tech swimsuit was the one with lower hydrodynamic drag values, although very similar to textile swimsuit (table 1).

Table 1. Drag coefficient and drag force values to each swimsuit condition.

| Swimsuit condition | Drag coefficient | Drag force (N) |
|--------------------|------------------|----------------|
| Textile suit       | 0.325            | 76.23          |
| High-tech suit     | 0.323            | 75.82          |
| Underwear          | 0.453            | 105.84         |

**CONCLUSIONS:** One can state that wearing a swimsuit may positively influence swimmer's hydrodynamics, especially reducing the pressure drag component. Moreover, minor differences were obtained between a standard and a high-tech swimsuit.

The Portuguese Government supported this work by a grant of the Science and Technology Foundation (PTDC/DES/098532/2008; FCOMP-01-0124-FEDER-009569).

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**1923** Board #331 MAY 30 3:30 PM - 5:00 PM

**Changes in Speed Skating Technique are Related to Changes in Skating Velocity**

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(No relationships reported)

**BACKGROUND:** Efficiency is an important parameter in endurance sports. In speed skating the push-off angle, or effectiveness ( $e$ ), is most likely related to efficiency. As the skating posture favors lactate accumulation resulting in muscle fatigue, we hypothesized that skating efficiency decreases during a race.

**PURPOSE:** To evaluate the change in  $e$  and skating velocity ( $v$ ) during a 5000 m speed skating race and to determine whether  $\Delta e$  is associated with  $\Delta v$ .

**METHODS:** Video recordings were made during a 5000 m ISU World Cup race ( $n = 34$  males). Two JVC mini DV cameras were placed outside the track, in line with the straight part of the lap. Ones every 400 m lap pixel coordinates of the middle of the push-off leg at the height of the hip and the tip of the skate blade were determined just before opening the hinge of the klapskate.  $e$  was determined, as the angle between the push-off leg and the horizontal. The average  $v$  was determined over the same part of the track. To increase precision,  $e$  and  $v$  were averaged over 3 successive laps, and differences were determined between these averages. The association between  $\Delta e$  and  $\Delta v$ , accounting for the effect of part of the race, was determined with Generalized Estimating Equations (GEE).

**RESULTS:** Fig. 1 shows that  $e$  increased and  $v$  decreased during the race.

The interaction between  $\Delta$ lap and  $\Delta e$ , which would indicate a different association between  $\Delta e$  and  $\Delta v$  for each of the  $\Delta$ laps, was not significant. Therefore,  $\Delta$ lap was only included as a confounder in the regression (not significant), which resulted in a significant association between  $\Delta e$  and  $\Delta v$  ( $\beta = -0.066$ ,  $p < 0.001$ ).

**CONCLUSION:** During a 5000 m speed skating race  $e$  increased and  $v$  decreased. Besides that,  $\Delta e$  is significantly associated with  $\Delta v$ , independent of part of the race.

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**1924** Board #332 MAY 30 3:30 PM - 5:00 PM

**Hip And Knee Joint Mechanics During Cutting Maneuver With And Without A Lacrosse Stick**

Manabu Sanomura, Masanori Sakaguchi, Yasuaki Saho, Toru Fukubayashi. Waseda university, Saitama, Japan.

(No relationships reported)

Most non-contact anterior cruciate ligament (ACL) injuries occur during jumping and cutting maneuvers. Women's lacrosse is associated with a higher incidence rate of ACL injuries than other women's sports. Lacrosse-specific movements such as jumping and cutting maneuvers with a lacrosse stick cause compensatory lower limb motions such as excessive knee abduction and hip adduction.

**PURPOSE:** To compare the hip and knee joint kinematics and kinetics during a cutting maneuver with and without a lacrosse stick.

**METHODS:** Nine female collegiate lacrosse players (mean age,  $20.0 \pm 1.3$  years; height,  $159.6 \pm 5.8$  cm; weight,  $55.1 \pm 6.3$  kg; lacrosse experience,  $24 \pm 3.4$  months) participated in this study. Thirty-six reflective markers were placed on the upper limb, trunk, pelvis, and right lower limb. An eight-camera motion analysis system (Motion Analysis Corp.) and a force plate (Kistler Corp.) were used to record the three-dimensional marker positions and ground reaction forces sampled at 240 Hz and 2400 Hz, respectively, during the cutting maneuver. The subjects were instructed to run a distance of 4-5 m and then land with their right foot on a force plate, followed by a change in direction to the left to cut an angle of  $45^\circ$ . Each trial was performed while holding a lacrosse stick in the right hand (with their right and left hands on the top and bottom of the shaft, respectively; RH), left hand (with their left and right hands on the top and bottom of the shaft, respectively; LH), and not holding a lacrosse stick (NH). The peak values of knee abduction angle, hip adduction angle, knee abduction moment, and hip adduction moment during the stance phase of the cutting maneuver were analyzed.

**RESULTS:** The peak hip adduction angle in the RH trial was significantly greater than that in the NH trial ( $5.7 \pm 5.8^\circ$  vs.  $1.1 \pm 7.9^\circ$ ,  $p = 0.041$ ), and the peak hip adduction moment in the RH trial was significantly higher than that in the NH trial ( $2.02 \pm 0.63$  vs.  $1.76 \pm 0.56$  Nm/(kg\*h),  $p = 0.025$ ). The peak knee abduction angle and the peak knee abduction moment were not significant differences between the RH, LH and NH trials.

**CONCLUSION:** The results of this study suggested that the cutting maneuvers with a lacrosse stick have significant effect on hip joint mechanics which has been implicated as a risk factor for non-contact ACL injury compared to those without a lacrosse stick.

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**1925** Board #333 MAY 30 3:30 PM - 5:00 PM

**Rotational Velocities, Pelvic: Torso Separation, and Spiked Ball Velocity in Female Collegiate Volleyball Athletes**

Charlie A. Hicks-Little, Patricia A. Eisenman, FACSM, Michael Waller, Justin Brown, Bader J. Alsarraf. University of Utah, Salt Lake City, UT.

(No relationships reported)

High velocity provides a competitive advantage in volleyball. High ball velocity in other rotational skills, like the baseball pitch and golf swing, is achieved by initiating pelvic rotation before torso rotation (Pelvic Torso Separation Angle) in combination with high rotational velocities of the pelvis and torso. Little is known about the contribution of pelvic and torso rotational velocities and the amount of separation of the pelvic and torso rotation on ball velocity during the spike.

**PURPOSE:** The primary aim of the current study was to examine the influence of peak pelvic rotational velocity (PPRV), peak upper torso rotational velocity (PUTRV), and peak pelvic torso separation angle (PPTSA) on spiked ball velocity (SBV) during both down-the-line (DL) and diagonally across-court (DAC) spikes.

**METHODS:** Three-dimension motion capture analysis was used to examine the kinematics of the volleyball spike and SBV. Fourteen collegiate female players ( $20.9 \pm 2.8$  yrs) were fitted with 21 reflective markers; each performed 10 DL spikes and 10 DAC spikes. Differences in SBV, PUTRV, PPRV, and PPTSA between DL and DAC spikes were determined by using a two-way factor mixed repeated measures factorial ANOVA. Correlations were used to examine relationships between the kinematic variables and SBV.

**RESULTS:** Statistically significant differences between the DL and DAC spikes were observed for SBV ( $17.54 \pm 2.35$  m/s vs.  $15.97 \pm 2.36$  m/s,  $p = 0.039$ ) and for PPTSA ( $-9.16 \pm 5.32^\circ$  vs.  $-12.65 \pm 5.36^\circ$ ;  $p = .043$ ). Moderate positive correlation coefficients were observed between DAC SBV and PPRV during the forward swing phase ( $r = 0.47$ ), PUTRV during the forward swing phase ( $r = 0.66$ ), and PPTSA at the top of the back swing phase ( $r = 0.56$ ). A multiple regression analysis predicting SBV from the rotational variables for DAC spikes resulted in a statistically significant multiple  $R^2$  value ( $R^2 = 0.58$ ). The most important predictor of SBV was PPTSA. Additionally, a low to moderate positive correlation ( $r = 0.31$ ) was observed between SBV and PPTSA at the top of the back swing phase for the DL spikes. A multiple regression analysis for DL spike was not statistically significant.

**CONCLUSION:** PPTSA is an important contributor to DAC SBV. Further research is warranted to determine if PPTSA can be altered, thus improving SBV.

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**1926** Board #334 MAY 30 3:30 PM - 5:00 PM

**Intra-limb Coordination In Karate Roundhouse Kick**

Federico Quinzi, Valentina Camomilla, Paola Sbriccoli. Rome Foro Italico, Rome, Italy. (Sponsor: Carl Foster, FACSM)

(No relationships reported)

**INTRODUCTION:** Intra-limb coordination in sport activities has been the focus of many studies, where it has been quantified using Continue Relative Phase (CRP). In martial arts no previous study investigated lower limb coordination during kicking actions.

**PURPOSE:** The aim of this study is to investigate differences in CRP in elite athletes performing the roundhouse kick, directed respectively to the opponent's face (HRK) and waist (LRK).

**METHODS:** After signing written informed consent, 6 elite karateka volunteered to participate in this study. All subjects performed 3 trials of each kick (HRK; LRK). Pelvis and lower limb kinematics were acquired with a stereophotogrammetric system (Vicon System), using the CAST protocol. Intra-limb coordination was computed for the Hip and Knee joints of the kicking leg

on the sagittal plane starting from the ready stance to knee full extension (considered as the end of the kick). For both joints, the Phase Plots (PP) was generated by plotting the normalized angular displacement vs. the normalized angular velocity (Li et al. 1999). Subsequently, for each joint the angle between the positive horizontal axis and each point of the PP was computed (Phase Angle-PA). The Continue Relative Phase (CRP) was computed by subtracting the PA of the Distal segment from that of the Proximal one. A CRP value of 0 rad means in-phase movement whereas  $\pm 3.14$  rad means anti-phase movement. In order to test for differences between the CRP of HRK and LRK, a repeated measures ANOVA was performed on the CRP mean absolute value (Stergiou et al. 2000) computed on 10% intervals and on CRP mean peak.

**RESULTS:** The CRP differentiated the kicks only from 51 to 80% of the kick corresponding to Hip and Knee flexion phase: being higher in the HRK from 51 to 70% (51-60%: HRK 0.47 $\pm$ 0.07 rad; LRK 0.20 $\pm$ 0.04 rad; 61-70%: HRK 1.13 $\pm$ 0.07 rad; LRK 0.55 $\pm$ 0.08 rad;  $p < .002$ ) and then in the LRK from 71 to 80% (LRK 1.21 $\pm$ 0.14 rad; HRK 0.58 $\pm$ 0.10 rad  $p < .002$ ).

**CONCLUSION:** Kicking height influences the timing but not the magnitude of Hip and Knee flexion-extension CRP mean peak in Karate elite athletes. This difference in timing might be attributed to differences in the occurrence of angular velocity peak between the two joints during the flexion phase.

#### REFERENCES

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**1927** Board #335 **MAY 30 3:30 PM - 5:00 PM**  
**Gender Differences in Plantar Loading During Unanticipated Cutting on FieldTurf**

Conor Irwin, Robert J. Butler, Claude T. Moorman, III, William E. Garrett, Jr, FACSM, Robin M. Queen. *Duke University, Durham, NC.*  
(No relationships reported)

Fifth metatarsal stress fractures are more common in men and have a high incidence of delayed union, non-union, and re-fracture. Cleat plate design has been altered to avoid loading beneath the fifth metatarsal, however, gender differences in loading patterns were not considered in the design process.

**PURPOSE:** To determine if total foot, lateral midfoot (LMF) and lateral forefoot (LFF) loading (as defined by maximum force [MF], contact area [CA], and force-time integral [FTI]) were significantly different between men and women when performing an unanticipated cut on FieldTurf.

**METHODS:** Plantar loading in 32 (16 men, 16 women) healthy, collegiate, recreational athletes was evaluated using the Pedar-X in-shoe system collecting at 100Hz (Novel, St. Paul, MN, USA). Exclusions included any lower extremity injuries in the past 6 months, foot or ankle surgery in the past 3 years, and previous metatarsal stress fractures. Subjects completed 12 unanticipated cutting trials in a firm ground soccer cleat on FieldTurf. Subjects were asked to run straight forward until a light came on to have them cut to the left or right at which time they cut 45 degrees in the indicated direction. The plant foot was used for analysis. A series of independent t-tests were used to examine differences between genders during unanticipated cutting ( $\alpha=0.05$ ).

**RESULTS:** Men were significantly taller and heavier than the women ( $P < 0.001$ ). CA was greater for the women in the LMF (8.3%,  $P=0.046$ ) and the LFF (9.9%,  $P < 0.001$ ). The FTI was greater beneath the total foot for the men when compared to the women (23.9%,  $P < 0.001$ ), with no significant differences in the LMF and LFF. MF was greater for the women than the men in the LMF (21.7%,  $P=0.001$ ) and the LFF (17.2%,  $P=0.001$ ).

**CONCLUSIONS:** During unanticipated cutting, women loaded the lateral column of the foot more than men, which is contrary to the current literature. Future work will need to examine the differences between genders to determine the need for gender specific footwear design as well as to determine if different cleat plate configurations are able to optimize foot loading patterns while completing an unanticipated cutting task.

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**1928** Board #336 **MAY 30 3:30 PM - 5:00 PM**  
**Biomechanical Measures of the Knee Predict Anterior Cruciate Ligament Injury Risk in Female Basketball Athletes**

Heng-Ju Lee, Tung-Hsi Tseng, Yu-Ming Lee. *National Taiwan Normal University, Taipei, Taiwan.*  
(No relationships reported)

Basketball is a sport that involved many pivoting and cutting maneuvers. Female basketball players suffer ACL injuries at a 4- to 6-fold greater rate than do male basketball players. Most ACL injuries in female athletes occur during a noncontact episode, typically during deceleration, lateral pivoting, or landing tasks that are often associated with high external knee joint loads and high anterior knee shear forces.

**PURPOSE:** To determine ACL injury risk factors between cutting and cross over step maneuvers in female basketball athletes.

**METHODS:** There were 12 healthy female basketball players participated in this study (age: 20.3 $\pm$ 1.8 yrs; height: 174.2 $\pm$ 5.3 cm; weight: 62.5 $\pm$ 5.8 kg). Subjects were instructed to perform a vertical jump, raising both arms to touch the target, which was set at their 50% maximum jump height. Subjects landed with both feet at the same time on separated force plates, then immediately performed cutting or cross over step to the dominant side and kept running for 3 meters. Leg dominance was defined as the leg that would be used to kick a ball. Subjects performed 5 successful trials in each step maneuver with 30 s of rest between trials to minimize the potential effects of fatigue. The motion capture system consisted of 10 digital cameras (200Hz) (Vicon, UK) were used to collect 3D trajectories from 28 reflective markers. The 2 force platforms (Kistler, Germany) collected GRF data at 1000 Hz and were time synchronized with the motion capture data. One-way ANOVA with significance level of 0.05 was used to compare biomechanical measures of the supporting leg between two different step maneuvers.

**RESULTS:** Knee anterior shear force (5.05 $\pm$ 1.88 vs. 3.55 $\pm$ 1.17 N/kg,  $p < 0.05$ ), knee valgus moment (0.66 $\pm$ 0.17 vs. 0.20 $\pm$ 0.10 Nm/kg,  $p < 0.05$ ) and hip flexion moment (0.81 $\pm$ 0.60 vs. 0.51 $\pm$ 0.34 Nm/kg,  $p < 0.05$ ) during cutting were significant greater than cross over step maneuver of the supporting leg.

**CONCLUSION:** Knee anterior shear forces and valgus moments were the primary predictors of ACL injury risk. Physiologic valgus torques on the knee can increase anterior tibial translation and loads on the ACL by several-fold. The current findings indicate that female basketball players might have higher risk of knee injury during cutting step than cross over step maneuver. Supported by NSC grant 100-2628-H-003-013-MY2.

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**1929** Board #337 **MAY 30 3:30 PM - 5:00 PM**  
**Footwear Intervene in Typical Badminton Movement**

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(No relationships reported)

Badminton is very popular physical exercise in all age groups in modern world.

**PURPOSE:** This study aim to investigate the footwear function in badminton sports through biomechanical analysis of typical maneuver. We want to find out whether the professional shoes for badminton existing better advantage or not.

**METHODS:** Twenty subjects participated in this study are badminton players with more than six years training experience. Two different of kinds shoes were selected, one is professional badminton shoes (BS), the other is ordinary training shoes (TS). The badminton ball speed was controlled through the same dropping height, while the subjects were required to hit the ball by lunge step using the same racket. Dynamic foot loading force was measured by force platform (Kistler AG, Winterthur, Switzerland). The testing order of two kinds of shoes was random assigned to the subjects.

**RESULTS:** The contact time of whole lunge step in BS is significantly larger than the TS ( $P < 0.05$ ), as the mean value of movement completion in former condition is 0.68s, and the latter condition is 0.59s. Although the peak reaction force in BS (961N) is smaller than this in TS (978N), no significant different exist ( $P > 0.05$ ). Meanwhile, the peak friction force in BS is significantly larger than this in TS (386N vs. 361N,  $P < 0.05$ ).

**CONCLUSIONS:** From the experimental results finding in this study, it suggested that BS had certain advantages in preventing injury and improving performance through the good ground grip ability. The cause is likely that material and stripe pattern in the sole of BS can better increase friction between outsole and ground.

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1930 Board #338 MAY 30 3:30 PM - 5:00 PM

**Drop Landing Impact Forces in Figure Skaters vs. Non-skaters**

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(No relationships reported)

Success of competitive figure skaters (FS) is heavily dependent on the quality of jump landings. Though landing technique is emphasized during training, most FS injuries occur in the lower back and lower extremities. Impact force properties such as time to stabilization (TTS) of ground reaction forces (GRF) and peak relative GRF (GRF<sub>R</sub>) are of interest due to their potential implications on injury risk.

**PURPOSE:** Our specific aim was to determine the ability of TTS and GRF<sub>R</sub> to discriminate between FS and non-skater controls (NS). To achieve our aim, we tested the hypotheses that for a backward single leg landing (SLL) test, compared with NS: 1) FS would have lower TTS; and, 2) greater GRF<sub>R</sub>.

**METHODS:** Twenty-six female FS (14.7±4.5 yr, and 50.4±11.8 kg) with a wide range of competition experience (5.4±3.1 yr) and 18 NS controls (15.4±5.3, and 54.1±14.7 kg) completed three trials of a backward SLL from a 20cm high platform. GRF data along the mediolateral (M-L), anteroposterior (A-P), and vertical axes were collected from a single force plate at 1000 Hz and subsequently low-pass filtered at 10 Hz with a fourth-order and zero-lag Butterworth filter. From that data we were able to calculate TTS and GRF<sub>R</sub>. Between-group differences in TTS (M-L, A-P, and vertical) and GRF<sub>R</sub> (M-L, A-P, and vertical) were determined with two-tailed two-sample t-tests. Significance level was set *a priori* at  $P < 0.05$ .

**RESULTS:** While there were no differences between FS and NS in M-L TTS (2.44±0.54 s, and 2.50±0.50 s, respectively), FS had significantly greater A-P TTS (2.86±0.10 s vs. 2.75±0.11 s) and vertical TTS (2.38±0.07 s vs. 2.22±0.07 s). FS had significantly greater GRF<sub>R</sub> along the M-L (1.97±0.93 vs. 1.12±0.48 N/kg), A-P (10.42±3.34 vs. 2.24±1.63 N/kg), and vertical (37.64±7.60 vs. 30.28±6.62 N/kg) axes.

**CONCLUSIONS:** Hypothesis one was not supported as FS exhibited greater TTS than NS along the A-P and vertical axes. This may have been due to the unfamiliarity of landing barefoot rather than in a skate boot, and/or of landing in a stationary position rather than gliding backwards. Hypothesis two was supported as FS demonstrated greater GRF<sub>R</sub> than NS along all three axes, a result previously documented in gymnasts. Future studies should explore the effectiveness of interventions aimed at decreasing GRF<sub>R</sub> in FS either through technique or equipment modifications.

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1931 Board #339 MAY 30 3:30 PM - 5:00 PM

**Analyzing Track Sprint Cyclists' Performances Using Position-Specific Maximal Torque- And Power-Cadence Relationships**

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(No relationships reported)

Performances produced during maximal sprint cycling are generally analyzed in reference to maximal Torque-Cadence (T-C) and Power-Cadence (P-C) relationships. This analysis requires that the performance's conditions that define the interaction between neural, muscular and mechanical processes closely match the testing conditions for which maximal T-C and P-C relationships were measured. Because track sprint cyclists perform in both standing and seated positions, maximal T-C and P-C relationships have to be determined for both positions in order to analyze the performances.

**PURPOSE:** To determine maximal T-C and P-C relationships of sprint track cyclists in seated and standing positions.

**METHODS:** Maximal Torque-Cadence (T-C) and Power-Cadence (P-C) relationships were calculated for eight junior elite track cyclists from the National Talent Identification and Victorian Institute of Sport track squads. T-C and P-C relationships were calculated from four all-out sprints performed in standing and seated positions. Maximal sprints in a standing position were performed on a carbon fiber track bike at the velodrome. Maximal sprints in a seated position were performed on an air-braked stationary ergometer in a laboratory. A calibrated SRM power meter (science version) interfaced to a custom instrumentation package was used for all mechanical measurements. Maximal T-C and P-C relationships were analyzed to calculate the following variables: maximal Torque (T<sub>0</sub>), maximal Power (P<sub>max</sub>) and optimal pedaling cadence (PC<sub>opt</sub>). Paired t-tests were used to compare variables measured during seated and standing efforts. Significance level was set as  $p < 0.05$ . Mean and SD values were reported.

**RESULTS:** All individual T-C and P-C relationships obtained for both body positions were fitted by linear regressions ( $r^2 = 0.95 \pm 0.02$ ) and second order polynomials ( $r^2 = 0.96 \pm 0.01$ ), respectively. Comparisons of the T-C and P-C relationships showed that T<sub>0</sub> was higher (209 ± 2.2N.m vs. 177.0 ± 3.9N.m,  $p < 0.05$ ), PC<sub>opt</sub> was lower (112.5 ± 11.4rpm vs. 120.1 ± 6.7rpm,  $p < 0.05$ ), and P<sub>max</sub> was higher (1261 ± 235W vs. 1076 ± 183W,  $p < 0.05$ ) in standing position.

**CONCLUSIONS:** The analysis of track sprint cyclists' performances can be improved by the determination of position-specific maximal T-C and P-C relationships.

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1932 Board #340 MAY 30 3:30 PM - 5:00 PM

**Grip Force And Muscle Activity Are Associated With Kinematics In The Golf Swing**

James Parker, M Charlotte Olsson, Sofia Brorsson. *School of Business and engineering, Halmstad, Sweden.*  
(No relationships reported)

**PURPOSE:** : Golf is a popular sport in the world, today there is little limited

information in the literature that discusses the hand motion and grip force and its relation to the golf swing. A better understanding of how the interaction between grip force, muscle activity and coordination influences the shot length in a golf swing would be beneficial to improve the game for both elite and recreational golfers. Thus, the purpose of this study was to analyze if grip force (finger extension and flexion force) and muscle activity in the forearm were associated to kinematics in the golf swing and to shot length.

**METHODS:** Seven elite golf players (mean age: 22±2 years) were included in the study. Primary outcomes were shot length, finger extension- and flexion force, and muscle activity measured with surface electromyography on the m. extensor digitorum communis (EDC) and the m. flexor carpi radialis (FCR) when performing a golf swing. Maximal voluntary isometric contraction for flexion- and finger extension force was measured on the dominant hand. Each subject was instructed to take five 'normal' swings with their 7-iron and hit into a net 8 meters from the tee area. EMG was synchronized with kinematic data and split the swing up in three phases, backswing, downswing and follow through.

**RESULTS:** Finger extension force was 54±20 N and grip force was 428±108 N in the group. Both extension ( $r_s = 0.81$ ,  $p < 0.01$ ) - and flexion force ( $r_s = 0.78$ ,  $p < 0.01$ ) were positively associated with shot length. Muscle activity in both FCR and EDC were significantly different in the three swing phases ( $p = 0.02$ ), and the muscle activity in all phases were related to shot length ( $p = 0.02$ ).

**CONCLUSIONS:** This study showed that increased grip force and muscle activity in all phases of the swing is positively associated with shot length. These results indicates that both maximal grip force and high muscle activity in the FCR and EDC can be important factors for increasing shot length, and that a highly coordinated pattern between these muscles are useful in order to maximize shot distance.

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1933 Board #341 Abstract Withdrawn

1934 Board #342 MAY 30 3:30 PM - 5:00 PM

**Different Pacing Strategies during Time Trials in 18°C and 30°C.**

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(No relationships reported)

Sports performance depends on the rate at which energy can be expended and on the distribution of energy during an event (pacing strategy). Pacing strategy is organized in an anticipatory way to optimize performance and to prevent unreasonable large homeostatic disturbances during exercise. It is not known to what extent a preceding, fatiguing fixed intensity exercise at different ambient temperatures influences pacing strategy during a time trial (TT).

**PURPOSE:** Therefore, the purpose is to examine differences in pacing strategy during a TT in normal and high ambient temperature preceded by 60min of exercise at these temperatures.

**METHODS:** Subjects performed 60min fixed intensity exercise at 55%  $W_{max}$  preceding a TT in 18°C (n=37,  $W_{max}$  344±36W) and 30°C (n=41,  $W_{max}$  341±37W). All subjects were male and endurance-trained. During the TT a predetermined amount of work had to be completed. The TT was started at 75% $W_{max}$ , but subjects were free to change resistance as desired from the onset of exercise. Power output was collected every second and averaged in 5% segments of total TT for statistical analysis.

**RESULTS:** Average TT time in 18°C was 30.7±2.1min, while in 30°C this was 37.8±4.7min (P<0.001). In 18°C there were no differences between the 5% segments and average power output (even paced). In 30°C, subjects decreased power output during the initial 15% of the TT (P=0.008), followed by a slight decrease in power output until it was significantly lower compared to average power at 85% of the TT (P=0.031), when an end spurt commenced. In the heat, final power was significantly higher compared to the average power (P=0.045).

**CONCLUSION:** These data provide evidence for different pacing strategies in different environmental temperatures. After fixed intensity exercise in 18°C, subjects choose an even-paced, strategy until the last 5% of the TT, where there was a non-significant end spurt. In the heat subjects significantly decrease power at the start and an end sprint is obvious in the last 15% of the TT. These data indicate that subjects anticipate to different environmental circumstances and volitionally adapt pacing strategy.

**Acknowledgements;** Bart Roelands is a post-doctoral fellow of the Fund for Scientific Research Flanders (FWO). This study is supported by a VUB research fund (OZR 1236).

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1935 Board #343 MAY 30 3:30 PM - 5:00 PM

### Modeling Relationships between Swimming Attributes for Performance Prediction

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(No relationships reported)

Swimming is a high profile sport in which an athlete with the fastest overall time wins and even a very small difference in overall times is decisive for medal winning. The inter-relationships between different swimming attributes and the overall time can be used to predict and optimize overall times hence to increase the medal winning chance.

**PURPOSE:** To model pair-wise inter-relationships between swimming attributes and the overall time, predict overall swim times, and train for optimal strategies.

**METHODS:** A linear regression analysis was performed to model the pair-wise inter-relationships between swimming attributes and the overall times in specific subsets of swims from a database of international events, filtered based on sex, age group, stroke, pool size, and distance. The F-statistic was calculated to evaluate regression models.

**RESULTS:** Examples of the results are shown in Table 1. In many cases, as evidenced by the small F-statistics, no significant relationship was found between attributes. We found this was the result of many missing values for those attributes. In some cases, no values were reported for the performance attributes, resulting in a “-” in Table 1. In some other cases, e.g., breath count in M, freestyle, 50m, lcm, open swims, a significant relationship was found thus the model could be used for predicting overall times.

**CONCLUSION:** The linear regression analysis of swimming attributes requires more sophisticated analysis that can handle the large number of missing values. Where enough data exists; however, this model can effectively be used for prediction of overall swim times.

**Table 1.** Examples of the evaluation results of linear regression analysis of swimming performance attributes and overall times

| Swims (sex, stroke, distance, pool size, age group) | F-statistic for some swimming performance attributes |             |            |               |              | #instances |
|---|--|-------------|------------|---------------|--------------|------------|
|   | Start time   | Finish time | Block time | Breakout time | Breath count |            |
| M, breaststroke, 100m, lcm, open                    | 1.3002   | 0.1871      | 0.6533     | -             | -            | 1070       |
| M, butterfly, 50m, lcm, open                        | 0.0007   | 0.0143      | 0.0099     | 9.2492        | 11.0256      | 754        |
| M, freestyle, 50m, lcm, open                        | 1.6383   | 2.2238      | 0.0511     | 7.2940        | 213.4720     | 1500       |
| F, breaststroke, 50m, lcm, open                     | 0.4759   | 1.0064      | 0.0031     | 0.1794        | 0.0995       | 704        |
| F, individual medley, 200m, lcm, open               | 0.2015   | 1.5870      | 1.1935     | -             | -            | 943        |
| F, freestyle, 50m, lcm, open                        | 0.0483   | 0.0166      | 0.0140     | 0.0247        | 0.4643       | 1525       |

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1936 Board #344 MAY 30 3:30 PM - 5:00 PM

### Delivery and Pitch Type Alter Ground Reaction Forces in Baseball Pitching

Michael E. Feltner, FACSM, Garrett Kass. *Pepperdine University, Malibu, CA.*

(No relationships reported)

Ground reaction forces (GRFs) exerted on a pitcher in reaction to the push of their legs against the ground create torques about the center-of-mass (CM) and generate the angular momentum necessary to rotate the body, including the segments of the throwing arm. Thus examination of GRFs provides insight into the causal mechanisms responsible for segmental rotation in baseball pitching.

**PURPOSE:** To determine the effects of delivery [wind-up (WU) vs. stretch (ST)] and pitch type [fastball (FB) vs. change-up (CU)] on GRFs in pitching.

**METHODS:** Eight collegiate baseball pitchers (3 right-handed and 5 left-handed) provided voluntary informed consent and threw maximal effort FB and CU pitches from the WU and ST positions from a regulation indoor pitching mound. Five pitches of each type were thrown from each delivery position. Two Kistler (Model 9281B) force plates mounted rigidly to the floor and imbedded in the pitching mound recorded GRFs (1200 Hz) under the push-off and stride foot, respectively. A video camera (60 Hz) was used to estimate the instant of ball release and a radar gun (JUGS Pro-Sports Model; accuracy ± 0.25 m/s) recorded ball speed. Comparisons of the GRF variables were made using two-way repeated measures ANOVA.

**RESULTS:** As expected, FB pitches had a higher ball speed relative to CU pitches (37.3±1.3 vs. 32.9±1.9 m/s, p<0.01); ball speed did not differ by delivery type. No pitch by delivery interactions were present. FB pitches had larger peak magnitude GRFs exerted in the anterior direction (direction of the pitch) on the push-off foot (FB: 0.78±0.13; CU: 0.75±0.14 BW; p<0.05) and exerted in the posterior direction on the stride foot (FB: -1.12±0.13; CU: -1.03±0.12 BW; p<0.01). WU pitches had larger mediolateral GRFs directed toward the throwing arm side exerted on the push-off foot (WU: 0.14±0.03; ST: 0.07±0.04 BW; p<0.01) and larger GRFs directed perpendicular to the surface of the mound (WU: 1.94±0.32; ST: 1.84±0.30 BW; p<0.05) exerted on the stride foot.

**CONCLUSIONS:** FB pitches require greater anteriorly directed forces on the push leg to accelerate the pitcher forward and larger posteriorly directed forces on the stride leg to decrease the forward momentum of the pitcher. WU pitches involve a greater mediolateral range-of-motion of the CM and require larger mediolateral forces exerted on the push-off foot.

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1937 Board #345 MAY 30 3:30 PM - 5:00 PM

### Influence Of Exercise-induced Fatigue On Submaximal And Maximal Joint-specific Power Production

Steven J. Elmer<sup>1</sup>, Camden S. Marshall<sup>1</sup>, Kyle W. Wehmanen<sup>1</sup>, Markus Amann<sup>1</sup>, John McDaniel<sup>2</sup>, David T. Martin<sup>3</sup>, James C. Martin, FACSM<sup>1</sup>. <sup>1</sup>University of Utah, Salt Lake City, UT. <sup>2</sup>Kent State University, Kent, OH. <sup>3</sup>Australian Institute of Sport, Canberra, Australia.

(No relationships reported)

Previous authors have reported reductions in maximum power after high-intensity endurance exercise. Exercise-induced changes in power produced by ankle, knee, and hip joint actions (joint-specific powers), however, have not been reported.

**PURPOSE:** To evaluate joint-specific power production *during* a cycling time trial (TT) and also compare *pre- to post-TT* changes in maximal cycling (MAX<sub>cyc</sub>) joint-specific powers.

**METHODS:** Ten male cyclists performed MAX<sub>cyc</sub> trials (90 rpm) before and after a 10 min TT (288 ± 10W, 90 rpm). Pedal forces and limb kinematics were determined with a force-sensing pedal and an instrumented spatial linkage, respectively. Joint-specific powers were calculated and averaged over complete pedal cycles and over extension and flexion phases.

**RESULTS:** Absolute pedal and joint-specific powers did not change during the TT. Pedal power produced during post-TT MAX<sub>cyc</sub> was reduced by 32 ± 3% (P < 0.001) relative to pre-TT. Relative pre- to post-TT changes in ankle plantar flexion (43±5%) and knee flexion powers (52 ± 5%) were similar but were greater than changes in knee extension (12 ± 4%) and hip extension powers (28 ± 6%) (P < 0.05). Pedal and joint-specific powers produced during post-TT MAX<sub>cyc</sub> were greater than those powers produced during the final 3s of the TT (P < 0.05).

**CONCLUSION:** Exercise-induced changes in MAX<sub>cyc</sub> power manifested with differential power loss at each joint action with ankle plantar flexion and knee flexion exhibiting relatively greater fatigue than knee extension and hip extension. However, changes in MAX<sub>cyc</sub> joint-specific powers were not presaged by changes in TT joint-specific powers. Despite working near maximal effort at the end the TT, participants had considerable neuromuscular reserve as they were able to produce substantially greater power during post-TT MAX<sub>cyc</sub>. We conclude that fatigue induced via high-intensity cycling does not alter submaximal joint-specific power production but has distinct functional consequences for maximal cycling joint-specific powers.

**1938** Board #346 **MAY 30** **3:30 PM - 5:00 PM**

**Kinematic Factors Related to Accuracy for Placekicking in American Football**

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(No relationships reported)

American football placekickers can score a majority of the team's points and often determine the outcome of a game. Despite the importance of the position and the popularity of football, little effort has been made to quantify the biomechanical aspects of placekick accuracy.

**PURPOSE:** To analyze biomechanical factors known to be related to accuracy during made and missed placekicks.

**METHODS:** Five experienced male placekickers were analyzed in three-dimension using two cameras (JVC 240Hz) and motion analysis software (Vicon-Peak Performance Inc. Motus). Each subject performed seven trials, kicking from 40 yards away from the post and dead center. Five variables known to affect kicking accuracy were selected: body lean angle (BL), side arm angle (SA), approach angle (AA), mediolateral plant foot distance from the ball (MLD), and anteroposterior plant foot distance from the ball (APD). All variables were analyzed using dependent t-test ( $\alpha = 0.01$ , SPSS, Chicago, IL).

**RESULTS:** No significant differences were found between made and missed placekicks (Table 1).

**CONCLUSION:** For the variables measured, the findings indicate no significant changes in placekicking mechanics between kicks that were made or missed. The participants in this study performed similar mechanics between kicks and can be considered "well coached" in terms of current coaching perspectives. This indicates the overall complexity of the placekick. The findings necessitate further biomechanics research, particularly with the timing aspects of the placekick.

Table 1. Average body lean angle (BL), side arm angle (SA), approach angle (AA), mediolateral plant foot distance (MLD), and anteroposterior plant foot distance (APD) measurements for made and missed attempts.

|         | BL (deg)     | SA (deg)     | AA (deg)   | MLD (m)         | APD (m)        |
|---------|--------------|--------------|------------|-----------------|----------------|
| Made    | 208<br>(±18) | 102<br>(±10) | 34<br>(±3) | 0.39<br>(±0.05) | 0.18<br>(±.10) |
| Missed  | 207<br>(±21) | 97<br>(±10)  | 34<br>(±3) | 0.36<br>(±.08)  | 0.18<br>(±.09) |
| p level | 0.81         | 0.14         | 0.97       | 0.46            | 0.96           |

**1939** Board #347 **MAY 30** **3:30 PM - 5:00 PM**

**Automatic 3D Motion Capture of Swimming: Marker Resistance**

Per-Ludvik Kjendlie, Bjørn Harald Olstad. *Norwegian School of Sport Science, OSLO, Norway.*  
(No relationships reported)

Motion capture (mo-cap) of swimmers have traditionally been done using manual digitalization of body points. New technology makes automatic 3D mo-cap available for aquatic purposes, and necessitates methodological studies.

**PURPOSE:** The aim of this study was to pioneer a 3D automatic mo-cap system used on human swimmers and to find the increased drag on human swimmers due to mo-cap markers attached to a swimmers body.

**METHODS:** Two subjects performed a total of 80 push offs with an 8 m underwater gliding phase. During each test, the velocity of the swimmers body was recorded using a Qualisys automatic tracking 3D motion capture system. Six underwater motion capture cameras (Oqus Underwater, Qualisys, Sweden) recorded spherical markers attached to the swimmer, using cyan LED light. Using inverse dynamics the drag coefficient was estimated in 40 tests wearing only 3 markers and compared to 40 tests where a total of 24 markers were attached to the swimmer. All markers had a diameter of 19mm.

**RESULTS:** The mean (±sd) passive drag coefficient when gliding with 24 markers was 30.49±1.72 and 26.37±0.96 for the two subjects respectively. Without markers the drag coefficients were 28.49±1.40 and 23.87±0.97 respectively. There was a statistically significant higher drag when wearing markers compared to without (p<0.01), the difference averaging to 7% and 10% for the two subjects respectively, and the effect sizes were large and 1.17 and 2.57 respectively.

**CONCLUSION:** Although spherical markers at a sufficient size are necessary for accurate motion capture under water, these markers create a significant increase in the passive drag of swimmers. This should be taken into account when making kinematical analyses with this system in the aquatic space. The results of this paper are limited to passive drag, and it should be expected that different results appear when active drag is considered.

**B-41 Free Communication/Poster - Strategies to Reduce Heat Stress**

MAY 30, 2012 1:00 PM - 6:00 PM  
ROOM: Exhibit Hall

**1940** Board #348 **MAY 30** **2:00 PM - 3:30 PM**

**Passive Cooling Effects on Microenvironmental and Thermoregulatory Responses in Soft Body Armor in Hot Environments**

Greg A. Ryan<sup>1</sup>, Charles P. Katica<sup>1</sup>, Stacy H. Bishop<sup>1</sup>, Robert L. Herron<sup>1</sup>, Andy M. Bosak<sup>2</sup>, Phillip Bishop<sup>1</sup>. <sup>1</sup>University of Alabama, Tuscaloosa, AL. <sup>2</sup>Georgia Southwestern State University, Americus, GA.  
(No relationships reported)

It has been well established that convective heat loss is reliant on the temperature gradient between the skin and the microenvironment and the volume of air movement over the skin. When either is compromised, excess heat is stored, raising core body temperature (T<sub>rec</sub>). This heat storage is further attenuated when an individual is wearing soft body armor (SBA) which inhibits

convective and evaporative heat loss. In the case of police and military personnel, where SBA use is required, any reduction in heat storage may be able to greatly reduce mortality and morbidity from heat injury. One way to possibly circumvent this excess heat storage is to promote the “chimney effect”, which can be achieved by promoting airflow through bodily movement or by creating venting, and may be beneficial in controlling heat strain.

**PURPOSE:** The purpose of this study was to investigate the effects of adding 1.27 cm standoffs to a Class II Soft Body Armor (SBA) on heat strain and perceived comfort compared to traditionally worn SBA.

**METHODS:** A counterbalanced, repeated measures protocol was performed with seven volunteers (20 ± 2 yr). Prior to each trial, participants were outfitted with a SBA in a traditional vest carrier or one fitted with 1.27 cm standoffs which moved the SBA off the body. Each participant performed cycles of 12 minutes of walking (1.25 L/min) and three min of arm curls (14.3 kg, 0.6 L/min) with a five min rest after every other cycle for a total of 120 min in a hot, humid environment (32°C, 80% RH). During each trial the following variables were recorded every six min: T<sub>rec</sub>; SBA microclimate (temperature and humidity [iButtons]); skin temp (forearm, chest); heart rate; thermal comfort; and perceived exertion. Sweat rate was calculated at the end of each trial. Paired t-tests were used to evaluate: T<sub>rec</sub> (main determinant); microclimate; heart rate; sweat rate; perceived exertion; and comfort.

**RESULTS:** No significant differences (p < 0.05) were noted between the standoff condition and the control in any of the variables tested. The microclimate under the SBA was warmer than the macroclimate during the majority of the tests.

**CONCLUSIONS:** The results indicate that in a controlled environment, the addition of standoffs on Class II SBA did not improve the body’s ability to dissipate heat relative to traditional SBA.

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**1941** Board #349 **MAY 30** **2:00 PM - 3:30 PM**

**Passive Vents in CB Uniforms During Low Dressed States Improve Tolerance During High Dress States**

Tom M. McLellan, FACSM<sup>1</sup>, Cathy Boscarino<sup>1</sup>, EJ Scott Duncan<sup>2</sup>. <sup>1</sup>DRDC - Toronto, Toronto, ON, Canada. <sup>2</sup>DRDC - Suffield, Medicine Hat, AB, Canada.  
(No relationships reported)

New lightweight protective assault uniforms (PTAUs) that can be worn as a stand-alone uniform and provide, as required, protection in a chemical and biological (CB) environment are being developed for unique tactical combat situations. The PTAU is designed to lower heat strain and increase tolerance time (TT) when worn in the highest protective dressed state (DS<sub>high</sub>) but also is intended to replace the battle dress uniform (BDU) and worn when the threat is low, during DS<sub>low</sub>.

**PURPOSE:** The purposes of these studies were twofold; first, to examine whether the use of vents in the arms, legs and chest of the PTAU reduced heat strain during DS<sub>low</sub>, and second, to determine whether the use of vents in the PTAU improved TT after the transition to DS<sub>high</sub> compared with the use of the BDU and overgarment (BDU+O).

**METHODS:** In study 1, six males (27 ± 4 y, 77 ± 9 kg, 177 ± 5 cm) performed a familiarization session and 4 trials (2 PTAUs with vents open or closed) at 35°C and 50% relative humidity with low wind (1 m/s) walking at 4.5 km/h for 90 min in DS<sub>low</sub>. For study 2, seven males (27 ± 4 y, 78 ± 8 kg, 177 ± 5 cm) performed 3 trials (2 PTAUs with vents open during DS<sub>low</sub> and BDU+O) which included up to a further 90 min in DS<sub>high</sub>. All trials included wearing a helmet, fragmentation and tactical assault vests, and carrying a rifle.

**RESULTS:** In Study 1, core temperature (T<sub>c</sub>), heart rate and vapor pressures over the thigh and shin were reduced significantly during DS<sub>low</sub> at 90 min when vents were open (37.9 ± 0.2°C, 120 ± 10 b/min, 3.7 ± 0.4 and 3.5 ± 1.0 kPa) vs closed (38.0 ± 0.1°C, 127 ± 5 b/min, 4.3 ± 0.3 and 4.6 ± 0.5 kPa). The vents had no effect on weighted mean skin temperature, ratings of perceived exertion or thermal comfort. In Study 2, there was no difference in physiological strain during DS<sub>low</sub> when the vents were open with the PTAUs compared with BDU. After the transition to DS<sub>high</sub> the rate of increase in T<sub>c</sub> was reduced and TT increased significantly with the PTAUs (1.1 ± 0.2°C/h and 46 ± 24 min) vs BDU+O (1.6 ± 0.2°C/h and 33 ± 16 min).

**CONCLUSION:** It was concluded that the use of vents in the legs of the PTAU reduced heat strain during DS<sub>low</sub> when a fragmentation vest was worn and a rifle was carried. Further, physiological strain during DS<sub>low</sub> with the use of vents in the PTAU was similar to the BDU thereby extending TT and reducing the increase in T<sub>c</sub> after the transition to DS<sub>high</sub> compared with BDU+O.

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**1942** Board #350 **MAY 30** **2:00 PM - 3:30 PM**

**Bomb Disposal In The Tropics: An Explosive Cocktail Of Environmental And Metabolic Heat**

Ian B. Stewart, Andrew D. Townshend, Amanda M. Rojek, Andrew P. Hunt. *Queensland University of Technology, Brisbane, Australia.* (Sponsor: Ed Melanson, FACSM)  
(No relationships reported)

Bomb technicians perform their work while encapsulated in explosive ordnance disposal (EOD) suits. Designed primarily for safety, these suits have an unintended consequence of impairing the body’s natural mechanisms for heat dissipation. In tropical environments the potential for heat illness is increased.

**PURPOSE:** To quantify the heat strain encountered during an EOD operational scenario in the tropical north of Australia.

**METHODS:** All active police bomb technicians, located in a tropical region of Australia (n=4, experience 7±2.1 yrs, age 34±4.9 yrs, height 183±4.7 cm, body mass 89±6.6 kg, VO<sub>2max</sub> 43±4.6 mL/kg/min) undertook an operational scenario wearing the Med-Eng EOD 9 suit and helmet (weight ~35 kg). The climatic conditions ranged between 27.1-31.8°C ambient temperature, 66-88% relative humidity, and 30.7-34.3°C wet bulb globe temperature. The scenario involved searching a two story non air-conditioned building for a target; carrying and positioning equipment for taking an x-ray; carrying and positioning equipment to disrupt the target; and finally clearing the site. Core temperature (ingestible pill) and heart rate were continuously monitored, and were used to calculate a physiological strain index (PSI; 1 - no/little strain, 9 - very high strain). Urine specific gravity (USG) assessed hydration status and heat associated symptomatology was reported.

**RESULTS:** The scenario was completed in 120±22 mins (24±0.4% work, 76±0.4% rest/recovery). Maximum core temperature (38.33±0.21°C), heart rate (173±5.4 bpm, 94±3.3 %max), PSI (7.05±0.44) and USG (1.031±0.002) were all significantly elevated. Heat associated symptomatology highlighted that moderate-severe levels of fatigue and thirst were universally experienced, with muscle weakness and heat sensations also experienced by 75% of the bomb technicians. Neurological symptoms of light-headedness, dizziness and confusion were also reported.

**CONCLUSION:** All bomb technicians demonstrated moderate-high levels of heat strain, evidenced by elevated heart rate, core body temperature and PSI. Severe levels of dehydration and noteworthy heat-related symptoms further highlight the risks to health and safety faced by bomb technicians operating in tropical locations.

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**1943** Board #351 **MAY 30** **2:00 PM - 3:30 PM**

**Effects of Loggers’ Protective Clothing on Thermoregulation**

Aitor Coca, Jeffrey B. Powell, Jung-Hyun Kim, W. Jon Williams, Raymond J. Roberge. *NIOSH/NPPTL, Pittsburgh, PA.*  
(No relationships reported)

Heat stress is common among forestry workers, including loggers.

**PURPOSE:** Evaluate the thermal responses to wearing loggers’ protective clothing (LPC) while performing moderate intensity exercise in the heat.

**METHODS:** Six healthy male participants performed two trials of treadmill exercise in a warm environmental chamber (35°C, 50% relative humidity [RH]) while wearing either sports clothes (CON) or LPC which included a safety vest, chainsaw chaps, gloves, safety helmet, long trousers, long sleeve shirts, wool socks and boots. The study protocol consisted of two stages of 20 min of exercise at a relative workload of 30% and 50% VO<sub>2max</sub>. The participants then performed a chainsaw maneuver (sawing motion against a vertical object) for 1 min followed by a recovery period (15 min rest) in the chamber. Study variables included core temperature (T<sub>co</sub>), mean skin temperature (T<sub>sk</sub>), and heart rate (HR). Data were analyzed by two-way (Trials × Time) repeated measures ANOVA.

**RESULTS:** All 6 subjects (CON) completed 41 min of exercise for CON, but only averaged 38.7 min of exercise (37.7 min treadmill and 1 min chainsaw maneuver) while wearing LPC. T<sub>co</sub> in the LPC was higher than CON. However, it was only statistically higher in the recovery time suggesting that wearing LPC in warm environments hinders the recovery of the users.



| Trial | Variables | Start of Ex | 20min<br>30%VO2max | 20 min<br>50%VO2max | 1min<br>Sawing | 15 min<br>Recovery |
|-------|-----------|-------------|--------------------|---------------------|----------------|--------------------|
| CON   | Tco       | 37.2(0.3)   | 37.4(0.3)          | 37.8(0.2)           | 37.8(0.2)      | 37.6(0.2)*         |
|       | Tsk       | 33.1(0.5)   | 34.9(0.4)*         | 35.4(0.8)*          | 35.5(0.7)*     | 35.1(0.4)*         |
|       | HR        | 93.3(5.9)   | 103.6(11.3)*       | 132.3(4.6)*         | 132.1(10.2)*   | 84.3(8.6)          |
| LPC   | Tco       | 37.2(0.2)   | 37.5(0.2)          | 38.1(0.4)           | 38.2(0.4)      | 38.3(0.3)*         |
|       | Tsk       | 33.5(0.7)   | 35.9(0.2)*         | 36.4(0.4)*          | 36.4(0.4)*     | 36.4(0.3)*         |
|       | HR        | 103.5(13.2) | 120.5(12.8)*       | 168.4(11.4)*        | 162.8(10.5)*   | 100.7(14.6)        |

\*Significant differences between same stages in the different tests (p<0.05)

**CONCLUSION:** Wearing LPC while exercising in the heat at the study specific workloads did impose a significant thermal burden on the wearer evidenced by the elevated HR and Tsk values in the LPC. Tco did not decrease in 15min recovery, showing that LPC imposes a thermal load on the user that may cause heat stress over time if no actions are taken to limit the risk.

**1944 Board #352 MAY 30 2:00 PM - 3:30 PM**

**Physiological and Perceptual Responses to Acute Firefighting Activity in Different Turnout Gear Ensembles**

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(No relationships reported)

Firefighters (FFs) routinely perform demanding physical work in extreme environmental temperatures. In addition, the weight and encapsulating nature of their protective turnout (TO) gear adds to the thermal and cardiovascular strain. b

**PURPOSE:** To examine the effects of two firefighting TO ensembles (standard vs enhanced) on physiological and perceptual responses to an acute bout of FF activity in the heat.

**METHODS:** 119 male FFs (M±SD: age=29.45 ± 7.94 y; ht=1.77 ± 0.07 m; mass=87.81 ± 15.44 kg; BMI=28.07 ± 4.41) free from known cardiovascular disease were randomly assigned to one of the two TO gear ensembles. The standard TO gear (n=59) consisted of bunker gear with spun Nomex lining, Kevlar fully-encapsulating hood, leather gloves, rubber boots, traditional-style helmet: M wt = 11 kg. The enhanced TO gear (n=60) consisted of bunker gear with Indura FR cotton lining, which circulated exhaled air from the firefighter to the coat's inner lining, Nomex hood, low-profile helmet, leather gloves, lightweight leather boots: M wt = 8.6 kg. FFs underwent 18 min of simulated FF activity (stair climbing, forcible entry, secondary search, hose advance), alternating cycles of 2 min rest with 2 min of activity. Physiological and perceptual measurements were obtained pre- and post-FF activities.

**RESULTS:** No significant differences were observed between TO gear ensembles (P > 0.05). Overall, FF activity resulted in significant (P < 0.05) increases in heart rate (Mpre, 92.9 ± 18.8 b·min<sup>-1</sup>, Mpost, 168.3 ± 14.8 b·min<sup>-1</sup>); core temperature (Mpre, 37.56 ± 0.37°C, Mpost, 38.22 ± 0.69°C); neck temperature (Mpre, 33.40 ± 1.76°C, Mpost, 38.40 ± 1.23°C); thermal sensation (Mpre, 4.3 ± 0.7, Mpost, 5.9 ± 0.9); and respiratory distress (Mpre, 1.1 ± 0.4, Mpost, 2.8 ± 1.1). Conversely, there was a significant (P < 0.05) decrease in feeling scale (Mpre, 3.8 ± 1.2, Mpost, 1.9 ± 1.9).

**CONCLUSIONS:** FF resulted in significant changes in physiological and perceptual measures. TO gear configuration (standard vs enhanced) did not differentially influence the physiological or perceptual strain.

**1945 Board #353 MAY 30 2:00 PM - 3:30 PM**

**Influence of Clothing Layers Under Firefighting Protective Clothing on Physiological/Perceptual Responses to Intermittent Work**

Jeannie M. Haller, Eric M. Hultquist, Wesley K. Lefferts, Denise L. Smith, FACSM, Patricia C. Fehling, FACSM. Skidmore College, Saratoga Springs, NY.

(No relationships reported)

Personal protective clothing protects firefighters from thermal and other occupational hazards; however, it also contributes to the physiological and perceptual strain experienced by the wearer. Although research suggests that the addition of a clothing layer could cause an increase in thermal stress, the influence of additional layers of clothing, such as a station uniform shirt over a t-shirt, has not been well studied.

**PURPOSE:** To examine the effect of clothing layers worn under structural firefighting turnout gear (TOG) on physiological and perceptual responses during alternating work/recovery cycles.

**METHODS:** Ten men (age, 21 ± 1 yr; height, 174 ± 6 cm; weight, 74.3 ± 7.4 kg; VO<sub>2max</sub>, 58.9 ± 6.3 ml·kg<sup>-1</sup>·min<sup>-1</sup>) completed a 110-min intermittent walking protocol (three 20-min exercise bouts/10, 20 and 20 min recovery sessions) in a thermo-neutral (21.0 °C, 58.7% RH) laboratory while wearing a cotton t-shirt (COT) or COT and a station uniform (SU) shirt under firefighting TOG (COT+TOG and COT+SU+TOG, respectively). Some or all TOG was removed during each recovery session. Changes in heart rate (HR), core temperature (T<sub>co</sub>), skin temperature (T<sub>sk</sub>), rating of perceived exertion (RPE), and thermal sensations (TS) were compared across exercise and recovery periods using general linear models with repeated measures ANOVA.

**RESULTS:** During exercise sessions HR, T<sub>co</sub>, T<sub>sk</sub>, and RPE reached similar levels for COT+TOG and COT+SU+TOG. During Recovery 1, 2, and 3, chest T<sub>sk</sub> decreased by 3.96 °C, 6.64 °C, and 6.49 °C, respectively, for COT+TOG compared to 2.24 °C, 3.78 °C and 4.09 °C for COT+SU+TOG (P < 0.05 for each period). Change in TS differed during Exercise 1; however, mean peak TS corresponded to "hot" for both ensembles.

**CONCLUSIONS:** The additional layer of clothing in the COT+SU+TOG ensemble imposed no greater level of physiological or perceptual strain during moderate-intensity work bouts compared with the COT+TOG ensemble. However, some modest benefits were experienced during the recovery sessions for the COT+TOG ensemble as evident by a lower chest T<sub>sk</sub>. These findings could guide departmental decisions about the use of station shirts.

Supported by Department of Homeland Security grant EMW-2009-FP-02044.

**1946 Board #354 MAY 30 2:00 PM - 3:30 PM**

**Effects Of A Cooling Vest On Cycling Performance In A Hot And Humid Environment**

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(No relationships reported)

Endurance sporting events often take place in hot and/or humid environments. Exercise in such conditions can significantly raise body temperature and increase physiological demands associated with maintaining homeostasis. It has been well established that exercise induced heat stress will negatively affect performance and lead to premature fatigue in short-term and prolonged exercise. Pre-cooling prior to exercise has been shown to decrease skin and core temperature delay fatigue, and improve anaerobic and aerobic exercise performance. To date, little evidence exists as to the effectiveness of wearing a cooling vest during a performance trial.

**PURPOSE:** To investigate the effects of wearing a cooling vest on cycling performance and thermoregulatory responses during a self-paced 40Km time trial in a hot and humid environment.

**METHODS:** Ten male cyclists (22-55 years) attempted two 40Km laboratory-based time trials consisting of: 1) wearing a light-weight ice vest (1-1.5Kg) for pre-cooling and during the entire trial, and 2) no vest (NV) or other cooling method. Both trials were conducted a hot environment (32.64°C ± 0.66°C, 48.43% ± 3.84% RH).

**RESULTS:** Performance times for 40Km could not be compared for all subjects as 7 of 10 subjects reached critical core temperature (39.5°C) prior to completing the time trials. Four of the 7 subjects rode longer before reaching critical core temperature with the vest (~39 min) compared to NV (~34.75 min), however this difference was not statistically significant (p=0.48). The mean final performance times (Time<sub>Final</sub>) for subjects that were able to finish the 40Km time trial was 1.08 min faster for the vest trials than NV; however, the performance times were not significantly different (p = 0.74). No significant differences were found for core temperature (T<sub>rec</sub>), mean skin temperature (T<sub>sk</sub>), power output (PO), percent max power output (PO<sub>%max</sub>) heart rate (HR), thermal comfort (ThC), thermal sensation (ThS), or rating of perceived exertion (RPE).

**CONCLUSION:** We conclude that wearing a cooling vest during a cycling time trial in a hot and humid environment does not blunt the rise  $T_{rec}$  and  $T_{sk}$ , or HR, and does not influence  $Time_{ec}$ ,  $Time_{final}$ , RPE, ThC or ThS. Therefore, cooling vest use during a time trial does not improve cycling performance.

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**1947** Board #355 **MAY 30** **2:00 PM - 3:30 PM**

**The Effect Of Pre-heating And Intermediate Cooling On Firefighting Performance**

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(No relationships reported)

During firefighting activities core temperature ( $T_c$ ) can exceed 39.0°C and reduce performance. Therefore it is crucial to prevent or delay the attainment of high  $T_c$ .

**PURPOSE:** To determine the effect of pre-heating and intermediate cooling on speed and quality of firefighting activities.

**METHODS:** Twelve firefighters visited the Fire Training Center based lab three times. In one trial, they were pre-heated (HEAT) prior to a search-and-rescue and fire extinguishing task within a fire drill in a burn building. In the other trials, subjects remained thermoneutral prior to the drill and afterwards they were either cooled by forearm immersion in 10°C water (FC) or remained seated in 20°C ambient temperature (CONTROL). After this 20-min recovery period, they performed a second drill. Core and skin temperature ( $T_{sk}$ ), heart rate (HR), rating of perceived exertion (RPE), speed, and quality of performance (QoP) were measured during the trials. QoP was ranked by two experienced fire instructors and the subjects themselves.

**RESULTS:**  $T_c$  was  $0.54 \pm 0.20^\circ\text{C}$  ( $P < 0.05$ ). After the first drill,  $T_c$  was higher for HEAT ( $38.4 \pm 0.4^\circ\text{C}$ ) than for CONTROL ( $37.9 \pm 0.2^\circ\text{C}$ ;  $P < 0.05$ ). Cooling rate of FC did not differ from CONTROL ( $0.024 \pm 0.014^\circ\text{C min}^{-1}$  and  $0.016 \pm 0.017^\circ\text{C min}^{-1}$ , respectively;  $P > 0.05$ ). No differences in average  $T_c$  and HR were found in the second drill ( $P > 0.05$ ). RPE was higher for HEAT than for CONTROL ( $14.3 \pm 2.1$  and  $12.1 \pm 2.9$ , respectively;  $P = 0.001$ ) whereas no differences were observed between FC and CONTROL ( $12.4 \pm 2.9$  and  $12.8 \pm 3.5$ , respectively;  $P = 0.93$ ). Although no significant difference was observed in time to completion ( $P > 0.05$ ), subjects performed slower in the second half of the first drill in HEAT than in CONTROL and faster in the second half of the second drill in FC than in CONTROL ( $P < 0.05$ ). In HEAT, firefighters rated QoP lower than in CONTROL ( $6.5 \pm 0.7$  vs.  $7.1 \pm 0.3$ , respectively;  $P = 0.02$ ), whereas expert opinion revealed no differences for pre-heating ( $P = 0.39$ ). No differences in QoP were found after forearm cooling ( $P > 0.05$  for self report and expert opinion).

**CONCLUSION:** Pre-heating affected pacing of firefighting exercise and self reported quality of performance. Intermediate forearm cooling was beneficial for pacing but not the quality of firefighting exercise.

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**1948** Board #356 **MAY 30** **2:00 PM - 3:30 PM**

**A Comparison Of Two Commercially Available Practical Cooling Interventions On Cycling Capacity In The Heat**

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(No relationships reported)

Exercise performance and capacity are both impaired in hot conditions but cooling interventions can attenuate this impairment. The majority of cooling literature has focussed on cooling prior to exercise (pre-cooling) but cooling during exercise using cooling vests (CV) and modified cooling collars (CC) has recently been shown to also enhance performance in hot conditions. Due to improvements in the technology behind commercially available cooling devices (e.g. reductions in bulk and improvements in cooling magnitude and duration) and an increase in their availability cooling during, rather than before, exercise is receiving greater attention.

**PURPOSE:** To investigate the effect of two unmodified, commercially available cooling devices on cycling capacity in a hot environment.

**METHODS:** Eight non-acclimated, untrained but healthy ( $W_{max}$ :  $240 \pm 25$  W) males completed an incremental cycle test to determine maximum power output ( $W_{max}$ ), a full familiarisation and three experimental cycle tests (either wearing a CV or a CC throughout or with no cooling (NC)). During the familiarisation and main trials the participants cycled to volitional exhaustion at 60%  $W_{max}$  in a hot environment ( $35.0 \pm 0.1^\circ\text{C}$ ;  $50 \pm 1\%$  rh). Exercise capacity, rectal temperature, weighted-mean skin temperature, torso temperature, neck temperature, heart rate, fluid loss and consumption, rating of perceived exertion, thermal sensation and feeling scales were recorded. One-way and two-way repeated-measures analysis of variance tests were conducted to evaluate differences between variables. Significance was set at the  $P < 0.05$  level.

**RESULTS:** Cycling capacity was longer in VC ( $32.2 \pm 9.5$  min) compared to NC ( $27.6 \pm 7.6$  min;  $P = 0.03$ ;  $d = 0.57$ ) and CC ( $30.0 \pm 8.8$  min;  $P = 0.02$ ;  $d = 0.26$ ). There was no difference in cycling capacity in CC compared to NC ( $P = 0.12$ ). Both cooling interventions lowered site-specific skin temperature and site-specific thermal sensation ( $P < 0.01$ ) but had no effect on any of the other physiological or perceptual variables ( $P > 0.05$ ).

**CONCLUSIONS:** Practical torso cooling using a commercially available CV improves the cycling capacity of untrained males in a hot environment without altering non-site-specific physiological or perceptual responses but cooling the neck using an unmodified, commercially available CC does not.

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**1949** Board #357 **MAY 30** **2:00 PM - 3:30 PM**

**The Effect of Wearing a Cooling Vest Between Two Heated Exercise Bouts on Core Temperature**

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(No relationships reported)

**PURPOSE:** The purpose of the investigation was to evaluate the effectiveness of a cooling vest to regulate core temperature following heated self-paced exercise, and the effect on exercise duration of a successive heated exercise bout.

**METHODS:** Six males (age =  $24.5 \pm 1.76$  yrs; body fat =  $12 \pm 2.28\%$ ; estimated  $VO_{2peak}$  =  $41.59 \pm 3.52$  ml/kg min) and six females (age =  $23.83 \pm 1.94$  yrs; body fat =  $21.5 \pm 1.64\%$ ; estimated  $VO_{2peak}$  =  $43.47 \pm 4.36$  ml/kg min) participated in two testing sessions. Each session consisted of two self-paced cycling bouts in a modified heat chamber separated by seated rest. Subjects were required to cycle until core temperature reached  $38.5^\circ\text{C}$  during the first exercise bout. Subjects were then removed from the heat chamber and required to sit until core temperature returned to within  $.3^\circ\text{C}$  of baseline. During the seated rest, subjects wore a cooling vest (experimental session), or a normal t-shirt (control session). During the second exercise bout subjects exercised at the same RPM and wattage as the first bout until core temperature reached  $38.5^\circ\text{C}$  or volitional fatigue. Subjects exercised using the same RPM and wattage for both exercise sessions. Thermoregulatory data was taken every 5 min, except for blood (HCT, Hb) which was taken every 20 min.

**RESULTS:** Time to reach  $38.5^\circ\text{C}$  during the second exercise bout was significantly ( $p < .05$ ) longer following the cooling vest trial ( $43.66 \pm 4.34$  min) than the control trial ( $34.28 \pm 3.97$  min). No significant difference in time to decrease core temperature during seated rest was found between the cooling vest and the control trial ( $p > .05$ ).  $T_{sk}$  was significantly ( $p < .05$ ) greater in female subjects ( $32.92 \pm .17^\circ\text{C}$ ) during seated rest in comparison to male subjects ( $32.13 \pm .17^\circ\text{C}$ ). Core to shell gradient was significantly ( $p < .05$ ) greater in male subjects ( $5.74 \pm .18^\circ\text{C}$ ) during seated rest in comparison to female subjects ( $5.12 \pm .18^\circ\text{C}$ ).

**CONCLUSIONS:** Independent of gender, a cooling vest worn between two heated exercise bouts significantly lengthens time to increase core temperature during the second exercise bout. Gender differences in core to shell gradient may be attributed to the higher body fat percentage in the female subjects.

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**1950** Board #358 **MAY 30** **2:00 PM - 3:30 PM**

**Running Performance and Thermoregulation is not Improved when Wearing a Palm Cooling Device**

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(No relationships reported)

There is evidence that attenuating the rise in core temperature with sophisticated negative pressure and cold application to the palm increases time to exhaustion during endurance exercise. To be athletically applicable during training and competitions more evidence for this effect is necessary with palm cooling devices that are portable.

**PURPOSE:** Our aim was to test the efficacy of a portable palm cooling device at attenuating the rise in core temperature and prolonging time to exhaustion during a run in hot conditions.

**METHODS:** Twelve subjects completed two randomly ordered time to exhaustion (TTE) runs at 75% of their VO<sub>2</sub>max at 30°C and 50% relative humidity. Randomization was based on the use (treatment) or absence (control) of a palm cooling device (PCD), placed in the palm of the hand at the beginning of the TTE. TTE runs started once core temperatures reached 37.5°C during the warm-up. Heart rate (HR), rating of perceived exertion (RPE), feeling, and core temperature (CT) were recorded at 2 minute intervals during the run.

**RESULTS:** The rate of rise of CT was moderate-strongly correlated with TTE in treatment ( $r_2 = 0.91$ ,  $p < 0.05$ ) and control ( $r_2 = 0.68$ ,  $p < 0.05$ ) trials. No significant differences occurred between treatment and control trials for HR, RPE, Feeling and CT. TTE was longer in control than treatment ( $46.7 \pm 31.1$  vs.  $41.3 \pm 26.3$  minutes, respectively,  $p < 0.05$ ), however, when warm-up time was included in analysis, there was no difference between trials for total exercise time ( $52.5 \pm 24.2$  vs.  $54.5 \pm 31.4$  minutes, respectively).

**CONCLUSION:** The use of a PCD during a run in hot conditions did not attenuate the rise in CT. Exercise time in hot conditions did not increase with the use of the PCD and time to exhaustion may have been negatively affected.

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**1951** Board #359 MAY 30 2:00 PM - 3:30 PM

### Effects Of Sportswear Design On Thermal Stress And Endurance Running Performance In Hot Condition

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(No relationships reported)

Clothing designed to minimize total air resistance and facilitate moisture transport would be possible to reduce athlete's thermal stress and improve running performance.

**PURPOSE:** to investigate the effects of clothing design on thermal stress and endurance running performance in hot condition.

**METHODS:** Eight healthy male athletes (mean  $\pm$  SEM: age  $21.8 \pm 0.5$  years, body mass index  $20.7 \pm 0.6$  kg·m<sup>-2</sup>, maximal oxygen consumption- max  $57.0 \pm 2.4$  ml·kg<sup>-1</sup>·min<sup>-1</sup>) participated in a cross-over designed study. Three garments, A, B and C consisted of vest and knee-length short pants and made of Nylon Fabrics, were used in this study. Clothing A had the lower Air Resistance (AR: 0.05 KPa·s·m<sup>-1</sup>) and the higher Overall Moisture Management Capacity (OMMC: 0.70) than Clothing B (AR: 0.08 KPa·s·m<sup>-1</sup>; and OMMC: 0.68). Clothing C was set as the control (AR: 0.67 KPa·s·m<sup>-1</sup>; and OMMC: 0.54). Under hot condition (temperature:  $30 \pm 0.2$  °C, relative humidity:  $50 \pm 5\%$ ), the athletes rested for 30min and then performed 5min warm up. After that, they performed 45min running at their 70% max and 1.5km time trial running. Skin and core temperature were continuously collected throughout the whole study at 1min interval. Mean skin temperature (T<sub>sk</sub>) was calculated by recording the skin temperature at chest, upper arm, thigh and calf respectively by four thermistors, whereas core temperature (T<sub>c</sub>) was recorded by ingested telemetric pill.

**RESULTS:** During 30min resting, T<sub>sk</sub> was higher for A when compared with B (T vs. O:  $33.8 \pm 0.03$  °C vs.  $33.5 \pm 0.03$  °C,  $p < 0.05$ ) and during 45min running, T<sub>sk</sub> was the lowest for A among the three garments (T vs O vs A:  $32.5 \pm 0.06$  °C vs.  $32.8 \pm 0.05$  °C vs.  $32.7 \pm 0.05$  °C,  $p < 0.05$ ). Differences were also found in the change of T<sub>c</sub> ( $\Delta T_c$ ) for A and C during the resting period and during the 10<sup>th</sup> min of running, respectively ( $p < 0.05$ ). During the 1.5km running, faster performance was found when wearing A as compared to the C (T vs. A:  $323.1 \pm 10.4$ s vs.  $349.9 \pm 12.0$ s,  $p < 0.05$ ).

**CONCLUSIONS:** clothing with lower AR and higher OMMC can reduce athletes' thermal stress and enhance endurance performance. Supported by Hong Kong Innovation and Technology Commission and HKRITA, China (ITP/014/08T) and HKSI, China (ITT/001/11TT).

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**1952** Board #360 MAY 30 2:00 PM - 3:30 PM

### Precooling Does Not Improve 2000m Rowing Performance Of Females In Hot, Humid Conditions

Paul C. Castle<sup>1</sup>, Natalie Fitch<sup>1</sup>, Lee Taylor<sup>1</sup>, Anthony Webbom, FACSM<sup>2</sup>, Alexis R. Mauger<sup>3</sup>. <sup>1</sup>University of Bedfordshire, Bedfordshire, United Kingdom. <sup>2</sup>University of Brighton, Eastbourne, United Kingdom. <sup>3</sup>University of Kent, Chatham, United Kingdom.  
(No relationships reported)

Performing self paced exercise in hot, humid conditions increases rectal temperature (T<sub>re</sub>) and results in premature fatigue compared to temperate conditions. Precooling lowers skin and core temperature, and can alleviate such performance decline, but has predominantly been studied in males. Females have a greater body surface area to mass ratio than men that provides a thermoregulatory advantage during exercise in hot, humid conditions. The potential ergogenic effect of precooling females remains unknown.

**PURPOSE:** This study investigated the effects of precooling on self-paced 2000 m rowing performance of females in hot, humid conditions. Data are analysed using a two way repeated measures ANOVA.

**METHODS:** Eight physically active females ( $19.9 \pm 1.5$  yrs,  $66.8 \pm 3.1$  kgs,  $30.0 \pm 5.0\%$  body fat) performed three 2000 m rows in a randomised order in temperate (20°C, 40% relative humidity; RH) and hot conditions (35°C, 60% RH). The temperate condition acted as control (CONT) and was preceded by 20 min passive rest. One HOT condition was preceded by 20 mins passive rest and the other was preceded by 20 min precooling via a lower body, cold water, shower (PREC;  $22 \pm 2$ °C). Time to complete the row was measured as performance. Rectal, skin temperature (T<sub>sk</sub>) and power output (PO) were recorded every 100 m of the row.

**RESULTS:** No differences were observed between conditions for performance time (CONT;  $8.89 \pm 0.45$  min; HOT,  $9.01 \pm 0.55$  min; PREC,  $8.87 \pm 0.48$  min). Although PO was 7% higher in PREC compared to HOT, no statistical differences were observed between conditions. Mean T<sub>re</sub> during the row was not different between conditions (CONT,  $37.8 \pm 0.2$ °C; HOT,  $37.7 \pm 0.3$ °C; PREC,  $37.5 \pm 0.2$ °C;  $P = 0.12$ ; Main Effect). However, the effect size between HOT and PREC was large (0.67) and lower T<sub>re</sub> was observed at 1600 m and 1800 m of the row in PREC compared to HOT ( $p < 0.05$ ; interaction). Skin temperature was lower in PREC than HOT for the first 1000 m ( $p < 0.05$ ).

**CONCLUSIONS:** Despite a 7% increase in PO, precooling did not enhance 2000 m rowing performance. The precooling technique used reduced T<sub>sk</sub> but not T<sub>re</sub> which may explain the lack of performance enhancement. More aggressive precooling techniques may be required for females due the higher percentage body fat that protects against the cold stimulus.

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**1953** Board #361 MAY 30 2:00 PM - 3:30 PM

### The Effect of Shivering on the Precooling Response During Endurance Exercise

Katie J. Bouley, Mary C. Stenson, Tracy D. Matthews, Vincent J. Paolone, FACSM. Springfield College, Springfield, MA.  
(No relationships reported)

Precooling can be utilized prior to endurance competition to lower body temperature in an attempt to delay the increase in core body temperature. The delayed rise of core body temperature may result in a delay of fatigue related to decreased pacing strategies, the CNS, and cardiovascular strain. However, the application of precooling techniques may result in a shivering response causing an increase in metabolic heat production.

**PURPOSE:** The purpose of the investigation was to determine whether shivering impacts on the precooling response during an acute bout of endurance exercise.

**METHODS:** Eight trained males ( $23.8 \pm 3.6$  years) completed three sessions with a minimum of 5 days in between sessions. The sessions included a control (C), precooling (PC), and precooling without shivering (NS) session, where subjects were asked to perform a maximum effort 3200 m run after precooling. Subjects remained seated for 60 min while either shirtless or while wearing an ice-vest in direct contact with the skin. The onset of shivering was determined by increased EMG activity of the sternocleidomastoid and resulted in the removal of the ice-vest until shivering subsided during the NS session. Core body temperature, 400 m run time, heart rate, ratings of perceived exertion (RPE), and thermal sensation were recorded every 400 m during the 3200 m run. Blood lactate was analyzed before and after precooling, and after the 3200 m run.

**RESULTS:** No significant differences ( $p > 0.05$ ) were observed for 3200 m run time between the C, PC, and NS sessions. No significant differences ( $p > 0.05$ ) were observed for blood lactate, core temperature, heart rate, or RPE between the C, PC, and NS sessions. Mean thermal scale values in the NS session were significantly lower than mean thermal scale values in the PC and C sessions ( $4.08 \pm .21$  vs.  $4.53 \pm .12$  and  $4.59 \pm .15$ ,  $p < 0.05$ ). Core body temperature was significantly lower after 60 min of precooling than baseline, at 1600 m, and at 3200 m ( $36.20 \pm .12$ °C vs.  $37.10 \pm .06$ °C,  $38.20 \pm .12$ °C, and  $38.72 \pm .11$ °C,  $p < 0.05$ ) in all sessions.

**CONCLUSION:** Performance of a maximal effort 3200 m run was not affected by precooling for 60 min prior to completion. The shivering response associated with wearing an ice-vest as a precooling technique had no impact on performance variables; however, there was a reduction in thermal sensation scale.

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1954 Board #362 MAY 30 2:00 PM - 3:30 PM

**A Meta-analysis Of The Hypothermic Properties Of Exogenous Melatonin In Humans**

Kelly Marrin<sup>1</sup>, Barry Drust<sup>2</sup>, Warren Gregson<sup>2</sup>, Greg Atkinson<sup>2</sup>. <sup>1</sup>Edge Hill University, Ormskirk, United Kingdom. <sup>2</sup>Liverpool John Moores University, Liverpool, United Kingdom.

(No relationships reported)

A number of pre-cooling methods have been developed in order to reduce starting core temperature at rest and thereby attempt to enhance subsequent performance in hot conditions. However, interventions such as cold showers can be impractical and difficult to tolerate (Marino, 2002, Br J Sports Med., 36: 89-94). The extent to which exogenous melatonin changes core body temperature in humans is enigmatic. Individual studies have involved small samples, which leads to imprecision in the population estimate of temperature change. There are also between-study differences in melatonin dose, study population and protocols.

**PURPOSE:** To meta-analyse the effects of exogenous melatonin on core temperature and explore the impact of various moderating variables on this temperature change.

**METHODS:** Following an extensive literature search, 33 studies involving 193 participants and 429 separate melatonin ingestions were meta-analysed. The outcome was the mean difference (95% confidence limits) in core temperature between the melatonin and control conditions in each study, weighted by the reciprocal of each standard error of the differences.

**RESULTS:** Publication bias was assessed using Eggers regression intercept and no significant publication bias was evident ( $P=0.39$ ). The meta-analysed reduction in core temperature was found to be 0.21 (0.18 - 0.24) °C, which was unaffected by gender and time of day of ingestion ( $P>0.05$ ). Low doses (0.1- 4.9 mg) resulted in a mean change in core temperature of 0.17 (0.14 - 0.21) °C compared with values of 0.26 (0.23 - 0.30) °C for high doses (5 - 40 mg). Within the melatonin dose range of 0.003 to 10 mg, a linear, but shallow, dose-response relationship was found with a slope of 0.013 °C.mg<sup>-1</sup> ( $P<0.0001$ ). The mean hypothermic effect was 0.13 (0.05 - 0.20) °C for oral temperature compared with 0.26 (0.20 - 0.32) °C for tympanic and 0.22 (0.19 - 0.25) °C for rectal temperature.

**CONCLUSION:** These data indicate that the hypothermic effect of melatonin is clinically significant and robust across genders and time of day. The hypothermic effect was lowest for oral temperature, probably because this site is more prone to masking influences. The meta-regression revealed a linear dose-response relationship that was, nevertheless, quite shallow in practical terms.

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**C-24 Free Communication/Poster - Behavior Change**

MAY 31, 2012 7:30 AM - 12:30 PM

ROOM: Exhibit Hall

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1955 Board #1 MAY 31 8:00 AM - 9:30 AM

**Is Self-selected Intensity During Weight Training Enough To Promote Health Benefits In Older Women?**

Sergio G. da Silva<sup>1</sup>, Hassan M. Elsangedy<sup>1</sup>, Kleverton Krinski<sup>1</sup>, Maressa P. Krause<sup>2</sup>, Luis AG Freitas<sup>3</sup>, Julia Z. Durigan<sup>3</sup>, Antonio C. Dourado<sup>3</sup>, Cosme F. Buzzachera<sup>4</sup>, Fredric L. Goss, FACSM<sup>5</sup>. <sup>1</sup>Federal University of Parana, Curitiba, Brazil. <sup>2</sup>Federal Technological University of Parana, Curitiba, Brazil. <sup>3</sup>State University of Londrina, Londrina, Brazil. <sup>4</sup>University of North Parana, Londrina, Brazil. <sup>5</sup>University of Pittsburgh, Pittsburgh, PA. (Sponsor: Fredric L. Goss, FACSM)

(No relationships reported)

**PURPOSE:** The purpose of this study was to verify the self-selected intensity during weight training of elderly women.

**METHODS:** Twenty non-smoking older women (60-70 yrs) underwent to 1) a familiarization period (2-weeks) including the utilization of the weight machines and appropriate form for performing the exercise, as well as the use of the perceptual scales; 2) a maximal load test (one maximal repetition, 1-RM) was performed in the following exercises: Chest press, Leg press at 45°, Lat pulldown, Leg (knee) extension, Lateral Shoulder Raise, Leg (knee) Curl, Biceps curl, and Push Down Triceps; 3) a session of weight training at self-selected intensity. Participants were instructed to self-selected a load for performing 3 sets of 10-15 repetitions. Data were analyzed by mean (standard deviation), and ANOVA with repeated measures ( $p<0.05$ ).

**RESULTS:** Global mean of the 3 sets was: chest press 41.0%1-RM (SP11.9); leg press at 45° 43.0%1-RM (DP: 17.2); lat pulldown 47.2%1-RM (11.1); leg (knee) extension 33.0%1-RM (DP: 8.1); lateral shoulder raise 51.1%1-RM (DP: 12.1); leg (knee) curl 43.5%1-RM (DP: 8.8); biceps curl 48.0%1-RM (DP: 15.5); and push down triceps 51.7%1-RM (DP: 13.3) - there was not significant differences between sets ( $p>0.05$ ).

**CONCLUSIONS:** These results indicated that previously sedentary older women self-selected an exercise intensity during weight training below the ACSM recommendation for improvements on muscle strength and hypertrophy. Nevertheless, it is plausible to suggest the utilization of this strategy because it can promote better muscle conditioning in older women until they achieve a level in which they can perform safely the load recommended for improvements on muscle strength and hypertrophy.

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1956 Board #2 MAY 31 8:00 AM - 9:30 AM

**The Impact Of An Instructor-led Ipad-based Program On Physical Activity (Preliminary Validation)**

Megumi Saito, Koji Takenaka, Takashi Shimazaki. Waseda University, Saitama, Japan.

(No relationships reported)

There are high expectations in Europe and the United States on the effects of computer-based intervention programs as a population approach method aimed at increasing the amount of physical activity based on the behavioral change theory. However, very few studies are conducted in Japan to validate the impact of such programs.

**PURPOSE:** To validate an iPad-based behavioral change program for instructors (iBCPI) aimed at changing their health behavior (healthy eating, smoking cessation, and increasing the amount of physical activity) based on the action planning strategy in behavioral change theory. This study was to validate the one of these behaviors such as the amount of physical activity, and to objectively assess by the step count.

**METHODS:** The study was conducted on 48 adults who were recruited by the undergraduate student for 1 month intervention period. Participants (18 men, 30 women; average age of 30.2 years; SD=16.4) were randomly assigned to one of the following three groups: 1) the action planning group (n=16); 2) the goal-setting group (n=16); and 3) the control walking group (n=16). A pedometer, a self-monitoring form were provided to all the participants. In addition to this, 1) the action planning group participants set a goal for step count, and the student engage participants in a discussion with iPad program of an action plan that can help the participant fulfill the goal. 2) the goal-setting group participants were asked set their achievable step count goal, and 3) the control walking group participants were encouraged to devise their own ways of increasing their step count.

**RESULTS:** There was a significant difference in the changes of step count based on the baseline step count between action planning group and control group (+1227±1449 steps vs. -63±1481 steps,  $p<0.05$ ). Actions to be chosen (43%) and executed (68%) to increase the step count the most by action planning group was using stairs when commuting/shopping.

**CONCLUSIONS:** Although preliminary, the iBCPI can be regarded as a promising population approach method. Action planning use of iPad program to define the place, times, frequency gave a positive effect on gradually increasing physical activities in daily life. However, the study period was short, and a longer-term intervention study is desirable.

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1957 Board #3 MAY 31 8:00 AM - 9:30 AM

**Impact Of A Mentoring Program On Self-esteem, Physical Activity And Perceived Competence In Young Boys**

Brett A. Brawerman, Kendall L. Adkins, Elizabeth K. Bailey. Elon University, Elon, NC. (Sponsor: Stephen P. Bailey, FACSM)

(No relationships reported)

According to a White House proclamation, everyone has a role to play in the fight to end childhood obesity. With increasing levels of sedentary behavior in children, programs aimed at improving activity levels are more important than ever. Coaching Health and Mentoring Positive Students (C.H.A.M.P.S.) is a program for boys in 4<sup>th</sup> and 5<sup>th</sup> grade which uses group education

sessions, physical activity and mentoring relationships with college males to address negative attitudes and unhealthy behavior, particularly lack of physical activity. Given that sports are often the source of physical activity in boys, C.H.A.M.P.S. utilizes sports skills training to improve perceived physical competence, which could result in improved physical activity levels and related positive outcomes.

**PURPOSE:** The purpose of this study was to evaluate whether participation in C.H.A.M.P.S (6 sessions) is related to positive changes in perceived physical competence, physical activity, self esteem and social physique anxiety.

**METHODS:** Prior to and following the conclusion of the program, participants completed: 1) an exercise questionnaire (EQ), 2) the Rosenberg Self-Esteem Scale (SE), 3) The Social Physique Anxiety questionnaire (SR), and 4) a modified version of Harter's Perceived Physical Competence scale (PPCSC). Questionnaire results were analyzed to assess changes from pre to post participation in the program.

**RESULTS:** Significant changes were noted on all measures: EQ (Mean<sub>pre</sub> 8.8 ± 0.45, Mean<sub>post</sub> 10.2 ± 0.52, p < 0.01); SE (Mean<sub>pre</sub> 23.4 ± 0.74, Mean<sub>post</sub> 25.4 ± 1.1, p < 0.05); SR (Mean<sub>pre</sub> 18.4 ± 0.95, Mean<sub>post</sub> 15.8 ± 1.2, p < 0.01); PPCSC (Mean<sub>pre</sub> 40.68 ± 2.07, Mean<sub>post</sub> 46.1 ± 2.09, p < 0.05).

**CONCLUSION:** Given that perceived competence in and enjoyment of physical activity are cited as being essential influences on young people's participation over time, it appears that CHAMPS is an effective vehicle to address the issues which play a role in obesity prevalence in this population.

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**1958** Board #4 MAY 31 8:00 AM - 9:30 AM

**Effects of Pre-habilitation on Self-Efficacy for Exercise and Outcome Expectations for Exercise Among Patients Before and After Total Knee Arthroplasty**

Kent Brown<sup>1</sup>, Robert Topp<sup>2</sup>, Joseph A. Brosky<sup>1</sup>, David Pariser<sup>1</sup>, Ann Swank, FACS<sup>3</sup>. <sup>1</sup>Bellarmine University, Louisville, KY. <sup>2</sup>Marquette University, Milwaukee, WI. <sup>3</sup>University of Louisville, Louisville, KY.

(No relationships reported)

Osteoarthritis (OA) is a clinical condition affecting over 27 million Americans. There is no known cure for OA other than replacing the diseased joint with a partial or total joint prosthesis, total knee arthroplasty (TKA).

**PURPOSE:** The purpose of this research is to compare pre and post-surgical exercise self-efficacy and outcome expectations for exercise among TKA patients who do and do not receive prehabilitation (exercise intervention before surgery).

**METHODS:** 31 participants (22 female, 9 male) scheduled for a TKA from a single orthopedic practice were randomly assigned to a Control (CON) or a prehabilitation (PRE) group following baseline testing. Outcome variables at baseline testing included the Self-Efficacy for Exercise (SEE) scale and the Outcome Expectations for Exercise (OEE) scale. In addition to baseline (T1), participants completed the outcome data collection protocols just prior to surgery (T2) and at 1 (T3) and 2 (T4) weeks following surgery.

**RESULTS:** Repeated measures ANOVA were conducted examining the effect of group (PRE vs. CON) over the four data collection points (Baseline, T2, T3 & T4). Significant main or interaction effects were explored further by calculating Fischer's least significant difference post hoc comparisons. Conducting a RM-ANOVA with time (T1, T2, T3, T4) [F (1, 18) = .42, p = .53] and group (PRE vs CON) [F (1, 18) = .03, p = .86] and interaction of group and time [F (1, 18) = .69, p = .419] as the sources of variability indicated no significant effect of the time, group or group x time on SEE. The SEE, of the PRE appeared to be consistently maintained over the study, and actually trended upward after their TKA at T3 and T4, but did not significantly increase. Differences in OEE within the sample over the duration of the study indicated a significant time effect [F (1, 18) = 4.57, p = .04]. Post hoc analysis indicated that the CON group significantly declined between T2 and T4; however the PRE group did not significantly change.

**CONCLUSIONS:** These findings indicate self-efficacy for exercise was unaffected by the preoperative exercise intervention (prehabilitation), while the outcome expectations for exercise improved in the PRE group. This improvement in outcome expectations for exercise may contribute to improve compliance with post operative rehabilitation exercises among TKA patients.

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**1959** Board #5 MAY 31 8:00 AM - 9:30 AM

**Hospital-based Exercise Intervention Program Can Promote Exercise Internal Motivation of Care-giving Housewife**

Jin J. Chen<sup>1</sup>, Wen-Hui Huang<sup>1</sup>, Frank J.H. Lu<sup>2</sup>. <sup>1</sup>National Yang-ming University, Taipei, Taiwan. <sup>2</sup>National Taiwan Sports University, Taipei, Taiwan.

(No relationships reported)

Physical inactivity of care-giving housewives had been noted due to lack of time and motivation to exercise regularly. So, we developed the eight-week hospital-based exercise intervention (HEI) using day-care treatment duration of their children twice per week to provide an accessible exercise time for them. However, motivation, especially internal motivation, was the key determinant for long-term participation of regular physical activity.

**PURPOSE:** to investigate the effects of HEI on exercise motivation promotion.

**METHODS:** Sixty sedentary care-giving housewives were recruited and assigned to two groups: HEI group (n=30) and control group (CG, n=30), voluntarily. HEI program consisted of 16 exercise sessions including 8 walking sessions and 8 Yoga-Pilates sessions. Control group received one exercise consultation session during the first visit only. Chinese-version of Behavior Regulation in Exercise Questionnaire-2 (BREQ-2) was used pre- and post-HEI to evaluate the effects of HEI on motivation promotion.

**RESULTS:** After 8 weeks exercise intervention, total motivation score of HEI group significantly increased from 22.3±19.4 to 32.8±20.2, p=.024, majorly due to significant promotion of identified regulation (17.8±7.7 to 21.1±6.7, p=.015) and intrinsic regulation (29.2±10.3 to 35.1±9.4, p<.000). However, there were no significant changes in external regulation of HEI group and all motivation scores of CG.

**CONCLUSION:** Hospital-based exercise intervention program can promote exercise internal motivation of sedentary care-giving housewives. The small-group hospital-based and caregiver-focused intervention model is an accessible, acceptable and substantial approach.

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**1960** Board #6 MAY 31 8:00 AM - 9:30 AM

**Can Public Health Take the HIT? High-Intensity Interval Training and Affect in Obese Women**

Emily S. Decker<sup>1</sup>, Panteleimon Ekkekakis, FACS<sup>2</sup>. <sup>1</sup>University of Kansas, Lawrence, KS. <sup>2</sup>Iowa State University, Ames, IA.

(No relationships reported)

Only 3% of obese women trying to lose weight report being physically active at the minimum recommended level (60 min daily). High-intensity interval training (HIT) is promoted as a way of combining the health and fitness benefits of high-intensity exercise and time efficiency. However, obese women report less positive affective responses compared to their normal-weight and even overweight counterparts, an effect that is accentuated at higher intensities.

**PURPOSE:** To compare the affective responses of obese women during a (shorter) HIT session and a (longer) moderate-intensity (MOD) session.

**METHODS:** Twenty-four obese and inactive women (M = 39 years) first completed a ramp test on a recumbent cycle ergometer to determine their ventilatory threshold (VT). They then completed two counterbalanced conditions: (a) a HIT session (4 iterations of 2 min at 85% of VT and 3 min at 115% of VT, for a total of 20 min) and (b) an isocaloric MOD session consisting of cycling at 90% of VT for 25 min. The Feeling Scale (FS) was administered before, during, and after exercise. The Physical Activity Enjoyment Scale (PACES) was administered post-exercise.

**RESULTS:** Analysis of FS data showed a significant condition by time interaction, F (3.29, 75.68) = 8.48, P < 0.001, as well as a significant condition main effect, F (1, 23) = 14.42, P < 0.05, with the HIT session leading to significantly lower ratings of pleasure overall. Likewise, a paired t-test of the PACES scores indicated that the women reported lower enjoyment after the HIT than the MOD, t = -2.14, P < 0.05.

**CONCLUSION:** Based on findings that affect can predict physical activity, these less positive affective responses could result in reduced adherence. Thus, the long-term sustainability of HIT in this high-risk population seems questionable given minimal time savings and less positive affective experiences.

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**1961** Board #7 **MAY 31** **8:00 AM - 9:30 AM**  
**Improving Exercise Adherence Through Online Journaling Following Physical Therapy Treatment for Chronic Low Back Pain**

Claire E. Freson, Sharon M. Henry, Paul R. Buzzell, Mike J. DeSarno. *University of Vermont, Burlington, VT.*  
(No relationships reported)

**BACKGROUND:** Low back pain (LBP) is a musculoskeletal condition that affects up to 80% of all people at some point in their lives. Due to high recurrence rates, this condition often escalates into a chronic, costly problem. We examined if online journaling for a prescribed physical therapy (PT) home exercise program (HEP) increased exercise adherence (EA) and led to decreased pain and improved function for subjects with LBP.

**PURPOSE:** To compare whether online journaling improved 6 month outcomes for pain (Numeric Pain Rating Scale [NPRS]), function (Oswestry Disability Index [ODI]), and EA rates for subjects (age 18-55 years) with LBP.

**METHODS:** Subjects completed the ODI and the NPRS at pre-treatment, and 7 weeks and 6 months post-treatment initiation. Following 6 weekly PT treatments, one group (Web group [WG]; n=20) was discharged with a HEP and online journal to record, daily for 6 months, the number of exercise repetitions done for the prescribed HEP and their pre- and post-exercise pain. The journals were monitored weekly; email reminders were sent to subjects to encourage continued participation. The control group (NoWeb [NW]; n= 20) was discharged from PT with a HEP to continue on their own. Six months after the initiation of PT, the two groups were compared using NPRS and ODI scores with an ANOVA with a significance level set to  $P = .05$ . EA rates were also compared.

**RESULTS:** There were no significant group mean differences in the NPRS or ODI scores ( $P = 0.37$ ,  $P = 0.73$ , respectively) across the three time points. However, there was a significant decrease from pre- to post- treatment in NPRS mean ( $P = 0.0009$ ) and in ODI mean ( $P < 0.0001$ ), but no significant mean differences from post-treatment to 6 months for either measure. Over the 6 months, the WG subjects, on average, completed specific exercises 68% (27 - 97%) of the time. At the 6-month time point, all but one NW subject reported doing specific exercises 25 - 50% of the time or less. The WG subjects demonstrated an average adherence rate for activities of daily living of 3.6 out of 4 while NW subjects reported an average level of 2.6 out of 4.

**CONCLUSIONS:** Although the improvements in pain or disability scores were similar between groups, the WG had better EA rates, suggesting a benefit in the use of online journaling as a method to enhance EA. Supported by a UVM URECA grant.

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**1962** Board #8 **MAY 31** **8:00 AM - 9:30 AM**  
**A Study of Messaging for Increasing Physical Activity: Exploring Components of Persuasive Messages**

Takashi Shimazaki, Koji Takenaka, Megumi Saito. *Waseda University, Tokorozawa, Japan.*  
(No relationships reported)

To motivate individuals to adhere to a routine of regular physical activity, guidelines must be translated to a persuasive messages. Most interventions designed to increase physical activity have used a messaging process. The study of messaging includes examination of tailoring, targeting, and framing. Results of previous studies suggest that these approaches should be prepared with regard to acceptability and usability for individuals.

**PURPOSE:** This study explored the constructs of acceptability and usability for persuasive messages.

**METHODS:** Thematic analysis is widely used qualitative analytic method within psychology when notably explored theoretical framework. We examined 177 adults (Age = 19 to 68 years, 83 men and 94 women) by obtaining open-ended responses about acceptable and usable information to motivate physical activity.

**RESULTS:** Thematic analyses revealed six themes of acceptability: constitution of verbal messages, framing, verbal message information, visual message information, desirable delivery channel, and desirable place. Additionally, four themes of usability were identified: information benefiting physical activity, information about how to exercise, information related to physical activity, and tailored information about physical activity. Results of chi-square analysis showed that differences between men and women. Information about anti-ageing ( $\chi^2 = 16.2$ ,  $df = 1$ ,  $p < .01$ ), information about improve stiff shoulder and backache ( $\chi^2 = 4.0$ ,  $df = 1$ ,  $p < .05$ ), and information about ingestion and consumption calorie ( $\chi^2 = 4.6$ ,  $df = 1$ ,  $p < .05$ ) were significantly desired by women in theme of usability. No differences between the sexes were found in theme of acceptability.

**CONCLUSIONS:** These study results are expected to contribute to intervention aimed at increasing individuals' physical activity for improvement of public health.

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**1963** Board #9 **MAY 31** **8:00 AM - 9:30 AM**  
**Does Stage Of Change Predict Psychological Outcomes In A Physician Delivered Dietary And Physical Activity Intervention?**

Sheree Shapiro, Heather Morton, Robert J. Petrella, FACSM. *Lawson Health Research Institute, London, ON, Canada.*  
(No relationships reported)

**BACKGROUND:** The purpose of the present study was to determine whether a predictive relationship was observed in participants between baseline stage of change (SOC; prior to beginning a stage-matched, physician-delivered physical activity and nutrition counselling program) on decisional balance and self-efficacy for diet and physical activity.

**METHODS:** Participants were eligible for the study if they were between the ages of 30-85 and had elevated blood pressure and blood glucose. Participants (n = 69) attended 5 study visits over the course of 52-weeks. At each visit, they received a Step Test and Exercise Prescription, and were counselled on adopting a Mediterranean diet (MD). In addition, they completed the following questionnaires: 1) Physical Activity Self Efficacy (PASE); 2) MD Self Efficacy (MDSE); 3) Decisional Balance for Physical Activity (DBPA); 4) Decisional Balance for MD (DBMD); and 5) SOC for diet and physical activity. Linear regression was used to determine the relationship between baseline SOC, self-efficacy, and decisional balance.

**RESULTS:** Medium negative correlations were observed between mean baseline SOC (MD = 2.91; PA = 3.09) and cons for DBMD at baseline, 8-and 16-weeks only (mean = 2.19,  $r = -0.35$ ,  $p = 0.13$ ; mean = 2.00,  $r = -0.34$ ,  $p = 0.01$ ; mean = 1.94,  $r = -0.43$ ,  $p = 0.00$  respectively), as well as pros for DBPA at 8-and 16-weeks only (mean = 1.4,  $r = -0.36$ ,  $p = 0.01$ ; mean = 1.45,  $r = -0.36$ ,  $p = 0.02$  respectively). Medium positive correlations were observed between baseline SOC and MDSE at 16-weeks only (mean = 98.26,  $r = 0.35$ ,  $p = 0.02$ ), as well as baseline and 24-weeks for PASE (mean = 52.51,  $r = 0.32$ ,  $p = 0.02$ ; mean = 56.08,  $r = 0.46$ ,  $p = 0.00$  respectively). There were no significant correlations between SOC and either variable at 52-weeks.

**CONCLUSION:** Based on the results, a higher baseline SOC was a moderate predictor of lower perceived cons for diet and physical activity. Interestingly however, a higher baseline SOC for physical activity predicted lower perceived pros of physical activity at 8-and 16-weeks. A higher baseline SOC was also a moderate predictor for higher MDSE and PASE midway through the study. Baseline SOC thus may predict some aspects of success part-way through dietary and physical activity behavioral change interventions.

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**1964** Board #10 **MAY 31** **8:00 AM - 9:30 AM**  
**A Comparison Of Exercise Self-efficacy Between Individuals With And Without Asthma**

Greg Farnell, Britton Adams. *University of Central Oklahoma, Edmond, OK.* (Sponsor: Ellen Glickman, FACSM)  
(No relationships reported)

**PURPOSE:** Asthma is a medical condition that is often overlooked as chronic or terminal. Its effects on a person's performance emotionally and physically should be noted and taken into account when a person engages in physical activity. The purpose of this study was to examine the influence of having asthma on exercise self-efficacy where exercise self-efficacy refers to the relationship with exercise behavior and attitudes towards exercise.

**METHODS:** Fifty participants completed the Exercise Self-Regulatory Efficacy scale (Ex-SRES). Fifty participants volunteered to participate in this study and each completed the Ex-SRES. Twenty-one participants (6 male, 19 female) from a general education class at a local university served as a control group and 29 participants (8 male, 17 female) were surveyed at an area asthma clinic. The survey consists of 16 questions that measured the confidence levels of continuing to exercise under specific conditions (e.g. "If the weather was bothering him or her"; "If they had no support from others"). Each question was given a Likert-scale response of "Not at all confident" (0%) to "Highly Confident" (100%). Data was analyzed for between-group differences using a one-way ANOVA.

**RESULTS:** The ANOVA revealed significant difference between groups ( $p < 0.05$ ) for 3 out of the 16 questions. These questions read, "If I feel aches and pains while exercising"; "If I am on vacation or away from home"; and "If I feel stressed".

**CONCLUSIONS:** The findings of this study suggest there is minimal difference in exercise self-efficacy between those individuals with and without asthma.

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## C-25 Free Communication/Poster - Children and Exercise II

MAY 31, 2012 7:30 AM - 12:30 PM  
ROOM: Exhibit Hall

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1965 Board #11 MAY 31 9:00 AM - 10:30 AM

### Maximal Running Velocity Characteristics of 11-14 Years of Age Trained Children

Caner Acikada<sup>1</sup>, Manolya Akin<sup>2</sup>, Nigar Kucukbas<sup>3</sup>, Sultan Harbili<sup>4</sup>, Zambak Sahin BOZER<sup>5</sup>. <sup>1</sup>Indiana University, Bloomington, IN. <sup>2</sup>Mersin University, Mersin, Turkey. <sup>3</sup>Mustafa Kemal University, Hatay, Turkey. <sup>4</sup>Selcuk University, Konya, Turkey. <sup>5</sup>Washington State University, Washington, WA. (Sponsor: Robert Chapman, FACSM)

(No relationships reported)

Earlier sport specialisation of child athlete, raises the question of how the maximal speed is influenced by different sport training.

**PURPOSE:** To determine the influencing factors of different sport training on maximal speed in trained boys and girls.

**METHODS:** 11-14 years of age 53 boys and 41 girls not regularly trained normal healthy children were randomly selected from a nearby school as control group, and 146 boys and 151 girls from track and field athletics, basketball, and volleyball were selected as athletes. Two different tests were conducted in order to determine the maximal (100 %), and sub maximal (97 % and 94 % maximals) velocities and running times over 50 m sprinting, during which the maximal attained 5 m velocity was timed by a photocell placed at each 5 m section. During the second test a video camera was placed to record the 5 m section where the maximal velocity was attained for stride frequency and length. Correlation coefficient of the influencing parameters of stride frequency and length was examined by Pearson Correlation Coefficient Test, and the differences between the attained maximal velocity, according to different training groups, ages and gender were tested by MANOVA.

**RESULTS:** The control group had significantly shorter strides ( $F=57.043$ ,  $p<0.05$ ) and lower stride frequency ( $F=8.363$   $p<0.05$ ) at maximal and sub maximal velocities when compared to athletes. Athletes showed different stride length as a result of anthropometric variables and specific training results. There was no difference in stride frequency between the ages in both sexes ( $F=2.437$   $p>0.05$ ) in all velocities. However, males showed higher stride frequency at all ages ( $F=76.934$ ,  $p<0.05$ ) when compared with female athletes. In general most of the strength parameters showed significant correlation with stride length and frequency both in male ( $r=0.558-0.872$ ;  $r=0.552-0.813$ ;  $p<0.05$ , respectively) and female ( $r=0.551-0.843$ ;  $r=0.557-0.735$ ;  $p<0.05$ , respectively) groups in maximal velocities. There was a higher reading in stride frequency in male athletes ( $F=76.934$ ,  $p<0.05$ ), but no difference in stride length between the sexes ( $F=0.289$ ,  $p>0.05$ ).

**CONCLUSION:** In conclusion at this age and training groups, stride frequency and length are influenced by age, gender, strength, anthropometric variables and specific training.

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1966 Board #12 MAY 31 9:00 AM - 10:30 AM

### Heart Rate Recovery is related to Vascular Health in Preschoolers

Nicole A. Proudfoot, Maureen J. MacDonald, Leigh Gabel, Brian W. Timmons. *McMaster University, Hamilton, ON, Canada.* (Sponsor: Boguslaw Wilk, FACSM)

(No relationships reported)

Heart rate recovery (HRR) following exercise is an indicator of aerobic fitness and predictive of cardiovascular risk and mortality in adults. The relationship between HRR and vascular health in preschoolers (3- to 5-year-olds) is unknown.

**PURPOSE:** To examine the relationship between HRR and measures of vascular health in preschool-aged children.

**METHODS:** Ninety-six preschoolers ( $4.4 \pm 0.9$  years, 50 girls) participated. Arterial stiffness was assessed in a combination of aortic and peripheral vessels using pulse wave velocity (PWV). ECG and pressure waveforms in the right dorsalis pedis artery were recorded following at least 10 minutes of supine rest. PWV was calculated as the time delay between ventricular depolarization and the arrival of the pulse wave at the dorsalis pedis artery, divided into the measured distance between these sites. Seated blood pressure was measured in the right brachial artery. HRR was determined as the difference in peak heart rate during a maximal exercise test (Bruce protocol) and heart rate 1 minute following exercise. Only children who reached a peak heart rate  $\geq 180$  bpm were included in analyses. Pearson correlations were performed to assess the relationships of HRR with PWV and blood pressure.

**RESULTS:** Participants had an average HRR of  $63 \pm 14$  bpm and PWV of  $3.3 \pm 0.2$  m/s. HRR was inversely related to PWV ( $r=-0.349$ ,  $p=0.002$ ). Systolic and diastolic blood pressure percentiles were also negatively related to HRR ( $r=-0.266$ ,  $p=0.025$  and  $r=-0.275$ ,  $p=0.019$ ; respectively).

**CONCLUSIONS:** Preschoolers with slower HRR have faster PWV (increased arterial stiffness) and higher blood pressure. These findings suggest that young children with higher aerobic fitness levels have more favourable indices of vascular health. Future research is required to determine if vascular health can be improved by increased fitness in preschoolers.

Supported by the Canadian Institutes of Health Research (CIHR).

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1967 Board #13 MAY 31 9:00 AM - 10:30 AM

### Reliability of 20 m Sprint Running Test on Adolescent Boys and Girls

Giorgos Paradisis, Panayiotis Pappas, Elias Zacharogiannis, Anastasia Smirniotou, Stavros Tziortzis. *Track and Field Sector, University of Athens, Athens, Greece.*

(No relationships reported)

Sprint running is a complex movement that requires complex motor coordination between upper and lower body segments. Since performance in most individual and team sports depends on the athlete's sprinting ability, the use of reliable and valid testing procedures is beneficial for monitoring the effects of training, especially on adolescent boys and girls.

**PURPOSE:** Hence, the aim of this study was to determine reliability of sprinting ability measured on a large sample of adolescent boys and girls.

**METHODS:** 47 students (age  $14.6 \pm 1.72$  years, height  $168.4 \pm 9.76$  cm, body mass  $62.6 \pm 12.37$  kg) performed three maximal 20 m sprint run tests with standing start interspersed by 48 hours, using a Brower electronic timing system. For each trial of sprinting test mean, standard deviation, and range were calculated. An analysis of variance with repeated measures and correction for sphericity was used for detection of possible systematic bias between trials. Average intertrial correlation coefficients (AVR), intraclass correlation coefficients (ICC) and Cronbach's alpha reliability coefficients ( $\alpha$ ) were used to determine between-subject reliability of tests. Within-subject variation for all tests was determined by calculating coefficient of variation (CV) as outlined by Hopkins (2000).

**RESULTS:** The data of the present study indicated that 20 m sprint running produced very good repeatability between the three days ( $P<0.05$ ). Mean  $\pm$  SD and range of time for 20 m were  $3.64 \pm 0.27$ ,  $3.63 \pm 0.27$ ,  $3.65 \pm 0.27$  m s<sup>-1</sup> and 1.21, 1.38, 1.21 m s<sup>-1</sup> for days 1, 2 and 3 respectively. The AVR was 0.87, the ICC was 0.95, the  $\alpha$  was 0.95 and CV was 1.8%.

**CONCLUSIONS:** It is concluded that sprinting ability is a reliable testing procedure and can be used for monitoring the effects of training, especially on adolescent boys and girls.

Hopkins W. (2000). *Sports Med.* 30(1), 1-15.

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1968 Board #14 MAY 31 9:00 AM - 10:30 AM

### 6 Min Endurance Run And 20m Shuttle Run - Which Field Test Is More Valid To Assess Aerobic Fitness In Children?

Birte von Haaren<sup>1</sup>, Sascha Haertel<sup>2</sup>, Ilka Seidel<sup>3</sup>, Lars Schlenker<sup>2</sup>, Klaus Boes<sup>2</sup>. <sup>1</sup>House of Competence, Karlsruhe, Germany. <sup>2</sup>Institute of Sport and Sports Science, Karlsruhe, Germany. <sup>3</sup>Institute of Applied Training Science, Leipzig, Germany.

(No relationships reported)

Field tests of fitness offer an alternative to expensive and sophisticated laboratory procedures for the assessment of aerobic fitness in children and adolescents. The use of different tests for the assessment complicates the comparison of aerobic fitness between countries. Therefore the validation and standardization has to be a scientific goal.

**PURPOSE:** This study aimed at comparing the validity of two commonly used field tests, the 20m shuttle run and the 6 min endurance run, using the gold standard for aerobic fitness,  $\text{VO}_2\text{max}$ , as criterion reference. A second goal was to identify gender-specific differences.

**METHODS:** 30 children (16 boys) between 9 and 11 years of age ( $10.1 \pm 0.7$ ) performed a 6 min endurance run and a 20m shuttle run.  $\text{VO}_2\text{max}$  was determined via gas analysis during a progressive treadmill test with an initial pace of 6 km/h, a continuous slope of 1 % and a two minutes length of each grade. For data analysis, the total distance (in meters) of the 6 min endurance run and the test duration (in seconds) of the 20m shuttle run were taken into account.

**RESULTS:** The mean overall  $\text{VO}_2\text{max}$ , relative to body weight (ml/min/kg) during the progressive treadmill test was  $49, 8 (\pm 6,4)$ , with boys ( $50,5 \pm 4,4$ ) achieving a slightly higher  $\text{VO}_2\text{max}$  than girls ( $49,2 \pm 8$ ). The boys achieved 67 more meters in the 6 min endurance run compared to the girls (boys:  $1123 \pm 76,8$ ; girls  $1056 \pm 131,4\text{m}$ ). In the 20m shuttle run, the boys kept the pace 47 seconds longer than the girls (boys:  $434 \pm 60,7$ ; girls:  $387 \pm 111,1$ ).

The results of the 6 min endurance run showed higher correlations with  $\text{VO}_2\text{max}$  ( $r=0.69$ ;  $p<.01$ ) compared to the results of the 20m shuttle run ( $r=0.52$ ;  $p<.01$ ). The gender-specific analyses showed significantly lower correlations of the 20m shuttle run and  $\text{VO}_2\text{max}$  for the boys ( $r=0.29$ ;  $p>.05$ ) compared to the girls ( $r=0.58$ ;  $p<.05$ ).

**CONCLUSION:** In this study, the 6 min endurance run proved to be more valid to assess aerobic fitness in 9 to 11-year-old children than the 20m shuttle run.

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**1969** Board #15 MAY 31 9:00 AM - 10:30 AM

### Cardiovascular Fitness Improvements From High Intensity Training In Children

Brian K. Sanborn, Pratik Patel, Christian Larson, Bryan S. Heinrich, Nathaniel Fehl, Katie M. Heinrich. *Kansas State University, Manhattan, KS.* (Sponsor: Craig Harms, FACSM)

(No relationships reported)

High intensity exercise improves cardiovascular fitness in children; research has shown significant improvements in cardiovascular fitness for adults who spent <3 hours a week engaging in high intensity exercise. Data show many children do not meet the weekly physical activity recommendations of the ACSM. With high intensity training, cardiovascular fitness and body composition can be improved while spending significantly less time exercising.

**PURPOSE:** The purpose of this study was to determine the effects of a short-duration, high intensity exercise training program lasting four weeks on cardiovascular fitness when compared to active youth of similar age.

**METHODS:** This study used a pre-test posttest quasi-experimental two-group design. Nine children (8 males, 1 female, mean age 10.6y) were in the intervention group (IG) and 6 (6 males, mean age=11.3y) were in the Comparison Group (CG). The IG participated in high intensity exercise and skill training sessions (45 min, 2d/wk for 4wk). In brief, sessions consisted of 5min warm-up, 10min skill/technique work, 10-15min workout, short water break, and 10-15min playing an active game. Both groups completed the Fitnessgram pacer cardiovascular fitness assessment developed by the Cooper Institute. Heart rate was recorded immediately following the Pacer along with heart rate recovery one minute and two minutes following. Difference scores were computed and t-tests were conducted for statistical significance between groups.

**RESULTS:** The number of 20m laps completed during the Pacer decreased for both groups with a mean difference score of -5.44 (sd=5.79) for the IG and -3.67 (sd=8.94) for the CG; this difference was statistically significant,  $t=3.43$ ,  $p=.004$ . Heart rates remained similar and neither group showed significant improvement in their heart rate recovery measured after completion of the PACER test ( $p>.05$ ).

**CONCLUSION:** Both groups failed to show improvements in cardiovascular fitness (as measured by the Pacer test). Failure to improve cardiovascular fitness may be attributed to the overall duration of the intervention and total number of training sessions. Future research should examine if lengthening the intervention or having additional training sessions each week might result in significant improvements in cardiovascular fitness.

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**1970** Board #16 MAY 31 9:00 AM - 10:30 AM

### Fitness Gains from a Summer Youth Conditioning Camp

Pratik M. Patel, Brian Sanborn, Christian Larson, Bryan S. Heinrich, Nathaniel Fehl, Katie M. Heinrich. *Kansas State University, Manhattan, KS.* (Sponsor: Craig Harms, FACSM)

(No relationships reported)

High intensity (HI), low volume exercise may improve fitness better than low intensity, high volume training. Children struggling to achieve the recommended 60 minutes of daily exercise could benefit from exercising more intensely for less time.

**PURPOSE:** This study examined the effects of short-duration, HI exercise training on fitness and body composition for youth.

**METHODS:** Two groups of children participated in this quasi-experimental study: 9 in the Intervention Group (IG; mean =10.6 yrs, 8 M, 1 F), and 6 in the Comparison Group (CG; mean =11.3 yrs, 6 M). The IG participated in HI exercise (45 min, 2d/wk, 4wks). Both groups completed pretest and posttest fitness assessments, as well as a Dual-Energy X-ray Absorptiometry scan 4 weeks apart. Difference scores were computed for each fitness test and t-tests were conducted for statistical significance between groups.

**RESULTS:** Significant differences were found between groups for fitness and body composition (all  $p<.05$ ). A higher percentage of IG participants improved over the CG on the Margaria-Kalamen step test (33% vs. 16.7%), while the CG had faster times on a 40m dash (100% vs. 44.4%), agility (50% vs. 44.4%), and the Fitnessgram Pacer test (33.3% vs. 11.1%). Significant differences were found for changes in body composition. More participants in the IG grew taller (77.8% vs. 50.0%), while participants in the CG improved over the IG for total body mass decrease (44.4% vs. 16.7%), fat mass decrease (66.7% vs. 11.1%), lean body mass increase (83.3% vs. 33.3%), and body fat percentage decrease (83.3% vs. 11.1%).

**CONCLUSION:** Four weeks of HI exercise yielded greater increases in power and height. Both groups had participants that showed improvement in each area but the CG showed greater improvement in more areas of fitness (speed, agility, cardiorespiratory endurance) and body composition when compared to the IG. Potential

explanations include the short duration and frequency of the exercise intervention, measurement error and differences in reporting of fitness, body composition, and anthropometric measurement testing, psychological and motivational status of youth during testing sessions, and physical activity and fitness capabilities of youth between both groups.

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**1971** Board #17 MAY 31 9:00 AM - 10:30 AM

### Influence Of Resistive Load On Oxygen Uptake During Repeated Sprints In Prepubertal Boys And Men.

Apostolos Theos, Gregory Bogdanis, Anastasios Philippou, Maria Maridaki. *National & Kapodistrian University of Athens, Greece, Athens, Greece.*

(No relationships reported)

Oxygen uptake ( $\text{VO}_2$ ) during repeated sprinting differs significantly between different resistive loads in adults. Furthermore in two consecutive Wingate tests children produce energy more aerobically in comparison to adults.

**PURPOSE:** To examine the influence of two different resistive loads on  $\text{VO}_2$  during repeated sprints and in men and boys.

**METHODS:** Nine men ( $21.7 \pm 0.8$  yrs) and twelve prepubertal boys ( $11.8 \pm 0.2$  yrs) performed a force-velocity test on a friction-loaded cycle ergometer to determine the load corresponding to the optimal pedal rate (Fopt). On two separate occasions, ten 6-s sprints interspersed with 24-s recovery intervals were performed, against a load equal to Fopt or 50%Fopt in random order. Power output was recorded at 200Hz and  $\text{VO}_2$  was continuously monitored. Comparisons between the two conditions of repeated sprints were made using two-way ANOVA with repeated measures. Results are presented as mean  $\pm$  standard error.

**RESULTS:**  $\text{VO}_2$  for all ten sprints in men was higher in the Fopt compared with the 50%Fopt condition ( $37.1 \pm 1.0$  vs.  $34.0 \pm 0.9$  ml/kg/min for the Fopt and 50%Fopt, respectively,  $p<0.01$ ), while  $\text{VO}_2$  in the two conditions was similar in boys ( $35.7 \pm 1.8$  vs.  $34.0 \pm 1.9$  ml/kg/min for the Fopt and 50%Fopt respectively,  $p=0.42$ ). Scaling of  $\text{VO}_2$  per unit of power output (i.e. per Watt; ml/W/min) revealed significant differences between men and boys ( $p<0.001$ ). In particular in both the Fopt and 50%Fopt condition post-hoc analysis indicated that boys had higher values of  $\text{VO}_2$  per Watt compared with men from the second to the sixth sprint (average  $\text{VO}_2$  per Watt for sprints 2-6 for boys vs. men; Fopt:  $3.5 \pm 0.3$  vs.  $4.2 \pm 0.2$  ml/W/min,  $p<0.01$ ; 50%Fopt:  $3.3 \pm 0.2$  vs.  $4.4 \pm 0.2$  ml/W/min,  $p<0.01$ ). From the seventh to the tenth sprint men and boys had similar  $\text{VO}_2$  per Watt.

**CONCLUSION:** The results of the present study suggest that boys may generate power mainly through aerobic pathways during the initial part of a repeated sprint protocol compared with men.



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1972 Board #18 MAY 31 9:00 AM - 10:30 AM

**Association Between Knee Alignment, Body Mass Index And Physical Fitness Among Students**

Andreia Souza, Gerson Ferrari, Joao Pedro Silva Junior, Leonardo Silva, Luis Carlos Oliveira, Victor Matsudo. *Center of Studies of the Physical Fitness Research Laboratory from São Caetano do Sul (CELAFISCS), São Caetano do Sul, Brazil.*  
(No relationships reported)

**PURPOSE:** To assess the association between malalignment of the knees (genu valgum) and variables of physical fitness among schoolchildren.

**METHODS:** Sample is part of the Ilhabela Mixed-Longitudinal Project on Growth, Development and Physical Fitness\*, which is held since 1978 in the state of São Paulo, Brazil. Data were selected from a database of 16,000 schoolchildren measured from 1978 to 2010. We analyzed data collected between the years 2000 to 2009. Sample comprised 1141 schoolchildren of both sexes aged 06 to 18 years, who reached the following criteria: age between 6 and 18 years, and a full assessment of physical fitness, including measurement of genu valgus in at least one of the semester assessments. Postural evaluation (valgus) was determined by the intermalleolar distance, in centimeters. Body Mass Index (BMI) was determined through the growth curves of the World Health Organization. Physical fitness variables (strength of upper and lower limbs and velocity), were taken according to CELAFISCS standardization Statistics: Analysis of prevalence ratio (PR) was performed by unadjusted and adjusted Poisson regression with confidence intervals of 95%. Results:

**CONCLUSION:** There was a positive association between malalignment of the knees and body mass index among schoolchildren. No association was observed among genu valgum and physical fitness.

\*Supported by FAPESP process number 2010/20749-8

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1973 Board #19 MAY 31 9:00 AM - 10:30 AM

**Effects of Summer School and Exercise on Physical Fitness and Weight Gain in Hispanic Adolescents**

Jessica S. Zamarripa<sup>1</sup>, Kyung-Shin Park<sup>1</sup>, Noemi Ramirez<sup>1</sup>, David Martinez<sup>2</sup>. <sup>1</sup>Texas A&M International University, Laredo, TX. <sup>2</sup>JB Alexander High School, Laredo, TX.  
(No relationships reported)

Youth overweight and obesity prevalence rates have increased in the last 30 years becoming a significant public health concern particularly among low-income communities and ethnic minorities. Evidence indicates that weight gain and physical fitness declines are a result of physical inactivity and increased food intake during summer break.

**PURPOSE:** The purpose of this study was to determine the effect of a 5 week summer school program, including 12 hours/week of physical activity, on physical fitness and weight gain prevention in Hispanic adolescents.

**METHODS:** 89 high school students participated in this study and 62 (29 males and 33 females) completed three tests, before and after summer school program, and after summer break. For each test, physical characteristics such as height, body weight, BMI, waist and hip circumference, and fitness levels including push-up, sit-up, sit and reach, and Queens' college step test were measured. Variables were analyzed using one way (time) repeated measures analysis of variance (ANOVA) with Tukey post hoc tests.

**RESULTS:** No significant changes were found in height, body weight, BMI, waist and hip circumference, and sit and reach (flexibility) through summer break. Indices of muscular strength such as push-up (P<.01), sit-up (P<.05) and cardiorespiratory fitness (P<.05) were significantly improved through summer school program, but returned to baseline at the end of summer break. Data collected before and after summer school program, and after summer break are as follows: push-up (20.6±1.2→28.9±1.2→24.6±0.8, Mean±SE), Sit-up (26.9±1.3→ 32.4±1.5→ 30.4±1.5) and estimated VO<sub>2max</sub> (46.1±1.2 ml·kg<sup>-1</sup>·min<sup>-1</sup>→49.1±1.2→47.3±1.3).

**CONCLUSIONS:** Data analysis corroborates the initial hypothesis that summer school effectively prevents summer weight gain among Hispanic adolescents. Muscular strength and cardiorespiratory fitness were significantly enhanced during the 5-week summer school program, yet declined through the rest of the summer break. Results indicate that a long summer break may increase summer weight gain among Hispanic youth due to the lack of structure and unrestricted food access, which they would otherwise receive during the school year, thus encouraging physical inactivity and binge eating.

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1974 Board #20 MAY 31 9:00 AM - 10:30 AM

**Effects of Obesity and Fitness Levels on Academic performance in Hispanic Male and Female Adolescents**

Joseph Lee<sup>1</sup>, Briana Rodriguez<sup>2</sup>, Blas D. Salinas<sup>2</sup>, Arturo Limon<sup>3</sup>, Kyung-Shin Park<sup>3</sup>. <sup>1</sup>Harmony Science Academy, Laredo, TX. <sup>2</sup>United South High School, Laredo, TX. <sup>3</sup>Texas A&M International University, Laredo, TX.  
(No relationships reported)

Adolescents experience many changes in body structure and psycho-social functioning. Perceived obesity status and lower physical fitness are negatively associated with academic performance and the impact of these variables in academic performance may be different in males and females.

**PURPOSE:** The purpose of this study was to investigate whether levels of obesity and physical fitness have an influence on academic performance in Hispanic male and female adolescents.

**METHODS:** Body mass index (BMI), one-mile run and curl-up scores from 1,401 Hispanic adolescents in grades 9-11 were collected (746 males, 655 females). Students were classified into three groups for BMI score using CDC weight status cut point (normal, overweight, and obese) and three groups for aerobic fitness (one mile run) and muscular strength (curl-up) using FITNESSGRAM standards (ES: exceed standard, MS: meet standard, and US: under standard). Reading and Mathematics scores in Texas Assessment of Knowledge and Skills (TAKS) test were obtained from a South Texas school district. Variables were analyzed using two way (gender×group) analysis of variance (ANOVA) with Tukey post hoc test.

**RESULTS:** Obese male students showed lower scores in both Reading (31.6±1.7, Mean±SE vs. 36.6±0.6 and 36.9±1.1 for normal and overweight, P<0.05) and Math (29.1±1.7 vs. 34.5±0.7 and 34.6±1.2, P<0.05). However, there was no relation between the level of obesity and TAKS scores in female students. US males in curl-up (27.5±1.0) received significantly lower score in Math than NS and ES (32.7±0.9, 37.2±0.8, P<. 0.01) and US females in curl-up showed lower scores in both Reading (34.0±0.9 vs. 41.1±0.8 and 41.7±0.8, P<0.01) and Math (29.1±0.9 vs. 35.5±0.9 and 36.9±1.0, P<0.01). TAKS scores were not affected by levels of aerobic fitness (one-mile run).

**CONCLUSIONS:** Results indicate that academic achievement in Hispanic high school students is associated with level of muscular strength, but not affected by aerobic fitness. Gender difference is visible in the relation between obesity levels and academic achievement in Hispanic adolescents. Academic success in male students is more sensitively affected by level of obesity (body shape) than females.

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1975 Board #21 MAY 31 9:00 AM - 10:30 AM

**Factors Relating to VO<sub>2</sub> Peak in Healthy-Weight Versus Obese Young Children**

Elizabeth A. Easley, Linnie Toney, Jody L. Clasey, FACSM. *University of Kentucky, Lexington, KY.*  
(No relationships reported)

Despite concerted efforts to prevent and combat childhood obesity, the high prevalence remains and continues to adversely impact both the present and future health and well-being of these children. Aerobic fitness determined by measures of peak oxygen consumption relative to body weight (VO<sub>2</sub> peak; ml/kg/min) have been demonstrated to be related to both cardiovascular and body composition measures in adults.

**PURPOSE:** To determine the relationships between VO<sub>2</sub> peak and resting measures of heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), rate pressure product (RPP), and percent body fat (%Fat) in healthy-weight (HW) and obese (OB) children; and to examine whether group mean differences exist among these measures in HW versus OB children.

**METHODS:** HW (n=27; 9 girls and 18 boys) and OB (n=16; 6 girls and 10 boys) children ages 7-11 yr old completed a multistage maximal treadmill graded exercise test (GXT). Prior to the GXT, resting HR, SBP, MAP, and RPP were recorded and/or calculated. %Fat was measured using total body DXA scans. Simple regression was used to determine the strength of the relationships; and unpaired t-tests were used to determine the group mean differences between the HW and OB children.

**RESULTS:** In the HW children VO<sub>2</sub> peak (40.6 ± 8.2 ml/kg/min) was significantly (p<0.05) related to HR (86.0 ± 15.0 bpm; r = -0.50) and RPP (8677.7 ± 1742.1; r = -0.44); but not to SBP

(100.9 ± 7.5 mmHg;  $r = 0.03$ ), DBP (64.8 ± 11.1 mmHg;  $r = 0.05$ ), MAP (76.8 ± 8.6 mmHg;  $r = 0.05$ ) or %Fat (17.0 ± 6.0 %;  $r = -0.15$ ). In the OB children  $\text{VO}_2$  peak (27.2 ± 6.3 ml/kg/min) was significantly related to %Fat (42.5 ± 5.6;  $r = -0.52$ ); but not to HR (99.9 ± 13.9 bpm;  $r = -0.31$ ); SBP (109.3 ± 8.2 mmHg;  $r = -0.16$ ), DBP (74.1 ± 6.3 mmHg;  $r = -0.30$ ); MAP (85.8 ± 5.7 mmHg;  $r = -0.29$ ); or RPP (10926.1 ± 1795.0;  $r = -0.31$ ). With the exception of  $\text{VO}_2$  peak, the OB children had significantly greater resting HR, SBP, DBP, MAP, RPP and %Fat measurement compared to the HW children.

**CONCLUSION:** The relationships among  $\text{VO}_2$  peak, body composition, and resting cardiovascular measures and indexes may vary between young children of different levels of adiposity. Supported in part by the University of Kentucky PEP Laboratory Endowment Fund.

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**1976** Board #22 MAY 31 9:00 AM - 10:30 AM

**Effects Of Summer Physical Education Program On BMI And Level Of Fitness In Hispanic Adolescents**

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(No relationships reported)

The dramatic increase in the prevalence of overweight and obese children over the past several decades poses a significant public health concern, especially among low-income communities and ethnic minorities. Some evidence suggests that physical fitness declines during the summer months and that children gain most of their extra weight during this period due to physical inactivity and an increase in food intake.

**PURPOSE:** The purpose of this study is to investigate whether attending a 5-week summer physical education program for Hispanic high school students is beneficial for maintaining body weight and physical fitness through the summer break.

**METHODS:** Total of 132 students participated in measurements at the beginning and end of summer break such as height, body weight, BMI, muscular strength, and cardiorespiratory fitness. Only 62 students (treatment) attended a 5-week summer physical education program, which included 12 hours/week of physical activity. Variables were analyzed using two way (group×time) repeated measures analysis of variance (ANOVA) with Bonferroni's correction.

**RESULTS:** Non-summer school attendants gained body weight (63.6±1.9kg→65.6±1.9,  $P<.01$ , Mean±SE) and BMI (24.4±.7→24.97±.6,  $P<.05$ ) without significant change in height. Estimated cardiorespiratory fitness via step test also significantly decreased (43.4±1.0ml<sup>1</sup>kg<sup>-1</sup>min<sup>-1</sup> →41.7±0.9,  $P<.05$ ). Summer school attendants showed no significant changes in variables during summer break.

**CONCLUSIONS:** Results of study correspond with previous findings that adolescent weight gain during summer break may be due to physical inactivity and easy access to food. It is proposed that school districts incorporate a structured physical activity program throughout the summer break to prevent the prevalence of obesity.

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**1977** Board #23 MAY 31 9:00 AM - 10:30 AM

**Metabolomic Signatures following 8 Weeks of Play-Based Activity vs. Controls in Overweight Adolescent Children**

Scott R. Collier, FACSM<sup>1</sup>, Chelsea D. Curry<sup>1</sup>, Marco Meucci<sup>2</sup>, Carol B. Cook<sup>1</sup>, Carlo Baldari<sup>2</sup>, Wei Jia<sup>3</sup>. <sup>1</sup>Appalachian State University, Boone, NC. <sup>2</sup>Università degli Studi di Roma "Foro Italico", Rome, Italy. <sup>3</sup>University of North Carolina at Greensboro, Greensboro, NC.  
(No relationships reported)

Play-based activities can be used to increase participation of overweight and obese children increasing the time spent on movement activities increases. Urinary metabolomic signatures of exercise can elucidate an elemental shift in the metabolome giving investigators the potential mechanistic explanations behind improvements in physiological systems. The purpose of our study was to elucidate the dose-response urinary metabolomic signature shift in overweight adolescents following 4 or 8 weeks of play-based activity vs. a typical summer break control group.

**METHODS:** Twenty-two recreationally active adolescent children participated in the study. Subjects were assigned to each activity group due to the 8 or 4 week camp their parents enrolled them into (8w or 4w, respectively). The control group (C) was randomly chosen from flyers distributed throughout the community. They were not enrolled in any activities and had no plans of changing typical activity levels throughout the summer. Subjects reported to the Vascular Biology and Autonomic Studies Laboratory on two separate visits, at the beginning and end of 4 or 8 weeks of their enrolled group to give urinary samples at which time a graded exercise test was given and descriptive characteristics were recorded. A supervised partial least squares-discriminant analysis (PLS-DA) models were used to analyze the difference between pre- and post-exercise samples.

**RESULTS:** A valid PLS-DA model was obtained between post-exercise subjects in 8w group and C group (3 components,  $R^2X=0.332$ ,  $R^2Y=0.976$ ,  $Q^2=0.091$ ).

**CONCLUSION:** These data indicate that 8 weeks of play-based activity yielded identifiable metabolomic changes with several identifiable elements.

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**1978** Board #24 MAY 31 9:00 AM - 10:30 AM

**Reliability Of The Bruininks-Oseretsky Test Of Motor Proficiency In Children And Adolescents With Prader-Willi Syndrome**

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(No relationships reported)

Individuals with Prader-Willi Syndrome (PWS) present with overall motor deficiency, but the specific areas have yet to be identified in youth. To determine specific areas of deficiency, a reliable instrument must be used.

**PURPOSE:** To determine if the Bruininks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2) is a reliable instrument for assessing motor proficiency in children and adolescents with PWS.

**METHODS:** 10 children with PWS (5 girls/5 boys, mean age 11.1±1.7 yrs) participated in this study. Participants completed the test on two separate morning visits, one week apart. The BOT-2 test evaluates seven items related to motor proficiency: Fine motor precision, fine motor integration, manual dexterity, bilateral coordination, balance, running speed and agility, upper limb coordination, and strength. The test provides subtest item scores and a total composite score (TCS).

**RESULTS:** The Pearson product correlation coefficients between visits ranged from  $r=.712$  to  $r=.965$ , with a total composite test score  $r=.989$  (all significant at  $p<0.021$ ).

**CONCLUSION:** The total composite test score and the majority of subtest item scores showed moderate-to- high test-retest correlation coefficients. In conclusion, based on these pilot data, the BOT appears to be a reliable test to assess motor proficiency in children and adolescents with PWS ages 8 to 15 years old. Supported by USAMRAA W81XWH-09-1-0682

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**1979** Board #25 MAY 31 9:00 AM - 10:30 AM

**Accumulation of Physical Activity Training on the Cardiorespiratory and Cognitive Function in Obese Adolescents**

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(No relationships reported)

Adolescent obesity rate was almost doubled last 10 years in Korea. Regular physical activity (PA) improves cardiorespiratory and cognitive function in adolescents. However, it is still unknown the effects of accumulating short bouts of PA ( $\text{PA}_{\text{accum}}$ ) on cardiorespiratory and cognitive function in obese and overweight adolescents.

**PURPOSE:** To examine the effects of a  $\text{PA}_{\text{accum}}$  and a continuous PA ( $\text{PA}_{\text{cont}}$ ) training for 8 weeks on cardiorespiratory and cognitive function in obese adolescents.

**METHODS:** Obese and overweight male adolescents ( $n=32$ ; 12.8±0.8 yrs; body mass index, BMI = 27.3±3.1kg/m<sup>2</sup>) completed the training study. They were assigned to one of the three groups: a control (CON,  $n=8$ ) and two PA groups, the  $\text{PA}_{\text{accum}}$  (two 20-min sessions 4-hour apart;  $n=12$ ); and the  $\text{PA}_{\text{cont}}$  (a 40-min session;  $n=12$ ). The components of two PA programs composed of endurance (70% of peak oxygen uptake,  $\text{VO}_2$ peak) and strength exercise 5 days/week for 8 weeks were identical. All the participants performed maximal graded cycle ergometer test and cognitive function using standardized Korea multi-intelligence test including vocabulary, understanding, figure perception, numeracy, space perception and space inference before and after the training. Two-way ANOVAs with repeated measures were used ( $p<.05$ ).

**RESULTS:** Interactions were found in  $\dot{V}O_{2peak}$  ( $p=.025$ ), vocabulary ( $p=.002$ ), figure perception ( $p=.047$ ), space perception ( $p=.011$ ) and space inference ( $p=.003$ ). After the training,  $\dot{V}O_{2peak}$  was increased all three groups ( $PA_{con}$   $7.8\pm 4.6$  kg/ml/min;  $PA_{accum}$   $9.7\pm 6.3$  kg/ml/min;  $CON$   $2.8\pm 3.1$  kg/ml/min). BMI was not changed after the training. In cognition, after the training vocabulary ( $3.3\pm 4.2$ ), space perception ( $6.5\pm 9.2$ ) and space inference ( $6.5\pm 6.5$ ) was increased in  $PA_{accum}$ , only space perception ( $7.6\pm 7.3$ ) was increased in  $PA_{con}$  while none was changed in the control.

**CONCLUSION:** The accumulation of PA improved cardiorespiratory fitness although BMI was not changed in obese and overweight male adolescents. The  $PA_{accum}$  also improved cognitive functions such as vocabulary, space perception and inference. Accumulating short bouts of PA might be adopted to school in lunch break or recess to improve fitness and cognitive function in adolescents.

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**1980** Board #26 MAY 31 9:00 AM - 10:30 AM

**Associations Between High-intensity Training, Body Composition And Fitness In Youth**

Katie M. Heinrich, Pratik M. Patel, Brian K. Sanborn, Nathaniel Fehl, Bryan S. Heinrich, Christian R. Larson. *Kansas State University, Manhattan, KS.* (Sponsor: Craig Harms, FACSM)

(No relationships reported)

Fitness is protective against childhood obesity. In particular, greater cardiorespiratory (CR) fitness is associated with less total and abdominal adiposity. High-intensity (HI) exercise is associated with greater CR fitness levels in youth, and is an overall key to improving fitness.

**PURPOSE:** This pilot study examined the relationship between changes in body composition and fitness for youth participating in a HI intervention as compared to active youth.

**METHODS:** The intervention group (IG;  $n=9$ , 8m, 1f) were ages 10-13 (mean=10.78y) and the comparison group (CG;  $n=6m$ ) were ages 10-12 (mean=11.17y). The IG participated in 4 weeks of HI exercise (2d/wk, 45m/session). Pre- and posttest assessments included measured body composition (height and weight for body mass index-BMI, waist circumference-WC, dual X-ray absorptiometry for bodyfat percentage-BF%) and fitness (power-Margaria-Kalamen step test, vertical and horizontal jumps; speed-40m dash; muscular endurance- curlsups and pushups; balance-Stork Balance Test; accuracy-wall toss test; agility-Illinois agility test; CR endurance-Fitnessgram Pacer).

**RESULTS:** Based on BMI %iles, 2 IG and 1 CG participants were overweight and 1 CG participant was obese. Based on WC %iles, 3 IG and 2CG participants were overweight. Based on BF%iles, 1 CG participant was overweight and 1 CG participant was obese. After 4 weeks, both groups averaged lower BMIs (IG =  $-.038\pm .44$ ; CG =  $-.234\pm 1.21$ ) and increased WC (IG =  $.498\pm 1.89$ ; CG =  $1.0\pm .77$ ). Significant differences existed between groups for change in BF% (CG =  $-.43$ , IG =  $.83$ ;  $p=.021$ ). For the IG, BMI was negatively associated with speed; BF% was negatively associated speed ( $p=.008$ ); and WC was positively associated with agility ( $p=.018$ ), but negatively with pushups ( $p=.014$ ). For the CG, BMI was positively associated with lower vertical jump ( $p=.031$ ).

**CONCLUSIONS:** Despite high activity levels, 33% of the IG and CG participants were overweight or obese. Children participating in the HI intervention did not see gains in CR fitness. Overall the IG improved BMI, but had increased WC and BF%. The increased BF%, despite lower BMI, resulted in decreased speed, while the increased WC resulted in greater agility, but lower muscular endurance for the IG. Lower BMI in the CG decreased power.

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**1981** Board #27 MAY 31 9:00 AM - 10:30 AM

**Sex Differences in Childhood Athletic Performance**

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(No relationships reported)

**INTRODUCTION:** Growth and motor development literature suggests a two-way (age by sex) interaction for maturational traits and motor performance variables (Beunen & Malina, 1988). Much of the research in this area, however, focuses on sex differences around the adolescent growth spurt with little documentation of performance differences throughout childhood.

**PURPOSE:** The purpose of this study was to test for the presence of an age by sex interaction for a complex motor performance task and to determine whether or not sex differences exist for the performance of this task during childhood.

**METHODS:** The data for this project were provided by USA Swimming (USAS) and consisted of the best 50-yard Freestyle performance for all USAS registered male and female swimmers from 6-19 years of age that competed in the event from 2005-2010 ( $N = 1,193,362$ ). The distribution location was determined for each combination of age, sex and competition year using methods previously described (Hoaglin, 2006). ANOVA was then utilized to test the significance of the age by sex interaction.

**RESULTS:** ANOVA revealed a significant age by sex interaction effect ( $F(13, 65) = 136.2$ ,  $p < .001$ ). Simple effects analysis indicated that the location parameter was significantly lower (i.e., times were faster) for boys than girls for 8-10 and 13-19 year olds ( $p < .001$ ) while there was no difference in the location parameter between boys and girls 6-7 and 11-12 years old. The mean difference in the location parameter between boys and girls was significantly greater ( $p < .05$ ) for 13-19 year olds (2.64) than for 6-12 year olds (0.44).

**CONCLUSIONS:** The age by sex interaction for 50-yard Freestyle performance parallels the reported maturational changes. The marked acceleration in height, weight, and strength in boys beginning around 13 years magnifies the relatively small preadolescent sex differences. These traits play a crucial role in the increased performance difference between boys and girls from 12 to 13 years. While maturational traits play a role in adolescent performance differences, their role in childhood performance differences is unclear. Additional research is needed to determine whether or not the superior performance of boys relative to girls relates to physiological parameters and/or sex differences in participation and selection bias.

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**1982** Board #28 MAY 31 9:00 AM - 10:30 AM

**Sex Specific Effects Of Integrative Neuromuscular Training On Fitness Performance In 7 Year Old Children**

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(No relationships reported)

**PURPOSE:** To evaluate sex-specific effects of integrated neuromuscular training (INT) on selected health- and skill-related fitness components in children implemented during physical education (PE) classes.

**METHODS:** Forty children ( $7.6 \pm 0.3$  years) from two 2<sup>nd</sup> grade PE classes participated in this study. Classes were cluster randomized into PE plus INT (INT; 10 male, 11 female) or the control group (CON; 6 male, 13 female) who participated in traditional PE. INT was performed 2x/wk during the first approximately 15 min of each PE class and consisted of body weight exercises that focused on enhancing muscular strength, muscular power and fundamental movement skills. Main outcome measures were 8 health- and skill-related fitness tests.

**RESULTS:** At baseline, the male students demonstrated higher levels of performance in multiple fitness measurements as evidenced by significantly greater performance on the push-up, 0.8 km run, long jump, single-leg hop and shuttle run tests ( $p<0.05$ ). Significant time by group interactions were noted in INT females due to enhanced INT-induced gains in performance relative to CON on the curl-up, push-up, 0.8 km run, long jump, and single-leg hop ( $p<0.05$ ). Males did not demonstrate any interaction effects of training, but both INT and CON improved similarly in the 0.8 km run, long jump, single-leg hop and shuttle run post-training ( $p<0.05$ ).

**CONCLUSIONS:** These findings indicate that INT is an effective and time-efficient addition to PE to enhance motor skills and promote physical activity in children. The 2<sup>nd</sup> grade females in the current study showed greater sensitivity to the effects of INT.

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1983 Board #29 MAY 31 9:00 AM - 10:30 AM

**Establishing Criterion-Health Related Standards for Muscular Fitness Tests in High School Adolescents**

Pedro F. Saint-Maurice<sup>1</sup>, Gregory Welk, FACSM<sup>1</sup>, Ryan D. Burns<sup>2</sup>, James C. Hannon<sup>2</sup>. <sup>1</sup>Iowa State University, Ames, IA. <sup>2</sup>University of Utah, Salt Lake City, UT.  
(No relationships reported)

**BACKGROUND:** Physical fitness has been associated with risk of low back pain (LBP) in youth. Therefore, it is important to identify feasible and accurate field tests to identify individuals at risk for this condition.

**PURPOSE:** The purpose of this study was to test utility of different fitness field tests to predict self-reported LBP in high school adolescents.

**METHODS:** A sample of 100 high school (9<sup>th</sup> and 10<sup>th</sup> grade students) participated in the project as part of a supplemental school physical fitness evaluation. Participants first completed a survey instrument designed to assess the presence (and degree of) low back pain. On subsequent days, participants completed a battery of different physical fitness tests including: trunk extension test (in inches), dynamic curl-up (in number of repetitions), static curl-up (in seconds), plank (in seconds), lateral plank (in seconds), and the sit-and-reach test (in cm). The performance on the fitness tests were converted into z-scores and sums were then computed for all possible combinations of Z-scores from 2 and 3 tests. Receiver operator characteristic curves (ROC) were used to test the utility of the various combinations to predict self-reported LBP.

**RESULTS:** Girls classified "with LBP" (n=11) had Z-scores below average on all the tests (-0.60 to -0.12). Z-scores for girls that reported "No LBP" (n=19) ranged from -0.07 to 0.05. The static curl-up and the lateral plank tests combined were the best indicator of LBP in girls (AUC=0.69; Sensitivity=90.9, Specificity=52.6). The same analyses for males were inconsistent and revealed that males "with LBP" and males with "No LBP" did not differ on their fitness performance tests.

**CONCLUSIONS:** The ROC properties indicate that these tests can identify adolescents' girls with LBP (Sensitivity) however, the low value for Specificity indicate that girls with "No LBP" can be misclassified as being at risk for LBP. The same approach for males had mixed findings and therefore requires further testing.

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1984 Board #30 MAY 31 9:00 AM - 10:30 AM

**Bilateral Deficit In Vertical Jumping In Children And Adolescent Male And Female Athletes**

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(No relationships reported)

It has been reported that power output per leg is less in two-leg jumps than in single leg jumps. This phenomenon has been termed bilateral deficit and has been attributed to a reduced neural drive that may be lower in pre-pubertal children compared with post-pubertal teenagers and adults. However, it is not certain that a bilateral deficit exists in children and especially in young females.

**PURPOSE:** To examine bilateral deficit in vertical jumping in male and female child and adolescent athletes.

**METHODS:** One hundred and seventy children with at least 2 years of training experience in track and field were divided into four groups according to age and gender: (pre-pubertal boys: n=45, age: 10.1±0.1 yrs, 141±1 cm, 36.0±0.9 kg; pre-pubertal girls: n=42, 10.1±0.1 yrs, 140±1 cm, 37.3±1.2 kg; adolescent boys: n=41, 15.0±0.1 yrs, 171±1 cm, 61.5±1.4 kg; adolescent girls: n=42, 14.8±0.1 yrs, 161±1 cm, 52.8±1.1 kg). Participants performed one-leg and two-leg counter movement jumps without arm swing on a contact mat. The bilateral jump deficit index was calculated as: 1-(right+left leg jump height)/two-leg jump height x 100. Peak leg power output during jumping was also calculated and was scaled with body mass. Differences between boys and girls and the two age groups were analyzed using two way ANOVA.

**RESULTS:** Jump height and leg peak power were similar in pre-pubertal boys and girls (24.8±0.7 vs. 24.2±0.7 cm and 30.0±1.1 vs. 29.2±1.2 W, respectively). However, jump height and leg peak power were higher in adolescent boys compared to girls (37.8±0.8 vs. 29.3±0.9 cm and 49.0±0.8 vs. 40.2±1.0 W, respectively, p<0.01). The bilateral index was positive for males in both age groups (2.0±1.3% and 1.9±1.2%) indicating lack of bilateral deficit. This was also the case for the pre-pubertal girls (bilateral index: 0.1±1.2%). However, adolescent females showed a negative bilateral index (-3.3±1.5%), with the sum of the single leg jumps being significantly greater than the two-leg jump (30.3±1.0 vs. 29.3±0.9 cm, P<0.05).

**CONCLUSION:** There was a lack of bilateral deficit in vertical jumping in pre-pubertal boys and girls and also in adolescent boys. The manifestation of bilateral deficit only in adolescent girls may be explained by superior motor skill ability (i.e. balance on one leg and jump) of girls over boys in that age.

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1985 Board #31 MAY 31 9:00 AM - 10:30 AM

**Improved Movement Skill Competency in a Preschooler Physical Activity Intervention**

Anthony Dyrek, Anne R. Lindsay, Teresa Byington, Madeleine Sigman-Grant, Minggen Lu, Brett Campbell. University of Nevada Reno, Las Vegas, NV. (Sponsor: Lawrence A Golding, FACSM)  
(No relationships reported)

Mastery of fundamental movement skills in preschoolers is critical to the acquisition of gross motor task development. Since these fundamental movements form the basis for games, dance and sports that emerge in the later years, it is recommended that children are taught in the early years. All 4 Kids, developed by the University of Nevada Cooperative Extension is a preschool nutrition and physical activity intervention program that uses noncompetitive physical activities, such as dance, to teach essential movement patterns.

**PURPOSE:** To examine the effect of the All 4 Kids preschool physical activity and dance intervention on movement patterns.

**METHODS:** 321 preschool children in Head Start centers across southern Nevada participated in this study. They were divided into intervention and comparison groups. All children completed a movement assessment that evaluated fundamental, spatial, and temporal movement patterns. After the initial assessments the children in the intervention group participated in the 9-week All 4 Kids program while the comparison group continued with standard Head Start curriculum. The program utilized dances with a wide range of movement skills as recommended in Pre-Kindergarten physical development standards. Post assessments were conducted on both groups at the end of 9 weeks.

**RESULTS:** Using an ANCOVA, children's combined movement skills in the intervention group demonstrated a significantly higher composite score than the control group (n=179, p<.001) and a significantly greater ability to cross the midline of the body (n=321, p<.014). The intervention group also demonstrated a significant increase (p=.022) towards meeting the state's balance standard of 5 seconds, as compared to the comparison group (p=.511). Preschoolers in the intervention group showed a significant increase (n=170, p<.001) in the number of hops for 15 seconds.

**CONCLUSIONS:** Provision of music and movement skills that focus on skill development with intended outcomes for learning are critical to maintaining an active lifestyle beyond the preschool years. Preschool interventions should involve a wide range of antecedent movements such as those mentioned in national and state Pre-K standards. This study demonstrates that the All 4 Kids program is a viable teaching tool that can improve a child's movement skills.

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1986 Board #32 MAY 31 9:00 AM - 10:30 AM

**Self Reported Physical Activity, Body Composition and Aerobic Fitness of Hispanic Elementary School Children**

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(No relationships reported)

**PURPOSE:** Compare levels of PA, AF and Body Mass Index (BMI) and ascertain the effect PA on the attainment of the FITNESSGRAM<sup>®</sup> Healthy Fitness Zone in elementary school Hispanic children.

**METHODS:** Participants were fifty, fifth grade Hispanic boys (n = 24; M Age = 11.7 yrs., M Ht = 1.49m, M Wt = 48.9 kg.) and girls (n = 26; M Age = 11.5 yrs., M Ht = 1.47 m, M Wt = 44.3 kg.) from an urban school in the Southwest US. Variables measured were: Height (HT), weight (WT), body mass index (BMI), percent fat (FAT), aerobic fitness (AF) as measured by the PACER<sup>®</sup> test, and PA as measured by the Physical Activity Questionnaire for Older Children (PAQ) (Crocker et al, 1997). All measures were taken in the same month by a trained teacher as part of the Physical Education class. Descriptive statistics and independent samples t-tests were used to examine the differences between boys and girls. Logistic regression was used to assess

the effect of PA and other variables on achieving the FITNESSGRAM® Healthy Fitness Zone (HFZ) for FAT and AF. All significance tests were done at  $p < 0.05$  level.

**RESULTS:** Boys and girls were found to be significantly different on the PACER test ( $M = 29.21$ ,  $SD = 11.59$  vs.  $M = 21.5$  laps respectively),  $t(48) = 2.62$ ,  $p = .012$ , and PAQ ( $M = 3.15$ ,  $SD = .72$ ; vs.  $M = 2.75$ ,  $SD = .60$  respectively),  $t(48) = 2.10$ ,  $p = .041$ . The logistic regression model with gender (GEN), AGE, BMI and PAQ for achieving the HFZ was significant for FAT but not for AF. The model was significant,  $X^2(4, N = 50) = 38.30$ ,  $p < .05$ ; explained between 53% and 71% of the variance and correctly classified 86% of the cases. However, only BMI and GEN made significant contributions to the model.

**CONCLUSIONS:** Results show a difference between the important variables of AF and PA for boys and girls. Although PA has been found to be related to both BMI and AF; in this case it does not appear to have an important contribution to predicting the likelihood of achieving the corresponding HFZ. The lack of a significant relationship in the present group may suggest that PA's effect is confounded by other factors. It could be speculated that the young age of the subjects may not allow for the level of variability on the trait to ascertain differences. Additionally, self report PA has been found to have low levels of reliability in children that may have affected these results.

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**1987** Board #33 MAY 31 9:00 AM - 10:30 AM

**Adolescents Engaged In At Least Five Hours Of Physical Activity Weekly Show Numerous Health Benefits**

Claudia J. Brahler, Nicholas J. Hess, Bret M. Lorenzo, Mary I. Fisher, Betsy Donahoe-Fillmore, Terri Glenn. *University of Dayton, Dayton, OH.* (Sponsor: Paul Vanderburgh, FACSM)

(No relationships reported)

**PURPOSE:** To determine if scores on the Oswestry-Disability Index (ODI), body composition, back health or fitness indicators were significantly different in healthy adolescents based on the number of minutes per week they spend engaged in physical activity.

**METHODS:** A convenience sample of 152 healthy adolescents (age 14-18 years; 68 males and 84 females) provided written informed consent to participate in this study. Measured variables included hip flexion active range of motion (AROM), v-sit, lumbar lateral flexion AROM, a trunk extension hold, number of sit-ups in a minute and 90/90 hamstring length. Additionally, subjects completed the International Physical Activity Questionnaire (IPAQ) focused on organized physical activity participation and the Oswestry-Disability Index (ODI). Subjects were divided into 3 groups based on the number of minutes per week they spent in physical activities PA Group 1: 120 minutes or less, PA Group 2: 121 - 300 minutes, and PA Group 3: more than 300 minutes. One-way ANOVA and univariate general linear model (GLM) tests were completed.

**RESULTS:** ANOVA tests revealed that for PA Groups 1, 2 and 3 the means and associated p values were respectively, BMI, 25.61, 23.31, 23.03  $p = 0.026$ ; sit-ups in one minute 33.87, 39.00, 41.48  $p = 0.001$ ; and ODI scores 12.40, 17.29, 10.10  $p = 0.003$ . Because, on average, females scored higher than males on the ODI (15 vs 9.8, respectively  $p = 0.011$ ), a Univariate GLM test was completed with both gender and PA Group entered as factors and ODI as the dependent variable. With gender statistically controlled, PA Groups 1 and 3 still had significantly lower ODI scores compared to PA Group 2. Based on the ODI scores, twenty four percent of the adolescents were classified as having clinically significant back disability (ODI score > 20%). Lastly the ODI scores for adolescents were better correlated with weekly PA than any of the other common clinical measurements for back motion.

**CONCLUSIONS:** The level of physical activity that approximates the Surgeon General's Vision for a Healthy and Fit Nation 2010 recommendation of 60 minutes per day, appears to promote healthy back function, body composition and fitness indicators all of which are associated with overall improved health status.

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**1988** Board #34 MAY 31 9:00 AM - 10:30 AM

**Are Aerobic and Anaerobic Capacities in CUSSA Junior Alpine Ski Racers Improving? A Seven Year Follow-up.**

Kelley Holmes<sup>1</sup>, Emily Willaert<sup>1</sup>, Mark Blegen, FACSM<sup>2</sup>, David Bacharach, FACSM<sup>1</sup>. <sup>1</sup>St. Cloud State University, St. Cloud, MN. <sup>2</sup>University of St. Catherine, St. Paul, MN.

(No relationships reported)

**INTRODUCTION:** Central Region 1 of the US Ski and Snowboard Association (USSA) encourages athletes to participate in fitness evaluations as part of the selection process for Team Central. Over the past seven years, the 20m pacer test (aerobic) and 40cm box jump test (anaerobic) have been used to estimate individual capacities. Normative data have been used to provide feedback to athletes for the last three years as a motivational tool to encourage improvement.

**PURPOSE:** To determine if providing normative data to athletes would help them achieve higher levels of fitness on the aerobic 20m pacer test and anaerobic 40cm box test.

**METHODS:** Subjects ( $N=121$ ) were junior alpine skiers age 10-19 and members of the Central USSA. Data were collected from 2005 to 2011 on skiers who were able to complete both the aerobic and anaerobic portions of the test. Subjects performed a 20m pacer test to determine  $VO_{2max}$  and a 60s 40cm box jump. Minimum values from norms generated by Stielow and Bacharach (2010) were used to compare average values for each age and gender group over the seven years.

**RESULTS:** Recommended minimum values for each age and gender were compared to actual values from predicted aerobic capacity ( $VO_2$  ml/kg/min) and 60s box jump scores recorded each year. Paired t-tests were performed with a Bonferroni adjustment to account for potential Type I errors and  $P < .008$  was used to determine significance. No differences were noted for any group. A trend toward a decrease in aerobic capacity for female subjects age 15-19 yrs over this seven year period was observed ( $P < .009$ ).

**CONCLUSIONS:** Although annual fitness assessments have been able to provide recommended levels and quartile rankings for athletes to achieve on aerobic and anaerobic capacity tests, no improvements have been seen in these athletes. Perhaps maintaining fitness levels could be considered better than the downward trend seen in non-athletes of this age range over a similar time period (Science Daily, 2006); however, it appears clear that fitness parameters are not an area of great focus for these aspiring athletes. If athletes from Central Region 1 of USSA want to be competitive at a national level, they will have to address the deficit seen in these data.

The authors want to acknowledge and thank Region 1 coaches and parent-volunteers who assisted with data collection.

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**1989** Board #35 MAY 31 9:00 AM - 10:30 AM

**Acute Effects of Static and Dynamic Stretching on Agility Performance with a Skill Component in Elite, Youth Soccer Players**

Ajit Korgaokar, J. Bradley Jordan, Richard S. Farley, Jennifer L. Caputo. *Middle Tennessee State University, Murfreesboro, TN.* (Sponsor: Don Morgan, FACSM)

(No relationships reported)

Static stretching has been shown to decrease maximal force production and negatively affect explosive actions such as agility movements. Minimal research has been conducted using a skill component, such as dribbling a ball in soccer, to compare static vs. dynamic stretching on agility performance.

**PURPOSE:** To examine and compare the effects of static and dynamic stretching on agility performance while dribbling a ball through the Balsom agility course in elite youth soccer players.

**METHODS:** Elite, male soccer players ( $N = 14$ ), completed 4 trials of the Balsom agility test while dribbling a soccer ball. Height, age, and body mass were recorded and participants were familiarized with the Balsom agility test during the first trial. Randomized and counterbalanced trials of the Balsom agility test preceded by static or dynamic stretching were administered after a standardized warm-up (control condition). Standardized warm-up consisted of 3 minutes of self-paced light jogging and 2 minutes of passing and running with a ball. The muscles targeted for both the static and dynamic treatments were the hamstrings, quadriceps, and the Gastrocnemius and Solei. Differences between the times from the control condition and each treatment were calculated.

**RESULTS:** The mean difference between the control condition and the stretching trials was 0.34 sec for the static stretching protocol and 0.15 sec for the dynamic stretching protocol. No statistically significant difference was found between the effects of static and dynamic stretching on agility performance,  $F(1,13) = 0.61$ ,  $MSE = .426$ ,  $p = .45$ . A high mean square error (.426) indicated large within-group differences on agility performance.

**CONCLUSION:** The results do not support the preferential use of a static or a dynamic stretching protocol over a general warm-up prior to sport-specific agility tasks in youth soccer players. The addition of a sport-specific skill component, dribbling a ball, to an agility test may increase within-subject variance in trials involving youth soccer players.

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**1990** Board #36 MAY 31 9:00 AM - 10:30 AM  
**High Intensity Interval Training Versus Traditional Preseason Training in High School Football Athletes**

Fred Hale, Christine Lo Bue-Estes, Timothy N. Harvey, Anthony Spencer. *Mercyhurst College, Erie, PA.*  
(No relationships reported)

Sport specific training is central to implementing proper exercise protocols to achieve maximal performance outcomes. In many sports coaches will not employ training based on appropriate metabolic specificity.

**PURPOSE:** To assess improvement in anaerobic capacity via measuring: 40 yd dash, vertical jump, and agility based on, intervention specificity in varsity football athletes, with a minimum of 2 years previous playing experience.

**METHODS:** A convenience sample of 50 athletes (aged 17-18 years) was identified to participate in the project. Athletes were randomly assigned to two groups: an Aerobic group (n=25) or a High Intensity Interval Training (HIIT) group (n=25) and stratified by position type. Over the course of 10 weeks in preseason the additional training consisted of approximately 20 minutes of work, for both groups, with aerobic group running at 65-85% of RPE based capacity at a 1:2 work rest ratio (WRR), and the HIIT group working at >85% of RPE based capacity at 1:2 WRR for weeks 0-6, and 1:1 WRR for weeks 7-10. 40 yd dash, vertical jump, and shuttle run were assessed before and after completion of 10-week aerobic or HIIT intervention. Change scores were calculated for each group before and after the 10 week training period. One tailed, paired t-tests were used to compare change scores across both exercise interventions.

**RESULTS:** Both groups improved over the course of 10 weeks, with no difference between groups for the shuttle run (HIIT = 2.69, Aerobic = 2.84). The HIIT group, however, showed a greater improvement than the aerobic group for: 40 yard dash (3.90, 2.03; p=0.001), and vertical jump (9.05, 4.09, p=0.001).

**CONCLUSIONS:** Implementing a high intensity training protocol in adolescent varsity football athletes translates into greater improvements for speed and vertical jump, compared to aerobic intervention of a similar duration. Improvements in these variables will hopefully translate into greater on-field successes based on improved metabolic capacity, due to sport specific HIIT.

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**1991** Board #37 MAY 31 9:00 AM - 10:30 AM  
**Gender-Based Differences in Sprint and Acceleration Capacities in Very Young Athletes**

Daniel H. Serravite<sup>1</sup>, Brian Biagioli<sup>2</sup>, Charmaine DeFrancesco<sup>1</sup>, Joseph White<sup>2</sup>, Joseph F. Signorile<sup>2</sup>. <sup>1</sup>Florida International University, Miami, FL. <sup>2</sup>University of Miami, Coral Gables, FL. (Sponsor: Arlette Perry, FACSM)  
(No relationships reported)

Sport performance is determined to a large extent by the acceleration capacity of the athlete. This is especially true for team sports like soccer where field dynamics rapidly change. Even though sprinting and acceleration seem to be crucial to soccer, little is known about the gender-specific sprinting and acceleration characteristics of very young soccer players.

**PURPOSE:** The purpose of this study was to investigate the gender-related differences in sprint speed, acceleration and lower body power in 8 to 10 year old soccer players.

**METHODS:** 57 boys and 66 girls from 8 to 9 (U9) and from 9 to 10 (U10) years of age were evaluated (28 U9 boys [8.6 yr ± 0.4], 29 U10 boys [9.6 yr ± 0.3], 31 U9 girls [8.6 yr ± 0.3] and 37 U10 girls [9.6 yr ± 0.3]) in sprint and jump performance. Split times at 5m, 10m, 20m and 30m to allow the analysis of partial velocities (V5m, V10m, V20m and V30m) and accelerations (A0-5m; A5-10m; A0-10m; A10-20m) were evaluated during a 30m sprint using electronic timing gates. To assess leg power each subject performed 3 countermovement jumps (CMJ) on a pressure-sensitive mat. Leg power was computed using the best and mean CMJ heights and body weight.

**RESULTS:** Multivariate ANOVA analysis revealed a gender by age group interaction for V5m, A0-5m and A5-10m. Separate analyses of V5m by age showed that at U9 boys were faster than girls, but at U10 girls were faster than boys. This interaction was also reflected in the A0-5m, where boys had a greater acceleration than girls at U9 (p= 0.007), but girls showed a greater acceleration than boys at U10 (p= 0.001). Interestingly, although the analysis of V10m only showed main effects of age, with U10 faster than U9, the analysis of the A5-10m interaction revealed that U10 boys had a greater acceleration than girls (p < 0.001). There was a significant main effect of age for height, weight, and leg power showing increments with age, U10 were taller, heavier and more powerful than the U9.

**CONCLUSION:** Both gender and age uniquely contribute to velocity and acceleration in linear fashion in very young athletes. This is especially true in short sprints up to 10 meters. However, these differences were not explained by weight or power.

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**1992** Board #38 MAY 31 9:00 AM - 10:30 AM  
**Association Between Suspected Fatty Liver, Obesity, Inflammation And Cardiorespiratory Fitness In Portuguese Youth**

Clarice Martins, Andréia Pizarro, Luísa Aires, Gustavo Silva, Jorge Mota, Maria Paula Santos. *Faculty of Sports, Porto, Portugal.*  
(No relationships reported)

Nonalcoholic fatty liver disease (NAFLD) is one of the most frequent complications associated with excess adiposity and a number of variables, similar to current risk factors, have been associated to NAFLD in the pediatric population. However, few studies have addressed the association between suspected fatty liver, obesity, inflammation and fitness in children, as a possible diagnostic for predicting future NAFLD.

**PURPOSE:** To analyze the association between serum aminotransferase (ALT), waist circumference (WC), C-reactive protein (CRP), and cardiorespiratory fitness (CRF) in school children.

**METHODS:** A total of 79 obese students (40 girls and 39 boys), 10-11 year-olds (±60), with abnormal serum ALT from Porto public schools comprised the sample. Measurements included CRF (20-m Shuttle Run Test), WC (NHANES protocol), CRP and ALT (Cholestech LDX® analyser). Pearson correlation and general linear model with Bonferroni's adjustments for multiple comparisons were used to examine the differences in the measured variables, adjusting for CRF and gender.

**RESULTS:** The analysis showed negative correlations between fitness and the measured variables. Significant correlations were observed for WC (p=.002), CRP (p=.012) and ALT (p=.004). Data showed a significant main effect for CRF in ALT (p=.008) but not in WC (p=.057) nor PCR (p=.223). The gender main effect and the gender\*CRF group interaction were not significant (p>.05) for WC, PCR and ALT.

**CONCLUSIONS:** CRF is negatively associated to WC, PCR and ALT, and present a significant effect in ALT values in obese children.

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**1993** Board #39 MAY 31 9:00 AM - 10:30 AM  
**The Influence Of Wrist-worn Accelerometer Wear Location On Free-living Physical Activity In Adolescents**

Edward M. Davila, Daniel P. Heil, FACSM. *Montana State University, Bozeman, MT.*  
(No relationships reported)

The use of accelerometry-based wrist-worn activity monitors (AM) to measure free-living physical activity (PA) is popular in research settings. Although previously evaluated in adults, no research has investigated the impact of wrist-worn AM location (dominant [D] vs non-dominant [ND] or left [L] vs right [R]) on measurements of free-living PA in adolescents.

**PURPOSE:** The aim of this study was to evaluate the influence of wrist-worn AM wear location (D vs ND and L vs R) on measures of free-living PA in adolescents 12-17 years old.

**METHODS:** Eight boys (Mean±SD: 14±2 yrs, 53.9±13.6 kg, 160.5±14.5 cm, 20.6±2.3 body mass index [BMI]) and 12 girls (14±2 yrs, 56.1±9.9 kg, 160.3±7.4 cm, 21.4±2.6 BMI) participated in the study. Subjects wore two AMs for 7 consecutive days (24 hr/day), with one AM attached to the dorsal side of each wrist using locking plastic wrist bands. Subjects were instructed to engage in their usual daily activities. After downloading the raw AM data to a computer, previously validated regression algorithms were used to transform and summarize the data into counts (counts/day), activity energy expenditure (AEE; kcals/day), and duration of time (T; minutes/day) for 1, 5, and 10 minute bout durations (BDs) within light (L) and moderate-to-vigorous (MV) intensity categories for each AM. Dependent variables (CNT, AEE, T) for each BD within L and MV intensity between each AM (D vs ND and between L vs R) were compared using two-factor (AM Location x BD) multivariate repeated measures ANOVA (α=0.05). Scheffe's post-hoc analyses (α=0.01) were performed for all pairwise comparisons when indicated by the ANOVA. Pearson's correlation was used to analyze the relationship between dependent variables for all BDs within L and MV intensities between AMs (D vs ND and L vs R) (α = 0.05)

**RESULTS:** No significant differences were found amongst all dependent variables for any BD within L or MV intensity between AMs. There were high correlations ( $r = > 0.85$ ,  $p$ -value  $< 0.0001$ ) between dependent variables for all BDs within L and MV intensities between AMs.

**CONCLUSION:** These data indicate that wrist-worn AM location has no significant influence on PA outcome variables in adolescents under free-living conditions. Researchers can now give participants the option to choose which wrist they would prefer the monitor to be placed when being assessed.

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**1994** Board #40 MAY 31 9:00 AM - 10:30 AM

**The Effect of High School Sports Participation on Collegiate Level Physical Fitness and Physical Activity**

Patrick Schneider<sup>1</sup>, Jeanne Sowers<sup>1</sup>, Sarah Adams<sup>1</sup>, Christine Manville<sup>1</sup>, Lynne Shores<sup>1</sup>, Mary Dietrich<sup>2</sup>. <sup>1</sup>Belmont University, Nashville, TN. <sup>2</sup>Vanderbilt University, Nashville, TN.

(No relationships reported)

**PURPOSE:** The purpose of this study was to assess the effect of high school (HS) sports participation on physical fitness (PF) and physical activity (PA) levels in college among males and females.

**METHODS:** 113 students (50 males, 63 females) enrolled in a university level wellness class participated in the study. Participants completed a PF battery consisting of cardiorespiratory fitness (CRF), muscular endurance (ME), body composition (BC) and flexibility (FX) assessments. In addition, they completed a survey to determine HS sports participation (collegiate athletes were excluded). Self-reported PA levels were assessed to determine current PA status. Normally distributed values (CRF, BC, FX) are summarized as mean $\pm$ SD; skewed values (ME) are summarized using median values (25<sup>th</sup>, 75<sup>th</sup> IQR). ANOVAs were used to compare main and interaction effects of gender and HS sports participation on CRF, BC, and FX; a Kruskal-Wallis test was used for ME. Activity levels by gender and HS sports participation were compared using Chi-Square Tests of Independence.

**RESULTS:** There were no statistically significant differences in PF measures between HS athletes and non-athletes among genders.

|                 | Female HS athletes | Female HS non-athletes | Male HS athletes | Male HS non-athletes |
|-----------------|--------------------|------------------------|------------------|----------------------|
| CRF (ml/kg/min) | 46.7 $\pm$ 4.8     | 46.6 $\pm$ 4.0         | 53.9 $\pm$ 4.8   | 51.3 $\pm$ 6.7       |
| ME (reps)       | 30 (23,34)         | 25 (21,31)             | 30 (25,40)       | 30 (21,34)           |
| BC (% fat)      | 32.4 $\pm$ 7.4     | 30.7 $\pm$ 7.0         | 18.7 $\pm$ 6.9   | 14.8 $\pm$ 4.4       |
| FX (cm)         | 36.8 $\pm$ 7.6     | 35.0 $\pm$ 7.3         | 30.6 $\pm$ 8.3   | 28.3 $\pm$ 9.0       |

Statistically significant gender differences were observed for each PF measure except ME (males  $>$  CRF; females  $>$  BC, FX, each  $p < .001$ ) and males tended to be less active than females in this study ( $p = .006$ ). Furthermore, it appeared that male HS non-athletes tended to be less active than either female HS athletes or non-athletes, as well as male HS athletes ( $p = .024$ ).

**CONCLUSION:** The lack of statistically significant differences between PF measures of HS athletes and non-athletes in college may be due to the relatively homogenous fitness levels of students in this study.

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**C-26** Free Communication/Poster - Chronic Disease

MAY 31, 2012 7:30 AM - 12:30 PM

ROOM: Exhibit Hall

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**1995** Board #41 MAY 31 8:00 AM - 9:30 AM

**Physical Activity Change And Its Relationship With Change In Insulin Resistance (HOMA-IR)**

Kristi L. Storti<sup>1</sup>, Marquis S. Hawkins<sup>1</sup>, Jennifer N. Cooper<sup>1</sup>, Kelley Pettee Gabriel<sup>2</sup>, Kim Sutton-Tyrrell<sup>1</sup>, Andrea M. Kriska, FACSM<sup>1</sup>. <sup>1</sup>University of Pittsburgh, Pittsburgh, PA. <sup>2</sup>University of Texas Health Science Center at Houston, Austin, TX.

(No relationships reported)

Insulin resistance (IR) is associated with type 2 diabetes and the development of coronary heart disease. Physical activity (PA) is associated with decreased risk of IR. Less is known about whether time spent in different intensities of PA may be associated with decreased risk of IR.

**PURPOSE:** To determine the impact of PA change, as measured by accelerometer, on insulin sensitivity in overweight, sedentary adults aged 20-45 years, involved in a lifestyle intervention, which included a PA component.

**METHODS:** The Slow Adverse Vascular Effects of excess weight (SAVE) trial evaluated relationships between weight loss, dietary sodium, and vascular health. Subjects were randomly assigned to a regular or reduced sodium diet, and all received a one-year nutrition and PA intervention. PA data were collected at baseline and 12 months using an AM7164 ActiGraph accelerometer. Freedom threshold values were applied to describe time in different intensity levels. Total body movement was assessed via total counts per day (CTS). Homeostatic model of assessment of insulin resistance (HOMA-IR) was computed using fasting insulin and glucose measures. Linear mixed models were used to examine the impact of change (baseline to 12 months) in total time spent (min/d) being sedentary (SED), in light intensity PA (LPA), moderate to vigorous intensity PA (MVPA) and change in HOMA-IR. Model 1 adjusted for time (yrs) since baseline, age, sex, race, current smoking status, wear-time, and randomization group. Models 2, 3, and 4 additionally controlled for BMI; baseline MVPA; and change in MVPA, respectively.

**RESULTS:** From baseline to 12 months, MVPA and SED significantly increased, LPA significantly decreased. Improvements in HOMA-IR score were noted from baseline to 12 months [mean (SD) 2.9 (2.1) vs. 2.7 (1.6), respectively ( $p=0.11$ )]. Changes in MVPA and SED from baseline to 12 months were not associated with change in HOMA-IR. Change in LPA and CTS was significantly inversely related to change in HOMA-IR ( $p=0.02$  and  $p < 0.0001$ , respectively) after adjusting for BMI and MVPA change ( $p < 0.05$ ).

**CONCLUSIONS:** LPA and CTS were related to HOMA-IR rather than MVPA alone, likely reflecting the small amount of time spent in the latter. Interventions should focus on total movement rather than just increasing high intensity movement for insulin sensitivity.

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**1996** Board #42 MAY 31 8:00 AM - 9:30 AM

**How Much Exercise Is Needed To Improve Insulin Sensitivity In Sedentary Adults?**

Francesca Amati<sup>1</sup>, John J. Dubé<sup>2</sup>, Katelyn Fleishman Allison<sup>2</sup>, Valentin Rousson<sup>1</sup>, Bret H. Goodpaster<sup>2</sup>. <sup>1</sup>University of Lausanne, Lausanne, Switzerland. <sup>2</sup>University of Pittsburgh, Pittsburgh, PA.

(No relationships reported)

**PURPOSE:** Exercise improves insulin sensitivity (IS) and is a first line for the prevention and treatment of type 2 diabetes. The extent to which IS response is dose-dependent is not known. The purpose of this study was to examine whether or not exercise dose was associated with improvements in IS following four months of exercise training in previously sedentary adults.

**METHODS:** Fifty-five healthy volunteers (F=34, M=21, mean age 54 $\pm$ 15) participated in a 16-week supervised endurance exercise intervention with a pre/post intervention design. IS was assessed by euglycemic hyperinsulinemic clamp,  $VO_{2peak}$  by a GXT and body composition by DXA. Exercise dose, expressed as average kcal expended/week, was computed as the product of exercise intensity, duration and frequency. Paired T-tests, correlations and multivariate regression models were used.

**RESULTS:** At baseline 20% of the volunteers had class II obesity, 35% class I obesity, 33% were overweight and 13% were in the normal range. Improvements with intervention were observed for BMI (30.5 $\pm$ 4.4 vs. 29.5 $\pm$ 3.9,  $P < 0.001$ ),  $VO_{2peak}$  (1.9 $\pm$ 0.6 vs. 2.2 $\pm$ 0.7 L/min,  $P < 0.001$ ) and IS (367 $\pm$ 112 vs. 450 $\pm$ 130 mg/min,  $P < 0.001$ ). Average exercise frequency was

3.91±0.85 sessions/week and mean energy expended was 1094±519kcal/week. Improved IS was significantly related to exercise dose in a graded dose response relationship. No evidence of threshold or maximal dose-response effect was observed. Notably, even an exercise dose of ~400 kcal/week was associated with a significant improvement in IS. Furthermore, the IS gain was higher for the subjects starting with a lower IS. Age and gender did not influence this dose-response relationship.

**CONCLUSION:** This study identifies a graded dose-response relationship between exercise dose and improvements in IS. The implication of this observation is of importance for the adaptation of exercise prescription in clinical situations. These data reinforce the concept that more insulin resistant individuals at risk for developing type 2 diabetes attain greater benefit by performing more exercise, but that there is no obvious exercise volume threshold for these benefits. Taken together these data corroborate the notion that one exercise prescription does not fit all clinical circumstances and that a little exercise is better than nothing.

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**1997** Board #43 MAY 31 8:00 AM - 9:30 AM

**Effects Of A 12-week Exercise Training And Sedentary Time Reduction Program On Fasting Insulin Secretion**

Richard Viskochil, Sarah Kozey-Keadle, Corianne Oliver, Barry S. Braun, FACSM, Patty S. Freedson, FACSM. *University of Massachusetts-Amherst, Amherst, MA.*  
(No relationships reported)

Exercise training typically increases peripheral insulin sensitivity, which may reduce insulin secretion. Whether interventions designed to reduce sedentary time result in similar changes in insulin secretion has not been established.

**PURPOSE:** To determine changes in fasting insulin secretion, hepatic extraction (HE) and HOMA2-%B following exercise training (EX), an intervention designed to reduce sedentary time (rST), or combined exercise training and reduced sedentary time (EX+rST).

**METHODS:** 48 sedentary, overweight subjects were randomized to 12 weeks of: 1) EX (n=13), 5 days/wk at 50-60% heart rate reserve, 2) rST (n=13), targeted instruction designed to increase steps/day and reduce sedentary time, 3) Ex+rST (n=14) exercise training plus reductions in sedentary time or 4) control (CON, n=8). Sedentary time and steps/day were assessed using an activPAL wearable monitor. Glucose, C-peptide and insulin concentrations were determined using the glucose oxidase method and radioimmunoassay. HOMA2-%B was calculated using the HOMA2 calculator. Differences across conditions in C-peptide, fasting hepatic extraction (Insulin/C-peptide) and HOMA-%B were determined using paired t-tests and one-way ANOVA.

**RESULTS:** Both exercise groups increased VO<sub>2</sub>max (EX=9%, EX+rST=12%) indicating improved cardiovascular fitness. Sedentary time was significantly lower in the rST (4%) and EX+rST (7%), did not change in EX group, and increased in CON (4%). Steps/day significantly increased in EX, rST and EX+rST but not in CON. There were no pre- to post differences in fasting C-peptide concentrations (E=0.86 ± 0.39 vs 0.76 ± 0.32, rST= 1.33 ± 0.72 vs. 1.34 ± 0.66, EX+rST= 0.87 ± 0.39 vs 0.87 ± 0.33, CON= 1.19 ± 0.45 vs. 1.24 ± 0.43) However there was a decrease in HE in the rST group (13%±8%[pre] vs 11%±8% [post], p=.04). There were no differences in HOMA-%B in any group.

**CONCLUSIONS:** Exercise training and/or sedentary behavior reduction interventions did not alter fasting insulin secretion, however the rST intervention decreased hepatic insulin extraction, indicating that adaptations to reduced sedentary time may occur at the liver.

Funded by NIH RC HL099557

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**1998** Board #44 MAY 31 8:00 AM - 9:30 AM

**Longitudinal Analysis of Police Stress and the Metabolic Syndrome**

Hyeelim Yoo, Warren D. Franke, FACSM. *Iowa State University, Ames, IA.*  
(No relationships reported)

**PURPOSE:** To assess and compare the change in the prevalence of the metabolic syndrome and its components over time (2001- 2007) and to determine whether changes in stress affect the metabolic health risk among police officers.

**METHODS:** Perceived Stress and metabolic risk factors were assessed in 171 police officers in 2001 and again in 2007.

**RESULTS:** The perceived stress score (PSS) and the metabolic syndrome score (zMS) were not meaningfully different from 2001 to 2007. The prevalence of high body mass index, hypertension, and elevated triglycerides increased from 2001 to 2007. Overall, the prevalence of the metabolic syndrome increased from 17.5% in 2001 to 28.7% in 2007. The PSS in 2007 was highly correlated with the PSS in 2001 ( $r = 0.44$ ) and zMS in 2007 was strongly correlated with zMS in 2001 ( $r = .68$ ). Neither the change in perceived stress over time nor baseline perceived stress predicted the development of the metabolic syndrome in 2007 among police officers.

**CONCLUSIONS:** The prevalence of the metabolic syndrome and its several individual components increased over 6 years among LEOs. Stress as assessed by the PSS does not contribute to the development of metabolic health risk after a 6 year follow-up.

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**1999** Board #45 MAY 31 8:00 AM - 9:30 AM

**Prevalence of Cardiovascular Risk Factors in Indians with Coronary Artery Disease**

Shraddha M. Khialani, Hetal D. Poptani, Priyanka M. Mehat, Anjali S. Zende, Aashish S. Contractor. *Asian Heart Institute, Mumbai, India.*  
(No relationships reported)

**PURPOSE:** The prevalence of Coronary Artery Disease (CAD) has progressively increased in India during the latter half of the last century. Although there are studies available from West regarding prevalence of conventional cardiovascular risk factors (CVRF) in patients been diagnosed to have heart disease there is limited information on the same in Indian patients. This is vital as these risk factors do have an implication on the progression of the disease. Therefore the aim of the paper is to assess the risk factors in Indian patients diagnosed to have CAD.

**METHODS & RESULTS:** In this cross-sectional study, five hundred consecutive patients with CAD were included and data on major CVRFs was obtained in them. Mean age of male patients was 52.4 +/- 9.2 years while that of females was 61.8 +/- 6.9 years. However 30.1% of males (142/472) were below the age of 45 years. 68.4% of patients had a positive family history. The mean BMI was 26.7 +/- 3.9 kg/m<sup>2</sup>. 32.6% were normal weight while 67.4% had BMI > 25 kg/m<sup>2</sup>. 83.6% of patients had dyslipidemia. The mean lipid profile of patients (144/500) not on lipid lowering drugs were Total cholesterol- 195.6 +/- 44.3 mg/dl, LDL- 125.7 +/- 36.2 mg/dl, HDL- 37.8 +/- 7.5 mg/dl, Triglycerides- 160 +/-71.6 mg/dl. 59.8% patients were hypertensives, while the mean blood pressure of normotensives was 113.6/70.6 mm Hg. 35.6% reported history of smoking. 54.8% of patients had pre-diabetes or diabetes. The average fasting blood sugar of patients not on any drugs for diabetes was 106.7 +/- 22.7 mg/dl. 44.8% patients reported that they were sedentary while 55.2% patients reported moderate physical activity.

**CONCLUSIONS:** The present study shows high prevalence of most of the conventional risk factors especially family history, obesity, dyslipidemia, hypertension, diabetes and lack of physical activity.

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**2000** Board #46 MAY 31 8:00 AM - 9:30 AM

**Regional Differences In Physical Activity And Chronic Diseases In The United States**

David R. Bassett, FACSM, Scott Conger, Eugene Fitzhugh. *University of Tennessee, Knoxville, TN.*  
(No relationships reported)

**PURPOSE:** To examine whether there are regional disparities in physical activity, that might contribute to the high rates of chronic disease in the Southern US.

**METHODS:** Behavioral Risk Factor Surveillance System (BRFSS) data were used to determine adult physical activity, obesity, diabetes, and hypertension prevalence in 50 states. American Community Survey (ACS) data were used to determine the percentage of workers who commute on foot or by bicycle. Each state was placed into 1 of 4 regions, as defined by the U.S. Census Bureau. Data were analyzed using one-way ANOVAs to test for significant differences among regions.



**RESULTS:**

|                    | South          | Midwest       | Northeast     | West          | P value |
|--------------------|----------------|---------------|---------------|---------------|---------|
|                    | X (SD)         | X (SD)        | X (SD)        | X (SD)        |         |
| % Walk to Work     | 1.9            | 3.1           | 4.2           | 3.6           | <0.0001 |
| % Bike to Work     | 0.2            | 0.5           | 0.4           | 1.0           | <0.0001 |
| Physically Active  | 44.9(3.5)a,b,c | 49.9(3.5)d,c  | 52.1 (3.2)d   | 54.5 (3.3)a,d | <0.0001 |
| Inactive (no LTPA) | 27.1(3.4)a,b,c | 22.2 (2.4)d   | 21.8 (2.7)d   | 20.2 (2.3)d   | <0.0001 |
| Obesity %          | 28.8 (2.2) b,c | 27.1 (1.0)c,d | 23.9 (2.2)a,d | 24.2 (2.3)a,d | <0.0001 |
| Diabetes %         | 9.8 (1.0)a,b,c | 7.5 (1.2)d    | 7.8 (0.8)d    | 7.1 (0.9)d    | <0.0001 |
| Hypert %           | 30.6(2.2)a,b,c | 26.8 (2.1)d   | 27.1 (1.3)d   | 25.0 (2.3)d   | <0.0001 |

<sup>a</sup> = sig. different from Midwest; <sup>b</sup> = sig. different from Northeast; <sup>c</sup> = sig. different from West; <sup>d</sup> = sig. different from South

At the state level, physical inactivity is positively related to rates of obesity (r=0.7440) and diabetes (r = 0.8613). Southern states have the highest rates of physical inactivity, and the highest rates of obesity and diabetes. Active commuting (bike + walk) is inversely related to rates of obesity (r=0.4520) and diabetes (r=0.5752).

**CONCLUSION:** The South has higher rates of physical inactivity, and lower rates of active commuting, than other regions. In addition, the South has higher rates of obesity, diabetes, hypertension, and coronary heart disease.

**2001 Board #47 MAY 31 8:00 AM - 9:30 AM**

**The Awareness, Treatment, And Control Of Hypertension In A Supervised Wellness Program**

Miriam E. Pearman, Diana Gilleland, Daniel Bonner, David Donley, James Thomas, Randy Bryner. *West Virginia University, Morgantown, WV.* (Sponsor: Stephen Alway, FACSM)

(No relationships reported)

Though awareness, treatment, and control for hypertension (HT) have improved, the current control rates (34%) are still far below the Healthy People 2010 goal of 50%.

**PURPOSE:** To determine, in a supervised wellness program, a) the percent of individuals with uncontrolled HT (SBP > 140mmHg or DBP >90mmHg) at baseline and b) the affects of 12 months of supervised exercise in the following subpopulations: 1) not diagnosed with HT 2) medicated HT 3) ≥50 years old with medicated HT.

**METHODS:** Data were collected on 455 individuals, (mean age 52.72 ± 0.7 SE) including self reported HT diagnoses, HT medications, and measured BP. Monthly resting BPs were collected for the first year of participation. Paired sample t-tests determined significance for changes over time.

| RESULTS:                 | 1)Not Diagnosed w/HT  | 2) Medicated HT  | 3) ≥50 w/Medicated HT   |
|--------------------------|---|--|---|
| a)Uncontrolled           | 21.3%   | 41.5%  | 58.2%   |
| b) Time effect at 12 mo. | SBP:133.85 v. 126.85,p =0.001 DBP: 79.78 v. 74.47,p < 0.001 | SBP: 149.56 v. 134.44, p < 0.001 DBP 87.77 v. 79.61, p < 0.001 | SBP: 149.44 v. 136.31, p < 0.001 DBP: 87.33 v. 79.56, p < 0.001 |

**CONCLUSION:** In a wellness program, the percent of individuals unaware of HT (21.3%) is below the national average (30%); the percent of uncontrolled treated HT in the total (41.5%) and ≥50 population (58.2%) are also below the national average (64%). With a year's participation in a supervised wellness program, there is a statistically significant decline in BP to healthy norms.

**DISCUSSION:** Individuals joining a wellness program have better awareness and control of BP than the general population; those that are uncontrolled benefit from a year's participation.

**2002 Board #48 MAY 31 8:00 AM - 9:30 AM**

**Physical Activity: An Extra Minute a Day May Keep the Doctor Away**

Elena Boiarskaia. *University of Illinois Urbana-Champaign, Urbana, IL.* (Sponsor: Weimo Zhu, FACSM)

(No relationships reported)

It has been shown that regular physical activity (PA) decreases the risk of metabolic syndrome; yet, it is unclear how the effects of PA differ at various points of the distribution of a particular measure. Quantile regression (QR) (Koenker & Bassett, 1978) provides this insight by describing the effect of an input variable at any quantile of the distribution of the outcome variable.

**PURPOSE:** To examine differences in effect of accelerometer-determined moderate intensity PA in minutes per day on measures associated with metabolic syndrome using QR.

**METHOD:** PA data and outcome measures were obtained from the National Health and Nutrition Examination Survey (NHANES) 2003-2004 data for 3,199 adults aged 18-85, 49% male, with an average age of 50 (SD = 19.93) and average BMI of 27.88 (SD = 5.69). Determined using an ActiGraph monitor, moderate intensity PA was defined as ≥ 2020 intensity counts per minute for adults. Controlling for age, gender and BMI, the effects of moderate intensity PA on waist circumference (WC), blood pressure (BP) and plasma glucose levels (GLU) were analyzed using QR.

**RESULTS:** QR revealed that the effect of each additional minute of moderate intensity PA on WC was significant (p < .05) for all quantiles, but increasingly stronger for men above 60th percentiles (WC ≥102 cm). On average the reduction of WC was .11 cm (SD = .01), but men at the 95th percentile (WC = 123 cm) benefited by reductions of .19 cm (SD = .05). Similar results were found for women. Moderate intensity PA had a significant negative effect on GLU, but only above 40th percentiles (GLU ≥ 91 mg/dL). The strongest reductions of .07 mg/dL (SD = .02) were experienced above 85th percentiles (GLU ≥ 108 mg/dL). On average, PA did not appear to have an effect on systolic BP; however, QR showed that there were significant reductions of about .02 mmHg between 15th and 70th quantiles (101 ≤ BP ≤ 128 mmHg) for each additional minute of PA.

**CONCLUSION::**Differences in impact of moderate intensity PA on the various outcome variables across quantiles were found. Individuals considered at risk according to their WC and GLU benefited more from each additional minute of moderate intensity PA than those who were relatively healthy. On the other hand, those who were within the healthy range of systolic BP experienced significant benefits from PA, while those at the extreme ranges did not.

**2003 Board #49 MAY 31 8:00 AM - 9:30 AM**

**Interrelationships Between Depression, Physical Activity, Homocysteine And Metabolic Syndrome**

Paul D. Loprinzi<sup>1</sup>, Bradley J. Cardinal, FACSM<sup>2</sup>. <sup>1</sup>*Bellarmine University, Louisville, KY.* <sup>2</sup>*Oregon State University, Corvallis, OR.*

(No relationships reported)

Since studies have demonstrated a link between metabolic syndrome and cardiovascular disease, understanding factors that may influence metabolic syndrome is of great interest. Although inconclusive, studies have reported an association between depression and metabolic syndrome, with additional findings indicating that endothelial function, as measured by homocysteine levels, may be an important marker of metabolic syndrome.

**PURPOSE:** Given that previous studies have demonstrated links between physical activity and depression, endothelial function and metabolic syndrome, the purpose of the present study was to simultaneously examine the interrelationships among these variables in a nationally representative sample of the U.S. adult population.

**METHODS:** Data from the 2005-2006 National Health and Nutrition Examination Survey were used. After exclusions, 1,146 participants were included in the analyses. Physical activity was

objectively measured using accelerometry; demographic variables and depression were assessed using a questionnaire; and the biological variables were evaluated from blood samples. Multivariate linear and logistic regression was used to assess the interrelationships while controlling for potential confounders. Having metabolic syndrome was coded as 0.

**RESULTS:** The odds ratios between depression and metabolic syndrome, moderate-to-vigorous physical activity (MVPA) and metabolic syndrome, and homocysteine and metabolic syndrome were 0.91 ( $P = 0.36$ ), 1.28 ( $P < 0.001$ ), and 0.007 ( $P < 0.06$ ), respectively. The beta coefficients between depression and MVPA and MVPA and homocysteine were -0.33 ( $P < 0.001$ ) and 0.001 ( $P = 0.11$ ), respectively.

**CONCLUSIONS:** Depression was not associated with metabolic syndrome nor was homocysteine associated with MVPA or metabolic syndrome; however, depression was significantly inversely associated with MVPA, which in turn, was inversely associated with metabolic syndrome. Although future prospective studies are needed to better characterize the direction of these relationships, the present findings suggest that physical activity may directly influence metabolic syndrome as well as indirectly through reductions in depression symptoms.

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**2004 Board #50 MAY 31 8:00 AM - 9:30 AM**

**Physical Activity, Body Fat And Glycemic Control In A Type 2 Diabetic Portuguese Sample**

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(No relationships reported)

Diabetes mellitus has emerged as one of the main concerns to human health in current century. Previous research has emphasized the importance of an active lifestyle in the prevention and management of this disease. Furthermore, the amount of body fat is also known to influence glycemic control, as evaluated by the percentage of glycated hemoglobin A1c (A1c).

**PURPOSE:** to characterize physical activity levels, amount of body fat and glycemic control of a type 2 diabetic sample.

**METHODS:** Data was obtained from 104 previously sedentary Portuguese type 2 diabetic mellitus patients (mean age 65.8±6.7 years; 68 women and 36 men). Circulating levels of A1c were evaluated using blood sample analysis. Daily steps were assessed by accelerometry during one week (GT1M, Actigraph, LLC). Body composition was measured with DEXA (Hologic QDR) and subjects were classified as underfat, healthy (H), overfat (O) and obese (OB) in accordance with Gallagher et al. guidelines.

**RESULTS:** The prevalence of O+OB was high, with more than 92% of the subjects being considered O+OB. The number of daily steps for H, O and OB was 9480±3169, 7995±3087 and 7401±2723, respectively ( $p > 0.05$ ); subjects spent an average of 48±25 min/day (H), 37±23 min/day (O) and 32±21 min/day (OB) in moderate to vigorous physical activities ( $p > 0.05$ ). A1c was similar among H, O and OB, with 7.0±1.5, 6.6±1.2 and 6.6±1.4%, respectively ( $p > 0.05$ ).

**CONCLUSIONS:** Although there were differences in the considered variables among H, O and OB groups, these did not reach statistical significance. Leaner subjects showed a trend towards a higher number of daily steps and increased time spent on moderate to vigorous activities, but not in A1c levels. These results may be due to the relatively small sample size and diabetes related pharmacological therapy used by all subjects, which may attenuate differences among groups. Supported by PTDC/DES/104518/2008 (FCOMP-01-0124-FEDER-009599) and SFRH/PROTEC/50008/2009 grants.

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**2005 Board #51 MAY 31 8:00 AM - 9:30 AM**

**Adiposity, Blood Pressure, And Glucose Metabolism Correlate Favorably With Higher Peak 30-minute Cadence**

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(No relationships reported)

**PURPOSE:** Peak 30-minute cadence (defined as the average steps/min for the best 30, not necessarily consecutive, minutes in a day) has been introduced as an informative approach to describe accelerometry-determined intensity of best effort under free-living conditions. The purpose of this analysis of the 2005-2006 National Health and Nutrition Examination Survey (NHANES) accelerometer and health data was to determine the relationship between this objectively measured intensity parameter and directly measured indicators of adiposity (BMI, waist circumference), blood pressure (systolic and diastolic), and glucose metabolism (fasting glucose and insulin, HbA1c, and HOMA-IR).

**METHODS:** Accelerometer data were processed for 3522 NHANES adult participants (age= 47.5 (0.7), 47.7% male) who supplied 1-7 days of valid data (i.e., ≥10 hours of wear time/day). Minute-by-minute cadence data were ranked to identify and average the top 30 minutes each day, and then these were averaged across valid days. Spearman correlations were calculated to evaluate the relationships between peak 30-minute cadence and the specified health parameters.

**RESULTS:** All correlations with peak 30-minute cadence were statistically significant: BMI (-0.18), waist circumference (-0.25), systolic blood pressure (-0.21), diastolic blood pressure (0.05), glucose (-0.22), insulin (-0.18), HbA1c (-0.24), HOMA-IR (-0.22). Relationships were attenuated but still significant ( $p < .05$ ) when adjusted for age.

**CONCLUSIONS:** An indicator of natural best ambulatory effort in a day is significantly associated with measures of adiposity, blood pressure, and glucose metabolism. Peak 30-minute cadence is a continuous variable indicative of habitual intensity that may serve to expand upon volume-based estimates of ambulatory activity expressed only as steps/day.

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**2006 Board #52 MAY 31 8:00 AM - 9:30 AM**

**The Efficacy of a Six Month Corporate Health Initiative Program**

Bethany Garner, Jennifer Patrick, John C. Garner, Melinda W. Valliant. *The University of Mississippi, University, MS.* (Sponsor: Mark Loftin, FACSM)  
(No relationships reported)

The fast-paced lifestyle of today's society often allows little time for attention to personal health and wellness. As a result, rising medical costs, insurance rates, and employee absenteeism leave employers searching for ways to improve the health of their workforce and company. Employers often struggle to find an affordable program for their employees. A well-designed worksite wellness program has the capacity to greatly improve the health and well-being of participants, thus improving their productivity.

**PURPOSE:** The purpose of this study was to evaluate six months of a corporate wellness program in a rural plant of a major manufacturing company.

**METHODS:** Data from program participants collected in January 2011 and July 2011 were compared to data from non participants collected during the same times. Data evaluated included waist circumference (WC), blood glucose (BG), triglycerides (TG), high density lipoprotein cholesterol (HDL), low density lipoprotein (LDL) and blood pressure (BP). To test for statistical significance of differences in biometrical outcomes, pair-t tests between pre and post assessments for both groups was utilized.

**RESULTS:** Data comparisons resulted in a statistically significant improvement ( $p < 0.01$ ) in WC, BG, TG, HDL, LDL of participants (individual coaching and group fitness) compared to non participants ( $p = 0.18$ ). Further evaluation of participation revealed that those who attended individual coaching sessions more frequently showed the greatest improvement in the analyzed biometrics (correlation 0.91) compared to group fitness participation (0.82). However, those who participated in both showed the greatest improvement and strongest correlation (0.95). Blood pressure comparisons did not result in a statistically significant difference although it did approach contribution to the regression equation.

**DISCUSSION:** Based on the results reported to the manufacturing plant, more new participants are joining the initiative. This may provide the opportunity to have a greater impact on employee health of the plant as a whole. Consideration should be made to encourage participation in both individual and group activities to facilitate improvement in overall health.

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**2007 Board #53 MAY 31 8:00 AM - 9:30 AM**

**Food Consumption, Serum Vitamins, and Metabolic Syndrome Risk by Daily Steps in Middle Aged Men**

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(No relationships reported)

The purpose of this study was to examine metabolic syndrome risk and to find differences in food consumption and levels of serum vitamins by steps/day on the basis of data obtained from the 2005-2006 NHANES. The subjects were 948 men aged 40-70 years old. They were divided into three groups by tertiles of accelerometer-determined steps/day: G1 (n=313, <6,802 steps), G2 (n=322, 6,802 ~ 10,698 steps), and G3 (n=313, ≥10,699). Metabolic syndrome was defined as the presence of three or more of the following five components: waist circumference >40 inches; TG ≥150 mg/dL; HDL <40 mg/dL; blood pressure ≥130/85 mmHg, and fasting plasma glucose ≥100 mg/dL (NCEP ATP III). Logistic regression was used to estimate the odds ratios (ORs) and the 95% confidence intervals for the metabolic syndrome risk after adjustment for age. Univariate general linear model analysis of covariance (GLM-ANCOVA) adjusted for age and BMI,

and Bonferroni post-hoc test was used for multiple comparisons. G3 consumed significantly more "Fruits" and "Vegetables" than other groups, whereas G1 consumed significantly more "Milk and Milk Products" and less "Fruits" and "Vegetables" than other groups. The ratio of (Fruits+Vegetables) / (Eggs+Meats) was the highest in the G3 (2.46) and the lowest in the G1 (1.55). Serum levels of vitamin C, pyridoxal 5'-phosphate,  $\alpha$ -carotene, trans- $\beta$  carotene, cis- $\beta$  carotene, b-cryptoxanthin, lutein and zeaxanthin, trans-lycopene, retinyl pamate and vitamin D were the highest in the G3 and the lowest in the G1. There were no significant differences in the three groups in the levels of 4-pyridoxal acid, vitamin B<sub>12</sub>, retinal stearate, vitamin A and E. The OR of G1 to G3 (reference group) is 1.90 (1.89-1.90) for abdominal obesity, 2.46 (2.46-2.47) for fasting hyperglycemia, 1.97 (1.97-1.97) for hypertriglyceridemia, 2.07 (2.06-2.07) for low HDL, 1.96 (1.96-1.97) for hypertension, and 3.20 (3.20-3.21) for the metabolic syndrome. These results showed that middle aged men who do not walk much had the lowest levels of many serum vitamins and ate more milks, eggs and meats. Further, their daily steps and food intake are related to an increased risk of the metabolic syndrome.

**2008** Board #54 MAY 31 8:00 AM - 9:30 AM

**Relationship Between Physical Activity, Sitting Time and Metabolic Health**

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(No relationships reported)

**PURPOSE:** To study the relationship between sitting time and the metabolic health factors: total cholesterol (TCHO), low-density lipoprotein (LDL), high-density lipoprotein (HDL), triglycerides (TG) and blood glucose (GLU) in physical active and inactive individuals.

**METHODS:** Maximal oxygen uptake (VO<sub>2</sub> max) was measured in a cycle ergometer test (Astrand-Rhyming test). Level of GLU, cholesterol and TG was measured by Choletech LDX system. Activity habits and daily sitting time was self-reported. A sample of 1404 individuals (917 men), with a mean age of 41.8 (SD 11.0) participated in the study. A total of 1114 individuals completed all tests.

**RESULTS:** The participants were divided in six groups according to PA-level. VO<sub>2</sub> max increased according to PA (Tab 1). It was also found that the least active individuals had lower level of HDL (16,2%) and higher level of TG (34,3%), GLU (8,4%) and sitting time (31,5%) compared to the most active (p<.01). Among the physically inactive and among individuals who reported at least 90 min-wk<sup>-1</sup> with endurance training, there was a great variation of sitting time. However it was not found any significant correlations between sitting time and the metabolic health factors nor in the physically inactive or most active group.

**Table 1.** VO<sub>2</sub> max in different physical activity-levels.

|  | Number of times with moderate PA - minimum 30 min-day-1-wk-1 |               |              |              |                |               |
|--|--|---------------|--------------|--------------|----------------|---------------|
|  | 0<br>(n=258)   | 0,5<br>(n=62) | 1<br>(n=197) | 2<br>(n=279) | 3-4<br>(n=268) | 5+<br>(n=103) |
| VO <sub>2</sub> max<br>(ml·kg <sup>-1</sup> ·min <sup>-1</sup> ) | 31   | 32            | 35**         | 38*          | 40*            | 48*           |

\* Different from other PA-levels (p<.001).

\*\* Different from the least active (p<.001).

**CONCLUSION:** Even though there was a great variation in sitting time within the group of individuals who did not participate in endurance training, and the most active individuals, there were no significant correlations between metabolic health and sitting time. Activity level is according to our findings, a better indicator of metabolic health.

**2009** Board #55 MAY 31 8:00 AM - 9:30 AM

**Prevalence Of Obesity And Hypertension Among Senior Civil Servants In Lagos, Nigeria**

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(No relationships reported)

Weight has long been known to be a determinant of health and disease. Both overweight and underweight are associated with health consequences. Hypertension as well has been widely documented to be a major risk factor for heart attack, stroke, and kidney disease.

**PURPOSE:** To determine the prevalence of overweight, obesity and hypertension in Lagos State senior staff civil servants.

**METHODS:** A cross sectional cohort study of 305 (163 men, 142 women) senior civil servants in five ministries of the Lagos State civil service. Participants were aged 43.20 ± 7.37 years (range 25 to 65 years). The body mass index (BMI) and blood pressure (BP) of all participants were measured. The BMI and BP were stratified using acceptable international standards and data were analysed using descriptive statistics and Chi square. Level of significance was set at P < 0.05.

**RESULTS:** A prevalence of 47.9% and 30.8% were recorded for overweight and obesity respectively. Three (1.0%) participants were underweight while 62 (20.3%) had normal weight. Seventy-one (23.3%) of participants had hypertension (systolic blood pressure (SBP) ≥ 140 mmHg) while 161 (52.8%) had pre-hypertension (SBP of 120 - 139 mmHg) and 73 (23.9%) had normal BP (SBP < 120 mmHg). Gender and cadre were strongly significantly associated with BMI and SBP respectively (p = 0.000).

**CONCLUSIONS:** There is a high prevalence of overweight and obesity among senior staff of the Lagos State civil service. Majority of the workers were pre-hypertensive and a fair number of them were hypertensive. This study suggests that majority of the workers are at risk of cardiovascular diseases and other health related diseases. There is an urgent need for a public awareness on overweight, obesity and hypertension and appropriate measures for intervention and prevention in the studied population.

**2010** Board #56 MAY 31 8:00 AM - 9:30 AM

**Diabetes & Selected Components From Nhanes: Food Security, Ethnicity, Ses, Consumer Behavior, And Physical Activity**

M. Dot Fullwood, Pam Howard, Mi-Sook Kim, Marialice Kern, FACSM. San Francisco State University, San Francisco, CA. (Sponsor: Dr. Marialice Kern, FACSM)

(No relationships reported)

The primary aim of the present study was to examine predictabilities of socioeconomic status (SES) variables, food security, consumer behavior, and physical activity on the prevalence of type 2 diabetes (T2D) in ethnic groups. The first hypothesis was that all predictors would be negatively associated with T2D except poverty to income ratio. A second hypothesis was to examine ethnic group differences.

**METHODS:** Data from the 2007-2008 wave of NHANES was used for this study (n= 9,657 who responded to diabetes). Only selected NHANES instruments were used and select questions within the instruments were modified to capture consumer behavior, food security, and physical activity in relation to diabetes. Questions from the consumer behavior instrument were scaled and food security, physical activity, and SES markers were categorized into groups based on the literature.

**RESULTS:** Spearman's Rho correlations between all observed variables were not significant for the first hypothesis. No statistical relationship was identified at the p > 0.05 between the independent variables and the dependent variable diabetes. Ethnic group differences were found among four study variables using the Wilks Lambda at  $\Lambda = .746$ ,  $F(20, 500) = 3.95$ ,  $p < .000$ . The main effects were found in EatCook ( $F(2, 261) = 3.55$ ,  $p = .030$ ); Mexican American and Other Hispanic participants were different from the other two groups, HowOften ( $F(2, 261) = 14.43$ ,  $p = .000$ ); Mexican American and Other Hispanic non-White participants were different from non-Hispanic Black participants, LevOfEd ( $F(2, 261) = 13.91$ ,  $p = .000$ ); Mexican American and Other non-White Hispanic participants were different from the other two groups and PIR ( $F(2, 261) = 3.99$ ,  $p = .020$ ); Mexican American and Other non-White Hispanic participants were different from the other two groups.

**CONCLUSION:** Non-Hispanic Black and non-Hispanic White groups were more closely related for consumer behaviors in comparison to Mexican American and Other Hispanics. The current study's findings are in agreement with the breadth of knowledge suggesting that Mexican American and Other Hispanic, non-Hispanic White and non-Hispanic Black populations behave and operate in different manners with regard to the antecedents of T2D, this study could not demonstrate an association with the incidence of T2D.

**2011 Board #57 MAY 31 8:00 AM - 9:30 AM**  
**A Pareto Principle (20-80 Rule) Analysis of Daily Physical Activity and Diabetes Impact**

Weimo Zhu, FACSM, Elena Boiarskaia. *Univ. of Illinois, Urbana, IL*  
*(No relationships reported)*

Invented by Vilfredo Pareto, an Italian economist, the Pareto principle refers to a small number of causes is responsible for a large percentage of the effect and often a 20-percent to 80-percent ratio. While the principle has been applied to many different areas, the field of physical activity (PA) and health has not taken the advantage of this theory.

**PURPOSE:** To examine the most effective daily moderate and vigorous PA (MVPA) minutes (min) that may impact the diabetes population in the US according to the Pareto principle analysis.

**METHOD:** The National Health and Nutrition Examination Survey (NHANES) 2003-2004 data (N = 4,876, male = 2415 (mean age = 38 yr., SD = 24.32 yr.), female = 2451 (mean age = 38.3 yr., SD = 24.26 yr.)), were used for the analysis, in which diabetes were defined by subjects' responses to the question of "Doctor told you have diabetes" and plasma glucose levels using the cutoff " $\geq 110$ mg/dL". Daily MVPA min were determined using ActiGraph data (cutoff " $\geq 2020$  intensity counts per min"). Pareto diagrams, as well as corresponding statistics, were computed for both self-reported and glucose level-based diabetes rates by gender.

**RESULTS:** The impact of daily MVPA min on the US diabetes population (P = % of people who had diabetes and cumulative P) by gender (M/F) is summarized in the table below.

**CONCLUSION:** The increase in MVPA min at different levels had a nonlinear impact on the diabetes population. For males, the most effective minutes are between 30 and 60 min and for females, the most effective ones were between 20 and 30 min. Since these min were consistent to the recommended one by the US PA guideline, PA promotion, therefore, should focus on these min.

impact of daily MVPA min on the US Diabetes Population

|               | <10   | 11-20 min | 21-30 min | 31-40 min | 41-50 min | 51-60 min | 61-100 min |
|---------------|-------|-----------|-----------|-----------|-----------|-----------|------------|
| M-Self-report |       |           |           |           |           |           |            |
| P             | 22.98 | 16.03     | 13.74     | 11.39     | 8.94      | 7.75      | 13.75      |
| CP            | 22.98 | 39.01     | 52.75     | 64.14     | 73.08     | 80.83     | 94.58      |
| M-Glucose     |       |           |           |           |           |           |            |
| P             | 25.81 | 15.96     | 16.36     | 12.41     | 9.36      | 7.09      | 10.74      |
| CP            | 25.81 | 41.77     | 58.13     | 70.54     | 79.90     | 86.99     | 97.73      |
| F-Self-report |       |           |           |           |           |           |            |
| P             | 41.09 | 19.58     | 14.16     | 8.27      | 4.74      | 3.35      | 6.53       |
| CP            | 41.09 | 60.67     | 74.83     | 83.10     | 87.84     | 91.19     | 97.72      |
| F-Glucose     |       |           |           |           |           |           |            |
| P             | 45.93 | 22.11     | 16.18     | 7.64      | 3.82      | 1.91      | 2.11       |
| CP            | 45.93 | 68.04     | 84.22     | 91.86     | 95.68     | 97.59     | 99.70      |

**2012 Board #58 MAY 31 8:00 AM - 9:30 AM**  
**Alcohol Consumption Patterns And Metabolic Syndrome Criteria: 1999-2004 NHANES**

James R. Churilla, Tammie M. Johnson, Rebecca C. Curls. *University of North Florida, Jacksonville, FL*. (Sponsor: Scott Crouter, FACSM)  
*(No relationships reported)*

Several studies have examined the association between alcohol consumption patterns and metabolic syndrome (MetS) criteria, most of which used categorical dependent variables. Few studies have focused on the specific associations between alcohol consumption patterns and MetS criteria using linear modeling.

**PURPOSE:** To examine the linear relationship between alcohol consumption patterns and MetS criteria.

**METHODS:** Study sample (N=5,618) included adults, 21 years and older that participated in the 1999-2004 National Health and Nutrition Examination Survey.

**RESULTS:** The associations between moderate and above moderate alcohol consumption and MetS indicators varied by age group and indicator. The following findings control for race/ethnicity, gender, poverty level, smoking status, family history of diabetes, family history of heart disease, and physical activity level and use non-drinkers as the referent group. All reported findings have a p-value <0.05. Above moderate alcohol consumption was negatively associated with waist circumference among those in the 21-30 age group ( $\beta = -6.82$ ). Moderate alcohol consumption was negatively associated with waist circumference among those in the 31-40 and 41-50 age groups ( $\beta = -7.12$  and  $\beta = -4.27$ , respectively). Above moderate consumption was negatively associated with triglyceride levels among those in the 71-80 and 81+ age groups ( $\beta = -34.26$  and  $\beta = -49.89$ , respectively) and moderate consumption was negatively associated among those in the 41-50 and 61-70 age groups ( $\beta = -27.70$  and  $\beta = -15.96$ , respectively). Above moderate consumption was positively associated with HDL levels in all age groups ( $\beta$  range 9.44-14.98) except 81+ where it is negatively associated ( $\beta = -49.89$ ). Moderate consumption is positively associated with HDL in the age groups spanning 21-70 years ( $\beta$  range 3.86-6.03). Some statistically significant associations were observed between alcohol consumption level and blood pressure measures (systolic and diastolic), but these effects do not appear to be clinically relevant.

**CONCLUSION:** Moderate and above moderate alcohol consumption may favorable impact metabolic health risk, however, these finding need to be interpreted with caution.

**2013 Board #59 MAY 31 8:00 AM - 9:30 AM**  
**Effects of Kettlebell Training on Metabolic Syndrome in Women**

Karen I. Moreno, Peggy A. Plato. *San Jose State University, San Jose, CA*. (Sponsor: Craig Cisar, FACSM)  
*(No relationships reported)*

Metabolic syndrome (MetS) is a compilation of interrelated risk factors with the potential to significantly increase incidence of type 2 diabetes and cardiovascular disease. The prevalence of MetS is growing, with more women affected than men. Decreased physical activity and increased adiposity are contributing factors. Data support physical activity, primarily aerobic exercise, in the prevention of MetS. However, the prevalence of MetS in women increases with age, even among women with high cardiorespiratory fitness (Farrell et al., 2004). Thus, age-related physiological changes seem to result in unfavorable metabolic repercussions. Jurca et al. (2004) reported an independent and inverse relationship between muscular fitness and prevalence of MetS in men. The effect of increasing muscular fitness on MetS has not been explored in women.

**PURPOSE:** To examine the effects of a community-based, kettlebell resistance training program on the core components of MetS in women.

**METHODS:** Six physically inactive women ( $48.8 \pm 2.9$  years) with a BMI of  $31.8 \pm 2.4$  kg/m<sup>2</sup> and meeting at least two other components of MetS completed the training program. Strength and aerobic fitness, body composition, and risk factors for MetS were measured before and after the twice weekly, 10 week kettlebell program.

**RESULTS:** Upper and lower body muscular fitness increased 42% and 10%, respectively. Aerobic fitness increased 12%. Before training, fasting glucose was  $101.7 \pm 2.7$  mg/dl compared to  $94.4 \pm 1.3$  mg/dl after training. Body weight decreased 1 kg, but body fat decreased 3.8 kg ( $43.3 \pm 3.1\%$  pre vs.  $39.6 \pm 2.7\%$  post). Waist circumference decreased  $2.1 \pm 1.9$  cm. Systolic and diastolic pressures decreased  $1.8 \pm 2.4$  and  $1.2 \pm 2.1$  mm Hg, respectively. The training program did not favorably change triglycerides or HDL-C. Compliance was high; all participants completed 90-100% of the exercise sessions.

**CONCLUSION:** Although group changes were not statistically significant, individual improvements were encouraging, particularly in fasting glucose and body fat, and suggest that kettlebell training has potential for improving components of MetS in middle-aged women. Response to the training program was positive, indicating potential for kettlebell training to be effective within a community-based program.

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**2014** Board #60 MAY 31 8:00 AM - 9:30 AM

**Supervised Exercise Interventions for Women at Risk for Heart Disease: Relationship Between Compliance and Outcomes**

Megan Donnelly, Scott S. Billecke, Pamela Marcovitz, Elizabeth Brown, Barry Franklin, FACSM. *William Beaumont Hospital, Royal Oak, MI.*  
(No relationships reported)

**BACKGROUND:** Structured exercise programs improve cardiac risk factors and quality of life (QOL) in men with and without cardiovascular disease (CVD). Few data are available regarding the responses and compliance to exercise interventions among women, and what quantity of exercise is necessary to elicit beneficial outcomes.

**PURPOSE:** To determine the cardiovascular and QOL benefits of a structured exercise program for women, with specific reference to the modulating impact of exercise compliance and/or concomitant dietary changes.

**METHODS:** Women age >18 years without known CVD but with  $\geq 1$  coronary risk factors were enrolled in a 6-month structured exercise program. Relationships between compliance (percent of weeks achieving target attendance,  $\geq 3$  times/wk for 30 min/session) and changes in anthropometric measures (weight, BMI, waist circumference), cardiorespiratory fitness (serial BP, heart rate, rating of perceived exertion during standardized submaximal exercise workload) and QOL (depression [PHQ-9], dietary fat intake [Fat Screener], self-reported physical activity [Duke Activity Status Index], sleepiness [Epworth]) were evaluated.

**RESULTS:** The program enrolled 117 women whose mean  $\pm$  SD age, weight and BMI were  $57 \pm 9$  years,  $202 \pm 48$  pounds and  $35 \pm 8$  kg/m<sup>2</sup>, respectively. Compliance (n = 49) was  $63 \pm 19\%$  and participants demonstrated significant improvements in all parameters tested after 6 months (P < 0.0001). Those in the top compliance tertile (mean  $82 \pm 19\%$ ,  $130 \pm 22$  min/wk) experienced significant reductions in weight, BMI and systolic BP and heart rate during standard submaximal exercise workloads (P < 0.05) compared with the middle tertile ( $63 \pm 6\%$ ,  $100 \pm 19$  min/wk). No such improvements were observed when comparing top and bottom ( $42 \pm 12\%$ ,  $82 \pm 20$  min/wk) tertiles, possibly due to the latter demonstrating significantly greater dietary fat restriction (Fat Screener  $8 \pm 7$  vs  $3 \pm 5$ ; P = 0.038). Only reductions in exercise systolic BP were significantly associated with compliance (Spearman correlation, r = 0.34, P = 0.026).

**CONCLUSIONS:** Women at risk for CVD demonstrated improvements in anthropometric measures, cardiorespiratory fitness and QOL following a 6-month exercise intervention. Improvements were influenced by exercise compliance but may have been modulated by reduced dietary fat intake.

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**2015** Board #61 MAY 31 8:00 AM - 9:30 AM

**The Effect Of Weight Loss And Exercise On Cardiovascular Structure And Function In Class II And III Obese Women**

Steven D. Verba<sup>1</sup>, Blake D. Justice<sup>2</sup>, Lori Portzer<sup>3</sup>, Renee Ingel<sup>3</sup>, John M. Jakicic, FACSM<sup>3</sup>. <sup>1</sup>*Slippery Rock University, Slippery Rock, PA.* <sup>2</sup>*Pfeiffer University, Misenheimer, NC.* <sup>3</sup>*University of Pittsburgh, Pittsburgh, PA.*  
(No relationships reported)

**PURPOSE:** The purpose of this study was to examine effect of diet-induced or diet plus exercise-induced weight loss on cardiac structure and function in Class II and III obese women.

**METHODS:** 24 healthy, sedentary, obese women (BMI: 35.0 to <45 kg/m<sup>2</sup>; Age: 45.4  $\pm$  6.9 yrs.) underwent a 12-week diet and exercise intervention: caloric restriction alone (DIET), caloric restriction plus aerobic training (DIET+AT), and caloric restriction plus resistance training (DIET+RT). Subjects reported to UPMC Presbyterian Hospital to undergo Cardiac MRI to measure left ventricular mass (LVM), myocardial fibrosis (Ve), end diastolic volume (EDV), end systolic volume (ESV), and ejection fraction (EF).

**RESULTS:** 18 out of 24 subjects completed the intervention. 16 out of 24 completed 12 week Cardiac MRI at UPMC Presbyterian. Body weight significantly decreased across all treatment groups (~4.5kg lost, p=0.001). Subjects in the DIET group had significantly greater reduction in LVM (-7.2  $\pm$  3.9g) than the DIET+AT (2.3  $\pm$  4.7g) and DIET+RT (-0.2  $\pm$  3.5g) groups (p=0.007). Subjects in the DIET+RT group had a significantly higher Ve score at 12 weeks (27.9  $\pm$  1.5%) than subjects in the DIET+AT (26.5  $\pm$  1.4%) and DIET (24.0  $\pm$  0.8%) groups (p=0.010). There were no significant changes in EDV, ESV, or EF at 12 weeks between groups (p>0.159).

**CONCLUSIONS:** In conclusion, only LVM in the DIET group and Ve in the DIET+RT showed statistical changes from baseline. Further investigations into the effect of weight loss and exercise on cardiac structure and function in Class II and III obese adults are warranted to expand upon the results of this investigation.

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**2016** Board #62 MAY 31 8:00 AM - 9:30 AM

**Chronic Physical Training Modulates Inflammatory Response In Healthy Adults Rats**

Luciana -, Nishimura, João Pedroso, Emidio Matos-Neto, Michele Trindade, Julio Tirapegui. *University of São Paulo, São Paulo, Brazil.*  
(No relationships reported)

Several studies have shown the effect of exercise in reducing the risk of developing chronic degenerative diseases and cardiovascular diseases. Although it is unclear in the literature, several authors suggest that this benefit is due to changes in the inflammatory responses caused by exercise.

**PURPOSE:** Thus, the objective of this study was to investigate the effect of endurance exercise training on inflammatory proteins.

**METHODS:** Fourteen (14) adult male Sprague Dawley rats were assigned into two groups: sedentary (SED) (n = 6) and trained group (Training) (n = 8), which was subjected to 1-hour training per day on a treadmill for 8 weeks, 50 -70% VO2max. Cytokine levels were measured by multiplex immunoassay using rat serum adipokine (panel kit 7 LINCplex) for simultaneous measurement of TNF- $\alpha$ , IL-1, IL-6, MCP1 and leptin, in the automatic Lincplex 200.

**RESULTS:** Trained group showed a higher concentration of IL-6 (880.36 276.09 pg / ml and 194.31 76.97 pg / ml) and IL-1alpha (203.47 49.16 pg / ml, 31, 29 4.7 pg / ml) compared to SED group (p < 0.05). There was no statistically significant difference on MCP1 and TNF-alpha levels between groups. We observed a higher leptin concentration in SED group (17.03 4.46 ng / ml) compared to trained group (6.44 1.06 ng / ml) (p < 0.05).

**CONCLUSION:** The results suggest that eight weeks of aerobic training was able to alter the production of some inflammatory proteins, exerting anti-inflammatory effects, and can provide several metabolic and hormonal improvements in different tissues, thus providing a powerful tool to control and / or reduce the risk of developing chronic degenerative disorders. Financial support: FAPESP and CNPq.

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**2017** Board #63 MAY 31 8:00 AM - 9:30 AM

**Associations of Current Activity Level and Foot Peripheral Neuropathy (PN): The Framingham Foot Study (FFS)**

Jody L. Riskowski<sup>1</sup>, Alyssa B. Dufour<sup>2</sup>, Hylton B. Menz<sup>3</sup>, Virginia A. Casey<sup>4</sup>, Thomas J. Hagedorn<sup>4</sup>, Marian T. Hannan<sup>1</sup>. <sup>1</sup>*Institute for Aging Research, Harvard Medical School, Boston, MA.* <sup>2</sup>*Institute for Aging Research, Boston University, Boston, MA.* <sup>3</sup>*Institute for Aging Research, Harvard Medical School La Trobe University, Bundoora, Australia.* <sup>4</sup>*Institute for Aging Research, Boston, MA.*  
(No relationships reported)

Foot PN is often associated with diabetes, but many older adults have idiopathic PN, with age the main risk factor.

**PURPOSE:** To determine associations between current activity level and foot PN in the FFS by diabetes status.

**METHODS:** FFS members evaluated between 2002-08 for current activity level, foot PN and diabetes status were included. Individuals classified as having diabetes if fasting glucose  $\geq 126$  mg/dL or if taking oral hypoglycemic agent or insulin. A 128-Hz tuning fork assessed PN at: 1<sup>st</sup> and 5<sup>th</sup> metatarsal head and medial and lateral malleolus. Loss of vibrotactile sense at two or more sites on a foot defined foot PN. Current activity level computed by multiplying metabolic equivalent-hour (MET-hr) by self-reported hours sleeping (MET-hr: 0.9), sitting (1.0) and participating in light (3.0), moderate (4.5) and heavy (7.0) activity in a typical day. By tertile of METs, participants categorized as: high, low or moderate (referent) activity. Crude and adjusted (age, sex, body mass index [BMI], smoking, depression) logistic regression evaluated current activity level and foot PN associations.

**RESULTS:** There were 2090 FFS members included (Table 1). In individuals without diabetes, foot PN decreased 41% and increased 51% in the high and low activity groups, respectively, relative to the referent. With adjustment, associations persisted with wider confidence intervals. No significant associations noted between activity and foot PN in those with diabetes.

Table 1. Demographic information (reported as mean  $\pm$  standard deviation, unless otherwise noted) and odds ratios (OR) with 95% confidence intervals (95% CI) for current activity level and foot PN

|                        | FFS<br>(N=2090)     | No Diabetes<br>(N=1948) | Diabetes<br>(N=142) |
|------------------------|---------------------|-------------------------|---------------------|
| Age, years             | 66.1 $\pm$ 8.9      | 64.9 $\pm$ 8.9          | 69.9 $\pm$ 8.6      |
| Females (%)            | 1190 (55.6)         | 1127 (57.9)             | 63 (44.4)           |
| BMI, kg/m <sup>2</sup> | 28.3 $\pm$ 5.4      | 27.9 $\pm$ 5.0          | 30.6 $\pm$ 6.2      |
| Foot PN cases (%)      | 133 (6.4)           | 110 (5.6)               | 23 (16.2)           |
| Crude OR               |                     |                         |                     |
| Referent               | 1.00                | 1.00                    | 1.00                |
| High Activity          | 0.59<br>(0.34-0.92) | 0.64<br>(0.37-0.98)     | 0.44<br>(0.12-1.58) |
| Low Activity           | 1.51<br>(1.01-2.25) | 1.48<br>(1.01-2.31)     | 1.49<br>(0.54-4.12) |
| Adjusted OR            |                     |                         |                     |
| Referent               | 1.00                | 1.00                    | 1.00                |
| High Activity          | 0.56<br>(0.33-0.95) | 0.60<br>(0.34-0.99)     | 0.44<br>(0.12-1.57) |
| Low Activity           | 1.41<br>(1.01-2.26) | 1.45<br>(0.92-2.29)     | 1.25<br>(0.43-3.60) |

**CONCLUSION:** In older adults without diabetes, activity level is an independent idiopathic foot PN risk factor but not in those with diabetes. Future work investigating mechanisms linking activity level and idiopathic foot PN is needed.

SUPPORT: RO1-AR047853; T32-AG023480

**2018 Board #64 MAY 31 8:00 AM - 9:30 AM**

**A Prospective Population Study Of Resting Heart Rate And Peak Oxygen Uptake (the Hunt Study, Norway)**

Javaid Nauman<sup>1</sup>, Stian Thoresen Aspenes<sup>1</sup>, Tom Ivar Lund Nilsen<sup>2</sup>, Lars Johan Vatten<sup>3</sup>, Ulrik Wisløff<sup>1</sup>. <sup>1</sup>The K. G. Jebsen Center of Exercise in Medicine, Trondheim, Norway. <sup>2</sup>The human movement science programme, NTNU, Trondheim, Norway. <sup>3</sup>The K. G. Jebsen Center of Exercise in Medicine, and Department of Public Health, Faculty of Medicine, Trondheim, Norway.

(No relationships reported)

**PURPOSE:** Resting heart rate (RHR) and peak oxygen uptake ( $VO_{2peak}$ ) are strong and independent predictors of cardiovascular morbidity and mortality. Physical activity (PA) could modify the association of RHR with  $VO_{2peak}$ . However, the prospective association of RHR with  $VO_{2peak}$ , and combined effects of RHR and self-reported PA on later  $VO_{2peak}$  has not been assessed in population studies.

**METHODS:** In a prospective population study of 807 men and 810 women free from cardiovascular disease both at baseline (1984-86) and follow-up 23 years later, RHR was recorded at both occasions, and  $VO_{2peak}$  was measured by ergospirometry at follow-up. We used Generalized Linear Models to assess the association of baseline RHR with  $VO_{2peak}$ , and to study combined effects of baseline RHR and self-reported PA on  $VO_{2peak}$  at follow-up.

**RESULTS:** There was an inverse association of RHR at baseline with  $VO_{2peak}$  ( $p < 0.01$ ). Men and women with baseline RHR of 80 bpm or higher had 4.6 mL $\cdot$ kg<sup>-1</sup> $\cdot$ min<sup>-1</sup> (95% confidence interval [CI], 2.8 to 6.3) and 1.4 mL $\cdot$ kg<sup>-1</sup> $\cdot$ min<sup>-1</sup> (95% CI, 0.4 to 3.1) lower  $VO_{2peak}$  at follow-up compared to men and women with RHR below 60 bpm at baseline. Participants with relatively high RHR and high PA at baseline had a  $VO_{2peak}$  (0.7 mL $\cdot$ kg<sup>-1</sup> $\cdot$ min<sup>-1</sup>; 95% CI, -3.3 to 4.8) that was similar to inactive people with relatively low RHR (reference group). A combination of high PA and low RHR yielded highest  $VO_{2peak}$ .

**CONCLUSION:** A low RHR at baseline was a strong predictor of high  $VO_{2peak}$  23 years later. The results suggest that high levels of PA may compensate for the lower  $VO_{2peak}$  associated with a high RHR.

**C-27 Free Communication/Poster - Clinical Exercise Physiology Obesity/Diabetes (Clinical Exercise Physiology Association)**

MAY 31, 2012 7:30 AM - 12:30 PM

ROOM: Exhibit Hall

**2019 Board #65 MAY 31 9:00 AM - 10:30 AM**

**Use of Heart Rate Index to Predict Maximal Oxygen Utilization Before and After Exercise Therapy in Pediatric Obese Patients**

Yvette M. Gerdes, Wayne Mays, Michelle Amos, Sandra Knecht, Randal Claytor, Timothy Knilans. *Cincinnati Children's Hospital, Cincinnati, OH.*

(No relationships reported)

**PURPOSE:** To evaluate the utility of heart rate index (HRindex) as a predictor of maximal oxygen utilization in pediatric obesity patients.

**METHODS:** We evaluated 299 pediatric obesity patients (mean age 12.0  $\pm$  2.8 years, 109 males) with a modified Balke treadmill protocol before and after a 16 week exercise program. HRindex was calculated by dividing the maximal heart rate by the sitting heart rate at rest. Predicted maximal METS (PMMETS) was generated by the line equation: 6 times HRindex minus 5.

**RESULTS:** There was a significant decrease in weight (88.4  $\pm$  28.6 vs 86.3  $\pm$  27.9 kilograms,  $p < 0.001$ ), a significant increase in absolute (MVO2) and indexed (MIVO2) maximal oxygen consumption, (2224  $\pm$  605 vs 2476  $\pm$  647 ml/min,  $p < 0.001$ , 26.0  $\pm$  4.7 vs 27.6  $\pm$  5.4 ml/kg/min,  $p < 0.001$ ) and a significant increase in maximal METS (MMETS) and energy expenditure (EE) (7.4  $\pm$  1.7 vs 8.5  $\pm$  1.6  $p < 0.0001$ , 25.0  $\pm$  10 vs 27.6  $\pm$  11.0 kcal,  $p < 0.001$ ) after exercise therapy. There was a significant correlation between MMETS and PMMETS before and after exercise therapy (7.4  $\pm$  1.4 vs 7.8  $\pm$  2.0  $r = 0.29$ ,  $p < 0.001$ , 8.5  $\pm$  1.6 vs 8.1  $\pm$  2.1  $r = 0.22$ ,  $p < 0.01$ ). However, METS and PMMETS were significantly different ( $p < 0.01$ ). Before and after exercise therapy HRindex was significantly correlated to MVO2 ( $r = 0.13$ ,  $p < 0.01$  and  $r = 0.12$ ,  $p < 0.01$ ), MIVO2 ( $r = 0.29$ ,  $p < 0.001$  and  $r = 0.22$ ,  $p < 0.001$ ) and MMETS ( $r = 0.29$ ,  $p < 0.001$  and  $r = 0.22$ ,  $p < 0.001$ ). HRindex was not significantly correlated with EE before and after exercise therapy.

**DISCUSSION:** There is a significant correlation between HR index and MVO2, MIVO2 and MMETS before and after exercise therapy. However, the correlation is weak and provides little

predictive value for MVO<sub>2</sub>, MIVO<sub>2</sub> and MMETS. This lack of predictive robustness is demonstrated by the significant difference seen in MMETS and PMMETS before and after exercise therapy.

**CONCLUSION:** The predictive power of the heart rate index is limited in pediatric obesity patients. Future research should focus on a multivariable predictive model that may include heart rate index.

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**2020** Board #66 MAY 31 9:00 AM - 10:30 AM

### **Obesity Paradox and Cardiorespiratory Fitness in Women from the Veterans Exercise Testing Study (VETS)**

Ricardo B. Oliveira<sup>1</sup>, Paul A. McAuley<sup>2</sup>, Peter F. Kokkinos<sup>3</sup>, Paulo T.V. Farinatti<sup>1</sup>, Jonathan N. Myers, FACSM<sup>4</sup>. <sup>1</sup>Rio de Janeiro State University, Rio de Janeiro, Brazil. <sup>2</sup>Winston-Salem State Univ, Winston-Salem, NC. <sup>3</sup>VA Washington/Georgetown Univ, Northwest Washington, WA. <sup>4</sup>VA Palo Alto/Stanford Univ, Palo Alto, CA.

(No relationships reported)

Body mass index (BMI) has been inversely related to mortality in men from the Veterans Exercise Testing Study (VETS). Whether this “obesity paradox” occurs in women and how this is modified by cardiorespiratory fitness (CRF) has not been fully explored.

**PURPOSE:** To evaluate the relation of CRF and obesity to mortality in women.

**METHODS:** Subjects were 615 female veterans aged 20 to 83 (mean 53±12) years referred for exercise testing for clinical reasons at the Veterans Affairs Medical Centers in Washington D.C. and Palo Alto, CA during 1986-2008. Patients were grouped by BMI (kg/m<sup>2</sup>) according to three predetermined categories: normal weight (18.5-24.9), overweight (25.0-29.9) and obese (>=30.0). CRF was quantified as metabolic equivalents (METs) using final treadmill work rate and was categorized in tertiles. Associations of CRF (unfit - lowest third; fit - upper two-thirds) and BMI category with all-cause mortality were assessed by Kaplan Meier survival analysis and Cox proportional multivariate analysis adjusted for age, presence of diabetes, hypertension, smoking, and cardiovascular disease.

**RESULTS:** During a mean follow-up of 7.1 ± 4.9 years, a total of 55 patients (8.9%) died. Compared to the upper tertile of CRF, hazard ratios (HR) (95% confidence intervals [CI]) were 1.15 (0.47 - 2.80) and 2.31 (1.05 - 5.07) for middle and lowest tertiles, respectively. Survival rates did not differ significantly across BMI categories. In joint analysis, mortality risk was higher only for unfit-normal weight women (HR [95% CI] 4.48 [1.79-11.2]) (figure).

**CONCLUSIONS:** Although BMI was not predictive of mortality in this population of female veterans, our findings indicate that CRF is a more important predictor of outcomes than obesity in women.

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**2021** Board #67 MAY 31 9:00 AM - 10:30 AM

### **Underwater Treadmill Training, Aerobic Fitness, and Leg Strength in Adults with Type 2 Diabetes**

Ryan T. Conners, Christina L. Aquila, Don W. Morgan, FACSM, Jennifer L. Caputo. Middle Tennessee State University, Murfreesboro, TN.

(No relationships reported)

Persons with Type 2 diabetes are often overweight and may experience accompanying health conditions such as diminished cardiovascular health, lower skeletal muscle strength, and osteoarthritis. While aquatic therapy enables endurance and resistance exercise to be performed simultaneously while generating reduced ground reaction forces, relatively little is known concerning the health benefits of water walking in this patient population.

**PURPOSE:** To document cardiovascular and strength adaptations in adults with Type 2 diabetes following an 8-week program of underwater treadmill training (UTT).

**METHODS:** Seven adults with physician-diagnosed Type 2 diabetes (age = 55 ± 8 yrs) completed 8 weeks of UTT. Before and after UTT, measures of seated resting heart rate (Polar heart rate monitor), estimated VO<sub>2max</sub> (single-stage, land-based treadmill protocol), and concentric peak torque of the dominant leg hamstrings and quadriceps at 60°/sec and 90°/sec (Biodex System 3) were obtained. During UTT, participants completed three training sessions per week, with each session featuring three walking bouts separated by 4 to 5 minutes of rest. Starting at a relative intensity of 40% of heart rate reserve (HRR), walking speed was gradually increased so that participants were exercising at 70% of HRR by the end of the training program. Likewise, the duration of each walking bout was systematically increased from 10 to 20 minutes as training progressed. Water height was maintained at 10 cm below the xyphoid process throughout the study.

**RESULTS:** Paired t-tests revealed that resting heart rate was lower (83 ± 14 vs. 75 ± 13 bpm) and estimated VO<sub>2max</sub> was higher (28.8 ± 3.9 vs. 31.0 ± 4.0 ml/kg/min) following UTT (p < .05). Moreover, peak torque of the hamstrings at 60°/sec (58.0 ± 21.0 vs. 67.0 ± 15.2 ft-lbs) and 90°/sec (48.1 ± 19.3 vs. 56.4 ± 13.3 ft-lbs), p < .05) was greater after training.

**CONCLUSION:** Underwater treadmill training featuring progressive increments in walking speed and duration appears to be a safe and effective training modality to improve cardiovascular fitness and leg strength in adults with Type 2 diabetes.

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**2022** Board #68 MAY 31 9:00 AM - 10:30 AM

### **Cardiopulmonary Exercise Testing Predicts Hospital Length of Stay in Patients Undergoing Gastric Bypass Surgery**

Philip J. Hennis<sup>1</sup>, Paula M. Meale<sup>1</sup>, Rachel A. Hurst<sup>2</sup>, Alasdair F. O'Doherty<sup>1</sup>, James M. Otto<sup>1</sup>, Hugh E. Montgomery<sup>1</sup>, Martin Kuper<sup>3</sup>, Nick Harper<sup>3</sup>, Pratik Sufi<sup>3</sup>, Dugal Heath<sup>3</sup>, Michael P. W. Grocott<sup>4</sup>. <sup>1</sup>University College London, London, United Kingdom. <sup>2</sup>University of Hertfordshire, Hertfordshire, United Kingdom.

<sup>3</sup>Whittington Hospital NHS Trust, London, United Kingdom. <sup>4</sup>Southampton University Hospitals NHS Trust, Southampton, United Kingdom.

(No relationships reported)

Exertional peak oxygen consumption (Peak VO<sub>2</sub>) and anaerobic threshold (AT), determined by Cardiopulmonary Exercise Testing (CPET), can identify individuals at increased perioperative risk from non-cardiac surgery. In one study, this appears true for treadmill exercise-derived peak VO<sub>2</sub> in patients undergoing gastric bypass. We sought to confirm these findings, and to extend them to other exercise physiological variables using electronically-braked bicycle ergometry.

**PURPOSE:** To determine whether pre-operative physiological variables derived from CPET are associated with increased postoperative length of stay (LOS) following gastric bypass surgery.

**METHODS:** The study was approved by the hospital's audit department. All patients who completed CPET and underwent elective gastric bypass surgery at the Whittington Hospital NHS Trust between 01/09/09 - 25/02/11 were included in analysis. Subject age, sex, height, weight and Revised Cardiac Risk Index (RCRI) were recorded. From CPET, peak VO<sub>2</sub>, AT, and ventilatory equivalent for CO<sub>2</sub> (VE/VCO<sub>2</sub>) were derived. The primary outcome variables were hospital LOS (LOS) and critical care unit (CCU) LOS. CPET and non-CPET variables were separated according to postoperative LOS duration (LOS ≤ 3 vs LOS > 3, CCU LOS ≤ 1 vs CCU > 1) and compared using independent *t* tests. The capacity of CPET markers to predict LOS was determined using receiver operating characteristic (ROC) curves.

**RESULTS:** 106 patients (mean weight = 126 kg) were included in the study, 83 of whom were admitted to a CCU following surgery. Median LOS was 3 days and median CCU LOS was 1 day. AT was lower in patients with a LOS > 3 days compared to LOS ≤ 3 days (10.4 ± 1.4 vs 11.3 ± 1.8 ml·kg<sup>-1</sup>·min<sup>-1</sup>, P = 0.023). ROC curve analysis identified AT as a significant predictor of LOS > 3 day (AUC 0.640, P = 0.030), with an optimal AT to predict increased LOS of 11.4 ml·kg<sup>-1</sup>·min<sup>-1</sup> (sensitivity = 76%, specificity = 53%). AT was not different between those with a CCU LOS > 1 and those with a CCU LOS ≤ 1 day.

Peak VO<sub>2</sub>, VE/VCO<sub>2</sub>, weight, BMI and RCRI were not different between patients with a LOS ≤ 3 days compared to those with LOS > 3 days or between those with a CCU LOS ≤ 1 day compared to > 1 day.

**CONCLUSION:** In patients undergoing gastric bypass surgery, CPET-derived AT is predictive of prolonged hospital LOS.

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2023 Board #69 MAY 31 9:00 AM - 10:30 AM

**Influence Of Measurement Location Of Visceral Adiposity On Hdl Cholesterol In Obese Japanese Men**

Rina So<sup>1</sup>, Takehiko Tsujimoto<sup>1</sup>, Miki Eto<sup>1</sup>, Tomoaki Matsuo<sup>1</sup>, Hiroyuki Sasai<sup>2</sup>, Kiyoji Tanaka, FACSM<sup>1</sup>. <sup>1</sup>University of Tsukuba, Tsukuba, Japan. <sup>2</sup>National Institutes of Health, Bethesda, MD.

(No relationships reported)

**BACKGROUND:** Obesity accounts for the majority of cases of low HDL cholesterol (HDL-C) levels and accumulation of visceral adipose tissue (VAT) at L4-L5 is frequently associated with a concentration of HDL-C. However, previous studies have indicated that the commonly used L4-L5 image level used to estimate VAT may not be the best level. Furthermore, it seems clear that the L4-L5 image of VAT may not be an appropriate level for assessing obesity-related health risks. Because VAT and HDL-C are important risk factors for cardiovascular disease in obese men, it is necessary to clarify an optimal measurement level of VAT as related to HDL-C.

**PURPOSE:** To determine the best image levels for VAT in relation to HDL-C and changes in their relationships after exercise training.

**METHODS:** Twenty-five middle-aged Japanese obese men (age: 45.0 ± 10.8 yr, BMI: 29.8 ± 4.3 kg/m<sup>2</sup>) participated in a 12-week (3 times/week, 90 min/each) exercise intervention. Body composition, VAT areas, VAT volume, blood samples and VO<sub>2</sub>max were obtained before and after the intervention. VAT areas and volume were determined by continuous T1-weighted abdominal magnetic resonance images from the ninth thoracic vertebra (T9) to the first sacral vertebra (S1) with a 1.5-T system.

**RESULTS:** With -1.8 ± 3.6 kg of significant weight loss, there were significant reductions in VAT (area at L4-L5: -20.6 ± 34.2 cm<sup>2</sup>, volume: -456 ± 557 cm<sup>3</sup>) after the exercise intervention. VO<sub>2</sub>max (7.6 ± 6.6 ml/kg/min) and HDL-C (4.5 ± 6.2 mg/dl) significantly increased. At baseline, VAT areas at 12-17 cm above L4-L5 showed significant correlations with HDL-C (r = 0.41 - 0.44, P < 0.05), while measurement at L4-L5 was not correlated (r = 0.01, P = 0.26). No correlations were found between changes in VAT areas and changes in HDL-C.

**CONCLUSION:** Our data show that measurement level of VAT may have an influence on the association with HDL-C. Measurement position at L4-L5 may not be the best for the prediction of obesity-related health risk. It is unclear if increases in HDL-C are associated with reduction in regional VAT.

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2024 Board #70 MAY 31 9:00 AM - 10:30 AM

**Insulin Pump is Associated With Less Post-exercise Hyperglycemia Than Injected Insulin in Type 1 Diabetes**

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(No relationships reported)

Previous studies have found little or no impact of aerobic exercise training on blood glucose control as measured by hemoglobin A<sub>1c</sub> (HbA<sub>1c</sub>) in people with type 1 diabetes (T1D). This failure to improve metabolic control may be due to frequent occurrence of exercise-associated hypo and hyperglycemia. The vast majority of these studies, however, either did not account for the method of insulin delivery, or were conducted before the use of continuous subcutaneous insulin infusion (CSII) became more frequent among individuals with T1D.

**PURPOSE:** To examine whether the blood glucose response to aerobic exercise differs between T1D individuals using CSII versus those receiving insulin by multiple daily injection (MDI).

**METHODS:** 19 active T1D individuals (10 CSII, 9 MDI) performed 45 minutes of aerobic exercise (either cycling or treadmill running) at 65% of their pre-determined VO<sub>2peak</sub>. Interstitial glucose levels were monitored during and after exercise by continuous glucose monitoring (CGM) in a double-blinded fashion. Data are reported as mean ± SD.

**RESULTS:** HbA<sub>1c</sub> (CSII=7.3±1.1; MDI=7.2±1.2, %), VO<sub>2peak</sub> (CSII=48±8; MDI=46±10, ml·kg<sup>-1</sup>·min<sup>-1</sup>) and pre exercise interstitial glucose (CSII=8.9±2.9; MDI=8.4±3.5, mmol/L) did not differ between groups. Although glucose levels decreased similarly in both groups during exercise (CSII=3.0±2.0; MDI= 3.3±2.7, mmol/L), post-exercise increases in glucose concentration were significantly greater in MDI than in CSII from 90 minutes post-exercise (CSII=0.7±2.5, MDI=2.0±2.2 mmol/L, p=0.037) to 270 minutes post-exercise (CSII=0.8±1.3, MDI=4.9±4.8 mmol/L, p=0.020) resulting in hyperglycemia (interstitial glucose > 10 mmol/L) in 6 out of 9 MDI participants.

**CONCLUSION:** The use of CSII is associated with a lower risk of post-exercise hyperglycemia as compared to MDI in active individuals with T1D. Future exercise intervention strategies in this population should consider insulin delivery methods in their design and analysis.

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2025 Board #71 MAY 31 9:00 AM - 10:30 AM

**Relationship Between Body Composition and Oxygen Uptake Efficiency Slope in Heart Failure Patients**

Kelly Allsup<sup>1</sup>, Alexandra Zavin<sup>1</sup>, Ross Arena, FACSM<sup>2</sup>, Karla Daniels<sup>1</sup>, Samuel Davis<sup>1</sup>, Jacob Joseph<sup>1</sup>, Stewart Lecker<sup>3</sup>, Antonio Lazzari<sup>1</sup>, Daniel E. Forman<sup>1</sup>. <sup>1</sup>VA Boston Healthcare System, Boston, MA. <sup>2</sup>University of New Mexico, Albuquerque, NM. <sup>3</sup>Harvard Medical School, Boston, MA. (Sponsor: Ross Arena, FACSM)

(No relationships reported)

**INTRODUCTION:** Functional capacity is often diminished among patients with chronic heart failure (HF). Differences in body composition may underlie these functional consequences. Standard performance measures for HF patients provide little insight regarding body composition.

**PURPOSE:** To study functional capacity in relation to body composition in HF patients, with particular focus on a novel cardiopulmonary (CPX) index, Oxygen Uptake Efficiency Slope (OUES). We compared CPX indices (OUES, peak oxygen consumption [VO<sub>2</sub>], and ventilatory efficiency [VE/VCO<sub>2</sub>] slope) in HF patients and controls and studied the relative impact of lean vs. fat body tissue.

**METHODS:** 68 male subjects (mean age 66.2±9.7 years), 30 euvolemic, systolic HF patients (LVEF≤40%) and 38 age-matched controls. CPX was used to assess functional capacity. Dual-energy x-ray absorptiometry (DXA) was used to assess body composition (differences in lean and fat mass, and differences in distributions).

**RESULTS:** HF patients had relatively reduced aerobic capacity (Table 1a). Body composition was similar between groups (Table 1b). While peak VO<sub>2</sub> and VE/VCO<sub>2</sub> showed no associations with body composition, OUES showed significant correlations (Table 1c).



Table 1: Results

| Table 1a: Comparison of CPX Variables (expressed as mean±SD)        |            |          |           |          |              |          |
|---|------------|----------|-----------|----------|--------------|----------|
|   | HF         |          | Controls  |          | Significance |          |
| OUES  | 1.7±0.6    |          | 2.3±0.6   |          | p<0.01       |          |
| Peak VO2 (ml/kg/min)  | 15.3±4.3   |          | 23±6.6    |          | p<0.0001     |          |
| VE/VCO2   | 38.1±8.9   |          | 31.3±4.5  |          | p<0.02       |          |
| Table 1b: Comparison of Body Composition (expressed as mean±SD)     |            |          |           |          |              |          |
| Total Lean (kg)   | 54 ±1.0    |          | 56.2 ±7.7 |          | p<0.32       |          |
| Legs Lean (kg)  | 17.8 ±4.0  |          | 19.3 ±3.0 |          | p<0.07       |          |
| Total Fat (kg)  | 29.3 ±17.5 |          | 28 ±9.1   |          | p<0.73       |          |
| Legs Fat (kg)   | 8 ±5.1     |          | 9.7 ±14.0 |          | p<0.51       |          |
| Table 1c: Correlations between OUES, VO2, VE/VCO2 and DXA Variables |            |          |           |          |              |          |
|   | OUES       |          | VO2       |          | VE/VCO2      |          |
|   | HF         | Controls | HF        | Controls | HF           | Controls |
| Total Lean Mass   | 0.63***    | 0.61***  | -0.17     | 0.15     | -0.15        | -0.16    |
| Legs Lean Mass  | 0.65***    | 0.69***  | -0.12     | 0.22     | -0.2         | 0.14     |
| Total Fat   | 0.67***    | 0.19     | -0.19     | -0.23    | -0.22        | 0.01     |
| Legs Fat  | 0.62***    | 0.14     | -0.21     | -0.12    | -0.18        | 0.22     |

R-values are indicated. \* p<0.05, \*\*p<0.01, \*\*\* p<0.001

**CONCLUSION:** OUES enhances CPX assessment as it provides perspective on performance capacity as well as body composition. OUES may better reflect peripheral contributors to functional capacity than standard CPX measures. Further analysis of OUES is warranted as it augments CPX assessment with unique diagnostic and management information.

Sponsored by: Rehabilitation Research and Development, Department of Veterans Affairs F4726R

**2026** Board #72 MAY 31 9:00 AM - 10:30 AM

**Effects of Aerobic Exercise on Serum Sex Hormone Binding Globulin and Metabolic Syndrome Factors in Obese Postmenopausal Women**

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(No relationships reported)

Regular and continuous aerobic exercise is one of the most important nonpharmacologic methods in improving serum lipid concentrations, sex hormone-binding globulin (SHBG), and metabolic syndrome factors.

**PURPOSE:** We investigated the influence of aerobic exercise on SHBG and metabolic syndrome factors in obese postmenopausal Korean women.

**METHODS:** Twenty-six healthy postmenopausal, women aged 53.46 ± 2.74 years and with over 32 % body fat, were randomly assigned to an aerobic exercise group (EX; n = 13) or to a "non-exercise" control (Con; n = 13) group. The variables of body composition, visceral fat area, serum SHBG, lipid profiles, insulin levels, HOMA-IR, and metabolic syndrome factors were measured in all the participants before and after the 16-week study.

**RESULTS:** Post-training body weight and visceral fat area ( $p<0.05$ ), TC, glucose, and insulin levels ( $p<0.01$ ), and HOMA-IR ( $p<0.001$ ) decreased, whereas SHBG ( $p<0.001$ ) and metabolic syndrome factors ( $p<0.01$ ) increased in the exercise group but not in the control group. SHBG levels also showed a significant positive correlation with HDL-C and significant negative correlations with glucose, fat mass, and %BF ( $p<0.05$ ).

**CONCLUSION:** Our findings indicate that aerobic exercise improves body composition, SHBG, insulin levels, and metabolic syndrome factors. These findings suggest that in obese postmenopausal Korean women, 16 weeks of aerobic exercise is effective for preventing the metabolic syndrome caused by obesity.

**2027** Board #73 MAY 31 9:00 AM - 10:30 AM

**The Effect of Different Exercise Intensities on Blood Profiles and Body Composition for Type II Diabetes**

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(No relationships reported)

**PURPOSE:** To investigate the effect of different exercise intensities on blood profiles and body composition for type II diabetes.

**METHODS:** 40 type II diabetes patients (fasting glucose  $\geq 126$  mg/dl or 2-h glucose  $\geq 200$  mg/dl) with overweight (BMI  $> 25$  kg/m<sup>2</sup>) were divided into four groups (control, 40 of HRR; low intensity exercise, 60% of HRR; middle intensity exercise, 80 % of HRR; high intensity exercise group). The exercise groups participated in 60 min exercise program 3times a week for 12 weeks under the exercise director.

**RESULTS:** BMI was significantly decreased in middle and high intensity exercise groups. However, there was no different in control and low intensity exercise group. Waist circumference was significantly decreased in three exercise groups. The % of body fat was only decreased in high intensity exercise group. VO2max was higher in middle and high intensity exercise groups as compared with pre and post exercise program. There was no different in HbA1c. However, middle and high intensity exercise groups improved in HDL-C, TC/HDL-C ratio, triglycerides, fasting glucose, and HOMA-IR. The total cholesterol was significantly decreased in high intensity exercise group.

**CONCLUSION:** Over 60% of HRR intensity exercise may have positive effect on type II diabetes.

**2028** Board #74 MAY 31 9:00 AM - 10:30 AM

**Objectively Quantifying Physical Activity And Sedentary Behavior 10 Years Following Bariatric Surgery**

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(No relationships reported)

Bariatric surgery is currently the preferred treatment for severe obesity. Little is known about long-term physical activity patterns in patients who have had surgery. The purpose of this investigation was to characterize the patterns of physical activity and hours spent sitting in 19 patients who underwent bariatric surgery 10 or more years earlier. ActivPal™ 3-dimensional accelerometers were attached to the patient's upper leg and were instructed to wear the device for 7 consecutive days. Mean steps per day, transitions from sitting to standing and minutes of sitting per day were measured. Patients were also asked to quantify the number of bouts of vigorous exercise performed weekly. At baseline, 72% of the patients were female, weighed 149±25 kg with a BMI of 53±8 kg/m<sup>2</sup>. They had surgery on average 13.3 years earlier and had lost 45.5±24 kg. Patients took on average 6,522±3,139 steps per day, made 53±20 transitions from sitting

to standing per day and spent 16.6±1.8 hours sitting or lying each day. Steps per day or sitting time was not significantly related to weight loss. Patients who reported doing more physical activity than before their surgery lost 61.2±10 kg which was significantly more ( $p<.001$ ) than those whose activity remained the same (32.0±26 kg) or those whose activity is now lower (20.0±21 kg). Only 21% of the participants reported doing three or more bouts of vigorous activity per week and 57% reported doing none. These data suggest that strategies to increase physical activity after bariatric surgery and reduce sitting time are needed for this population.

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2029 Board #75 MAY 31 9:00 AM - 10:30 AM

**Body Composition and Body Fat Distribution are Related With Cardiac Autonomic Control in NAFLD Patients**

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(No relationships reported)

Body composition (BC), particularly central body fat (BF), is a major issue in Non-alcoholic Fatty Liver Disease (NAFLD). Decreased vagal activity is known to be a marker of imbalanced cardiac autonomic control (CAC) and a risk factor for death. It has been shown that BC, as well as BF distribution, are significantly related to CAC. To our knowledge this is the first study to address the relationship between BC or BF distribution and CAC in NAFLD patients.

**PURPOSE:** To determine if, and to what extent, specific markers of BC and BF distribution, are related to CAC, as assessed by heart rate recovery (HRR), in NAFLD patients.

**METHODS:** Total and regional BC were assessed with Dual Energy X-ray Densitometry (DXA) in 25 NAFLD patients (17 males, 50.0 ± 13.2 yrs, and 8 females, 47.2 ± 13.0 yrs), who were diagnosed through liver biopsy or ultrasound, after exclusion of other causes of liver disease. Ratios between specific BF depots were calculated to assess BF distribution. All subjects underwent a maximum graded exercise test (GXT) on a treadmill monitored by 12 lead ECG. HRR was measured as the difference between peak exercise heart rate and the heart rate recorded 1 (HRR1) and 2 minutes (HRR2) immediately after GXT end.

**RESULTS:** Simple linear regressions between BC or BF distribution and HRR showed that Trunk BF and Abdominal BF were the only BF depots significantly correlated with HRR1 ( $r=0.47$  and  $r=0.48$ ; respectively,  $p<0.05$ ). Trunk BF:Limbs BF ratio and Abdominal BF:Total BF ratio were the only BF distribution markers significantly correlated with HRR1 ( $r=0.70$  and  $r=0.47$ ;  $p<0.001$  and  $p<0.05$ ; respectively). Only Trunk BF:Limbs BF ratio was related with HRR2 ( $r=0.74$ ;  $p<0.001$ ). Total BF, as well as all fat free mass variables, was not correlated with HRR1 or HRR2. Step-wise multiple regressions with all BC and fat distribution markers, as independent variables to predict HRR1 and HRR2, displayed only one model for each dependent variable, using solely trunk BF:Limbs BF ratio as predictor for both HRR1 and HRR2.

**CONCLUSIONS:** Body fat distribution, more than body composition, seems to be related to CAC as assessed by HRR in NAFLD patients. Trunk BF:Limbs BF ratio was the best predictor of both HRR1 and HRR2 and may be a useful indicator in clinical setting.

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2030 Board #76 MAY 31 9:00 AM - 10:30 AM

**Improving Body Composition With Taiji Quan: Differences Between Beginners And Experienced Post Menopausal Women.**

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(No relationships reported)

**INTRODUCTION:** The physiological aging process leads to a loss of physical function. In women, aging, and especially the transition of menopause, leads to changes in the hormonal profile that generate body composition changes, more specifically an increased body weight, abdominal fat accumulation and decreased skeletal muscle mass and bone density. The feasibility and accessibility of Taiji training, as well as its beneficial health benefits recently attracted some attention in the scientific community. However, this new type of physical activity intervention still needs to be explored. Indeed, Taiji training has shown to be effective in improving health status in beginners, but we don't know to what extend this activity benefits to experienced individuals.

**OBJECTIVES:** Therefore, the aim of the present study was to investigate the effectiveness of a 12 weeks intervention in Taiji according to the participant's experience (beginners vs. experienced) on functional capacity and body composition.

**METHODS:** Sixty-two postmenopausal women were recruited and divided in two groups (beginners (BE) and intermediates (EX) in Taiji practice). Body composition and functional capacity were measured pre and post intervention.

**RESULTS:** Significant improvements were observed in the chair test score for both groups (BE:  $p<0.001$ ; EX:  $p=0.003$ ) and the perception of fatigue (BE:  $p=0.002$ ; EX:  $p=0.03$ ). Only the EX group showed a statistically significant improvement for the stair test ( $p=0.004$ ). Only the BE group demonstrated significant strength increases (Kincom;  $p=0.02$ ). Finally, we observed a significant decrease in BMI ( $p=0.03$ ) and waist circumference ( $p=0.007$ ) for the EX group.

**CONCLUSION:** Taiji training seems to be effective in improving body composition and functional capacity in postmenopausal women. Even if it is a soft method, and in spite of past experience in this practice, Taiji interventions still may lead to improvements in functional capacity and body composition. Therefore, it could be considered as an avenue in sports medicine for postmenopausal women in order to accomplish a successful aging.

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2031 Board #77 MAY 31 9:00 AM - 10:30 AM

**Low Back Strength Adversely Affects Exercise Capacity in Obese, Older Adults with Chronic Back Pain**

Heather K. Vincent, Amanda N. Seay, Kevin R. Vincent, Cindy Montero, Bryan P. Conrad, Robert W. Hurley. *University of Florida, Gainesville, FL.*  
(No relationships reported)

Obese adults benefit from participation in regular exercise for weight loss and improved health. In older persons with chronic low back pain, however, avoidance of exercise may induce lumbar muscle weakness and subsequent lower exercise capacity.

**PURPOSE:** To determine the contribution of lumbar strength on maximal and functional exercise tolerance and physical function in obese older adults with chronic low back pain.

**METHODS:** Obese men and women ( $N=52$ ; 67±11 yrs, 65% women, body mass index [BMI] 32.2 ± 4.7 kg/m<sup>2</sup>) completed graded walking endurance treadmill tests, chair rise and stair climb tests and maximal strength testing of the lumbar muscles (MedX®, lumbar extension). Pain severity was assessed using a 0-10 numerical pain rating scale (NRS-pain) at rest and during each test. Fear of movement may impair exercise ability, and was measured with the Tampa Scale of Kinesiophobia (TSK). Hierarchical regression analysis was performed to determine the contribution of lumbar strength values on maximal and functional exercise capacity. In three separate models, treadmill endurance time, chair rise time and stair climb times were the dependent variables.

**RESULTS:** Mean back pain was 4.7±1.9 points, and lumbar extension strength was 199±115 Nm. Average endurance test time was 12.7±4.3 min, and chair rise and stair climb times averaged 1.1±0.5 sec and 5.9±2.2 sec, respectively. TSK scores averaged 23.4±6.5 points (range 13-40). After accounting for age, sex, BMI, pain and TSK scores, lumbar strength was a significant contributor to the variance in the model of walking endurance time (model  $R^2=0.501$ ,  $R^2$  change .091) but not chair rise or stair climb.

**CONCLUSION:** Lumbar strength appears more important for walking endurance than some specific functional exercise. Targeted lumbar exercise for strength improvement may facilitate longer participation in walking exercise, which is a critical component in weight loss and management in the obese older adult.

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**2032** Board #78 MAY 31 9:00 AM - 10:30 AM  
**Relationships Between Physical Function, BMI, Fitness, And Activity Behaviors In An Obese Pediatric Clinic**

Renee Privette, Gary D. Miller, Sherry Frino, Joseph A. Skelton. *Wake Forest University, Winston Salem, NC.*  
(No relationships reported)

Recent data show that 16.9% of U.S. children and adolescents are obese and 32% are either overweight or obese. An often overlooked comorbidity of obesity is impairments in physical function and physical fitness. This has been targeted in older adults, but the implications of obesity on measures of fitness and function in children and adolescents have not been well described.

**PURPOSE:** This study examined correlates of physical function in overweight and obese patients attending a pediatric obesity clinic (Brenner FIT (Families in Training)). **METHODS:** 279 children (aged 2- 18) from the Brenner's FIT obesity management clinic were assessed for physical function, physical fitness, and activity behaviors by a physical therapist. Function and fitness measures included the 6-minute walk distance (6MWD), sit-up and pushup tests, hamstring flexibility and a balance test. Screen time hours and involvement in organized physical activity were self-reported. Spearman correlations and linear and logistic regression analyses examined relationships between the independent variables [BMI and behaviors (participation in organized physical activity and screen time)] with physical function and fitness variables.

**RESULTS:** As BMI z-score increased, physical function significantly decreased across all measured variables. Also, participation in organized sports was related to increased 6MWD. Males had lower flexibility than females and older children had worse balance and flexibility than younger children. Screen time was associated with both 6MWD and hamstring flexibility. Using linear regression, BMI z-score had the strongest association with 6MWD ( $R^2$  change of 0.30). From logistic regression, BMI z-score was significantly associated with balance with an odds ratio of 4.86, such that for each unit increase in BMI z-score there is nearly a 5 fold increase in risk for an abnormal balance assessment.

**CONCLUSIONS:** These data show that obesity and low amounts of participation in organized physical activity and high amounts of sedentary behaviors negatively impacts physical function in obese children. These findings highlight factors pediatric weight management interventions should target to maximize patient improvements in mobility disability.

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**2033** Board #79 MAY 31 9:00 AM - 10:30 AM  
**Comparison of Exercise Test Responses Among Executives with and without Metabolic Syndrome**

Kirk D. Hendrickson, Allison Poremba, Barry Franklin, FACSM, Judith Boura, Joseph James, Lewis Rosenbaum. *William Beaumont Hospital, Royal Oak, MI.*  
(No relationships reported)

**BACKGROUND:** Executive physical exams are widely performed to screen for chronic diseases in asymptomatic individuals, including metabolic syndrome (MS). Individuals with MS have a 1.5 to 3-fold increased risk for developing coronary disease or stroke. This distinguishes the MS as a unique marker for increased cardiovascular risk, highlighting the need for aggressive risk factor reduction and treatment.

**PURPOSE:** To identify the incidence of MS in asymptomatic individuals undergoing executive physical examinations and to compare the exercise test responses among those with and without MS.

**METHODS:** We evaluated 299 asymptomatic executives (80.5% men, mean  $\pm$  SD age =  $53 \pm 6$  years) who underwent yearly physical examinations that included anthropometric measurements, peak or symptom-limited exercise testing, and blood chemistry studies to determine the incidence of persons who exhibited  $\geq 3$  risk factors for MS, including abdominal obesity, elevated triglycerides, low HDL-cholesterol, elevated blood pressure, and increased fasting glucose. Baseline evaluations included body mass index (BMI), waist circumference, resting and maximal heart rate, peak metabolic equivalents (METs), Duke treadmill score and heart rate recovery. Participants were divided into 2 groups based on presence or absence of MS.

**RESULTS:** Of 299 asymptomatic individuals, 7.4% were classified as having MS. The mean  $\pm$  SD age of individuals with ( $n = 22$ ) and without MS ( $n = 277$ ),  $54 \pm 6$  vs  $52 \pm 5$  years, was not significantly different. The cohort with MS had a significantly higher weight ( $104 \pm 6.4$  vs  $83 \pm 14$  kg;  $P < 0.0001$ ) and BMI ( $31.4 \pm 4.9$  vs  $26.4 \pm 3.3$  kg/m<sup>2</sup>;  $P < 0.0001$ ), and lower aerobic capacity ( $10.8 \pm 1.9$  vs  $12.5 \pm 2.1$  METs;  $P = 0.0003$ ), Duke treadmill score ( $10 \pm 2.4$  vs  $12 \pm 3.2$ ;  $P = 0.003$ ) and peak heart rate ( $158 \pm 12$  vs  $165 \pm 13$  bpm;  $P = 0.007$ ) than the group without MS. The incidence of arrhythmias and ischemic ST-segment depression between groups was not significantly different.

**CONCLUSION:** The present findings suggest that executives with MS were more likely to be overweight/obese, lower fit individuals with lower Duke treadmill scores and peak heart rates than their counterparts without MS. These data highlight the potential value of weight management and exercise interventions to prevent and treat MS.

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**2034** Board #80 MAY 31 9:00 AM - 10:30 AM  
**Effect Of Yoga On Anxiety, Psychological Stress, And Cortisol Of Type 2 Diabetes Mellitus Patients**

Maricarmen Vizcaino, George A. King. *University of Texas at El Paso, El Paso, TX.*  
(No relationships reported)

The prevalence of anxiety and its subsequent implications on quality of life have been previously documented among individuals with Type 2 diabetes mellitus (T2DM). In addition, evidence suggests that psychological stress negatively impacts glycemic control, possibly through the disruption of adequate self-care behavior or directly altering metabolism by inducing chronic elevations of circulating cortisol levels. Yoga practice has been shown to reduce symptoms of stress and anxiety in a variety of populations; however, information on the effect of yoga among individuals with T2DM is limited.

**PURPOSE:** To investigate the effect of yoga practice on anxiety, psychological stress, and cortisol levels of T2DM patients.

**METHODS:** Ten non-insulin dependent diabetes mellitus patients (mean  $\pm$  SD age:  $61.4 \pm 6.7$  y; BMI:  $36.3 \pm 7.6$  kg/m<sup>2</sup>; years since diagnosis:  $6.1 \pm 6.3$  y) underwent a systematic 6-week yoga program (3d/week) with a registered yoga teacher. Psychological stress was assessed with the perceived stress scale (PSS) and anxiety with the State-Trait Anxiety Inventory (STAI). Physiological stress was estimated by salivary cortisol content at midnight. All data were obtained at baseline and post-intervention. A one-way within-subjects ANOVA model with Bonferroni adjusted post hoc analyses was used to analyze the yoga effect on psychological measures. Due to non-normality, changes in cortisol were assessed with the Wilcoxon Signed Rank Test.

**RESULTS:** Perceived stress scores ( $22.8 \pm 8.0$  vs.  $17.5 \pm 7.1$ ,  $P = 0.03$ ), state anxiety scores ( $39.8 \pm 13.3$  vs.  $29.2 \pm 8.6$ ,  $P = 0.01$ ), and salivary cortisol values ( $6.9 \pm 7.7$  vs.  $2.8 \pm 1.7$  nmol/L,  $P = 0.04$ ) significantly decreased following the intervention. Trait anxiety scores ( $36.8 \pm 11.2$  vs.  $31.1 \pm 8.1$ ,  $P = 0.09$ ) improved, but the change was non-significant.

**CONCLUSION:** Yoga practice appears to be an effective alternative therapy to reduce symptoms of anxiety and psychological stress among T2DM patients. The observed decrease in circulating cortisol levels likely resulted from the positive impact of yoga on stress and anxiety. Further studies are needed to determine the impact of cortisol reductions in glucose metabolism of T2DM and subsequent glycemic control.

This study was partially supported by: TACSM, UTEP CHS Graduate Enhancement Funds, and UTEP Graduate School.

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**2035** Board #81 MAY 31 9:00 AM - 10:30 AM  
**Influence of Individual Metabolic Conditions on the Metabolic Syndrome in Southern Women**

L. Jerome Brandon, FACSM<sup>1</sup>, Larry Proctor<sup>2</sup>. <sup>1</sup>Georgia State University, Atlanta, GA. <sup>2</sup>B.E.A.M., LLC, Ruston, LA.  
(No relationships reported)

The metabolic syndrome (MetS) is the clustering of three metabolic conditions (elevated glucose, blood pressure, triglyceride and body fat (%fat), and depressed HDL-C) and is used to predict the development of cardiovascular disease (CVD).

**PURPOSE:** The purpose of this study was to determine if an abnormal level of each MetS conditions would be associated with similar levels of clustering with the other MetS conditions in obese southern women.

**METHODS:** One-hundred and thirteen obese southern women between the ages of 20 and 65 years participated in this hospital based study. All women were measured for blood pressure (BP), cholesterol (total (TC), HDL-C and LDL-C), triglyceride (TG), body mass index (BMI) percent %fat, waist circumference and glucose (Glu). Metabolic risk levels (example SBP  $\geq$  140 mmHg) of each condition were used to select subsamples and the subsamples were evaluated for abnormal values and subsequently MetS clustering. Analyses were completed using descriptive statistics and correlations.

**RESULTS:** The women were obese as their %fat was  $40.6 \pm 8.7\%$  and their BMI was  $31.2 \pm 7.8$  kg/m<sup>2</sup> and obesity was the only risk condition.

When risk values of each MetS condition were used for subsample

selection and the subsample was evaluated for MetS, only when Glu ( $\geq$  110 mg/dL) was the reference did the subsample have MetS (%fat 44.8; Glu 122.4; TG 206.0; HDL-C 41.5). No subsample for the other conditions had more than two abnormal MetS conditions and one of those was obesity.

**CONCLUSIONS:** These findings suggests that elevated glucose or insulin resistance is a more severe MetS condition as it is more likely to be clustered with two or more MetS conditions in southern women. This may partially explain why those living in the southern parts of the US are reported to have a higher prevalence of CVD.

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**2036** Board #82 MAY 31 9:00 AM - 10:30 AM

**Impairment of Skeletal Muscle Oxidative Metabolism during Knee-Extension Exercise in Severely Obese Women**

Stefano Lazzar<sup>1</sup>, Desy Salvadego<sup>1</sup>, Simone Porcelli<sup>2</sup>, Enrico Rejc<sup>1</sup>, Carlo Busti<sup>3</sup>, Raffaella Galli<sup>3</sup>, Fiorenza Agosti<sup>3</sup>, Alessandro Sartorio<sup>3</sup>, Bruno Grassi<sup>1</sup>. <sup>1</sup>University of Udine, Udine, Italy. <sup>2</sup>National Research Council, Segrate (MI), Italy. <sup>3</sup>Italian Institute for Auxology, IRCCS, Piacavallo (VB), Italy.

(No relationships reported)

**PURPOSE:** During dynamic knee extension exercise the recruitment of a relatively small muscle mass, i.e. the *quadriceps femoris* of one leg, significantly reduces constraints to oxidative function deriving from cardiovascular O<sub>2</sub> delivery. We hypothesized, in a group of severely obese women (OB), a significant impairment of oxidative metabolism during KE, lending support to the role of skeletal muscles in limiting exercise tolerance in OB.

**METHODS:** 11 OB (age  $29.5 \pm 5.5$  yr, body mass  $112.9 \pm 17.7$  kg and body mass index  $43.2 \pm 5.4$  kg·m<sup>-2</sup>) and 10 non-obese (NOB) women were tested. Fat free mass (FFM) of a lower limb was assessed by a densitometer. Heart rate (HR) and O<sub>2</sub> uptake (VO<sub>2</sub>) were determined during an incremental exercise test to voluntary exhaustion on a custom-built KE ergometer.

**RESULTS:** Maximal isometric force of KE muscles was higher ( $p < 0.05$ ) in OB ( $522.3 \pm 149.4$  N) vs. NOB ( $357.2 \pm 66.9$  N). Peak HR was  $125 \pm 4$  b·min<sup>-1</sup> in OB and  $141.9 \pm 7.7$  b·min<sup>-1</sup> in NOB ( $p = 0.291$ ). Peak VO<sub>2</sub> normalized per unit of lower limb FFM was lower ( $p < 0.001$ ) in OB ( $99.2 \pm 3.7$  mL·min<sup>-1</sup>·kg<sup>-1</sup> FFM) vs. NOB ( $144.5 \pm 10.9$  mL·min<sup>-1</sup>·kg<sup>-1</sup> FFM), whereas peak work rate values were not different ( $p = 1.000$ ) in the two groups ( $24.0 \pm 3.1$  W in OB vs.  $25.0 \pm 2.0$  W in NOB). The slope of the VO<sub>2</sub>·FFM<sup>-1</sup> vs. work rate relationship was lower ( $p < 0.001$ ) in OB ( $2.09$  mL·min<sup>-1</sup>·kg<sup>-1</sup>·FFM·watt<sup>-1</sup>) vs. NOB ( $4.34$  mL·min<sup>-1</sup>·kg<sup>-1</sup>·FFM·watt<sup>-1</sup>).

**CONCLUSIONS:** After eliminating or significantly reducing, by the adopted KE exercise protocol, constraints related to cardiovascular O<sub>2</sub> delivery, skeletal muscle oxidative function at peak exercise was impaired in OB. On the other hand, at submaximal work rates an increased efficiency of contractions was observed in OB, which could be related to their higher maximal force, possibly deriving from the chronic "strength training" associated with the excessive body mass bearing.

Supported by Italian Institute for Auxology (Milan).

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**2037** Board #83 MAY 31 9:00 AM - 10:30 AM

**Effect Of A Structured Exercise Program On Attitudes Toward Exercise In Post-bariatric Surgery Patients**

Paul G. Davis, FACSM<sup>1</sup>, Diane L. Gill<sup>1</sup>, Jeaneane C. Wilson<sup>2</sup>, Cody L. Sipe<sup>1</sup>, Maggie L. Roe<sup>1</sup>, Nicholas W. Justus<sup>1</sup>, Ryan W. Lepper<sup>1</sup>. <sup>1</sup>The University of North Carolina at Greensboro, Greensboro, NC. <sup>2</sup>Cone Health, Greensboro, NC.

(No relationships reported)

**PURPOSE:** Although exercise is generally advocated to assist patients with weight maintenance after bariatric surgery, little research on exercise adherence has been performed in this population. The purpose of this study was to examine the effects of a structured exercise program on factors related to exercise adherence in persons having undergone bariatric surgery.

**METHODS:** Eleven women (n=9) and men (n=2) (age:  $43 \pm 3$  y, BMI:  $38 \pm 2$  kg/m<sup>2</sup>; mean $\pm$ SE) having bariatric surgery in the past 6 weeks to 6 months were randomized to a 12-week group exercise program or a "usual care" (i.e., exercise encouraged with no formal instruction) wait list control group. The exercise program included three 1-hour exercise sessions per week (endurance and resistance exercise) and biweekly educational sessions (exercise, diet, and behavior change strategies). Participants completed a physical activity (PA) enjoyment Likert scale (1="I enjoy it", 5="I hate it") and a self-efficacy for exercise scale [possible scores range from 0 (lower self-efficacy) to 90 (higher self-efficacy)] at 0, 6, and 12 weeks. Since this was a pilot study, alpha was set at 0.10. Large effect sizes were defined by a partial eta squared ( $\eta^2$ )  $> 0.140$ .

**RESULTS:** Age was related to lack of PA enjoyment at baseline ( $r = 0.807$ ,  $p = 0.003$ ). A 2 (treatment) x 3 (time) ANCOVA with age entered as the covariate showed a significant time effect ( $p = 0.007$ ,  $\eta^2 = 0.463$ ) for PA enjoyment (Control - Pre:  $3.5 \pm 0.5$ , Mid:  $2.5 \pm 0.8$ , Post:  $2.6 \pm 0.5$ ; Exercise - Pre:  $3.9 \pm 0.4$ , Mid:  $3.4 \pm 0.7$ , Post:  $2.0 \pm 0.5$ ) with slightly greater improvement in the exercise group ( $p = N.S.$ ,  $\eta^2 = 0.183$ ). ANOVA showed a significant treatment x time effect ( $p = 0.096$ ,  $\eta^2 = 0.248$ ) for self-efficacy (Control - Pre:  $74 \pm 6$ , Mid:  $68 \pm 8$ , Post:  $69 \pm 8$ ; Exercise - Pre:  $49 \pm 6$ , Mid:  $54 \pm 7$ , Post:  $66 \pm 7$ ).

**CONCLUSIONS:** Results from this pilot study indicate that a 12-week structured exercise program may lead to enhanced physical activity enjoyment and exercise self-efficacy in patients recently having undergone bariatric surgery. Follow-up research is needed to determine if such changes can lead to longer-term physical activity adherence in this population.

Funded by a Regular Faculty Grant from UNC-Greensboro.

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**2038** Board #84 MAY 31 9:00 AM - 10:30 AM

**Reliability of Paired Reflex Depression Protocol for Assessing Presynaptic Inhibition in Diabetic Neuropathy Patients**

Shannon J. Palmer, Junggi Hong, Willamette University, Salem, OR. (Sponsor: Peter Harmer, FACSM, FACSM)

(No relationships reported)

Considerable progress has been made in understanding the role of inhibitory systems in neurological conditions. While evidence suggests that presynaptic inhibition (PI) may be impaired under neuropathic conditions as a result of disinhibition in the spinal dorsal horn, no study has yet investigated the characteristics of spinal inhibition in diabetic peripheral neuropathy (DPN) patients. Paired reflex depression (PRD) is a protocol used to evaluate homosynaptic reflex activity at the spinal dorsal horn.

**PURPOSE:** To assess the intra- and inter-day reliability of the PRD protocol in assessing PI of DPN patients.

**METHODS:** Eight participants ( $58 \pm 6$  yrs.) diagnosed with either type I or II diabetes and peripheral neuropathy were recruited for the study. PRD values were derived from the average change of the second H-reflex relative to the first following stimulation of the posterior tibial nerve. For the intra-day reliability, PRD was measured an hour after baseline assessment. For the inter-day reliability, PRD was measured 2 weeks after the first day of testing. A total of 10 trials per session were recorded. Reliability was calculated via Intra Class Correlation Coefficients (ICCs) with a 95% confidence interval.

**RESULTS:** The ICCs for intra- and inter-day reliability were 0.94 and 0.88, respectively.

**CONCLUSION:** The PRD protocol with the posterior tibial nerve of DPN patients was reliable within and between days. The demonstrated reliability of the PRD protocol observed in the study will assist researchers in clinical intervention studies investigating the efficacy of various treatments for diabetic neuropathy patients.

2039 Board #85 MAY 31 9:00 AM - 10:30 AM

### Effect Of Aerobic Exercise On Protein Expression In Muscle Of Overweight Adolescents

Maciste H. Macias Cervantes, Francisco J. Diaz, Victoriano Perez-Vazquez, Katya Vargas-Ortiz, Juan M. Guazman-Flores. *Universidad de Guanajuato, Leon, Mexico.*  
(No relationships reported)

**PURPOSE:** To increase the cellular understanding of the molecular mechanisms that underlie the aerobic training and obesity in adolescents by proteomic analysis of skeletal muscle from obese adolescents.

**METHODS:** participated 4 sedentary, obese male adolescents (16years, BMI= 33.81Kg/M<sup>2</sup>). Previously the participants and their parents signed informed consent. All participants developed a treadmill stress test according Blake protocol, after them they engaged in 12 weeks of aerobic training (50min/3 times per week). Before and after training we taken a *vastus lateralis* muscle sample by needle biopsy, the specimen were put into a buffer with protease inhibitor and quickly frozen until the proteomic analysis. 2D-PAGE were stained with silver and spots with changes expression after training were compared with different data base to proteins identify.

**RESULTS:** clinical characteristics are shown in table 1. All participants decreased glucose, insulin, total cholesterol, BMI and waist circumference(p< 0.05 for all). Proteomic differential analysis revealed 9 overexpressed proteins after training, which corresponds to carbonic anhydrase III, beta enolase, creatine kinase, ATP synthase beta subunit, Aldolase A, Glyceraldehyde-3-phosphate dehydrogenase, triosephosphate isomerase, piruvate kinase and adenylate kinase.

**CONCLUSIONS:** These proteomic findings suggest that obese adolescent changes their BMI, waist circumference and serum glucose after aerobic training trough to improve protein expression pattern helping especially glucose metabolism.

This research was supported by: CONCYTEG 08-16k662-130 and PROMEP/103.5/08/3252.

|                           | baseline | final |
|---------------------------|----------|-------|
| Age (years)               | 16.1     | 16.3  |
| Weight (Kg)               | 98.6     | 94.4  |
| BMI (Kg/M)                | 33.8     | 32.4  |
| body fat (%)              | 25.9     | 25.0  |
| Glucose (mg/dl)           | 101      | 82.4  |
| Total Cholesterol (mg/dl) | 152      | 138   |
| HDL-C (mg/dl)             | 36.7     | 32.4  |
| LDL (mg/dl)               | 78       | 87    |
| Insulin (microUI/dl)      | 59.8     | 33.5  |
| waist circumference (cm)  | 111.5    | 103.3 |

2040 Board #86 MAY 31 9:00 AM - 10:30 AM

### Weight Management, Weight Loss and Bariatric Care: A Curricular Approach Model to Therapeutic Exercise

Laura A. Richardson, Judith A. Juvancic-Heltzel. *The University of Akron, Akron, OH.* (Sponsor: Ellen L. Glickman, FACSM)  
(No relationships reported)

**BACKGROUND:** The importance of implementing effective therapeutic exercise to clients/patients of size has never been more important. Body Mass Index rates nationwide, and across the lifespan, continue to rise. Review of literature is weak in this field. It is evident that caloric expenditure via exercise is a cornerstone but little research identifies specific guidelines, theories, and strategies that should be used with this population. It is paramount that the body of knowledge, guidelines, and resources be expanded. Numerous textbooks were reviewed and none adopted due to the scope of materials not meeting needs of exercise science students. A significant gap exists between current texts and the targeted clinician audience.

**PURPOSE:** To develop an exercise science curriculum to address the use of exercise as a therapeutic tool in the scope of weight management, weight loss, and bariatric care.

**METHODS:** A course was developed which included current literature and clinical guidelines regarding weight management, weight loss and bariatric care. The teaching model was created using course modules encompassing: Evolution & Prevalence of Obesity, Classification of Morbidity & Mortality, Pathophysiology of Excess Fat, Fat Metabolism, Assessment of the Obese Client, Exercise Prescription, Obesity Treatment, Genetic Influences on Obesity, Sleep and Weight Management. Modules are formatted to include basic definitions, history, application, clinical examples and questions related to each of the topics. Each semester the course is offered, content is reviewed and revised to reflect new findings.

**RESULTS:** Feedback from students has been positive. The curriculum has developed a greater awareness and confidence of future clinicians in the application of using exercise as one of the cornerstone therapeutic tools for this clinical population.

**CONCLUSION:** It is imperative that future exercise science professionals possess the knowledge, skills and abilities to implement current evidence based practices in treating this ever growing population. Future directions of the curriculum will add service learning to include students working with patients at a local bariatric center. Direct interactions with this population would enhance the application of the curricular content.

2041 Board #87 MAY 31 9:00 AM - 10:30 AM

### Effects of Whole Body Vibration on Pain, Hemodynamics and Nerve Conduction in Diabetic Peripheral Neuropathy

Nathan J. Kessler, Michael M. Lockard, Junggi Hong. *Willamette University, Salem, OR.* (Sponsor: Peter Harner, FACSM)  
(No relationships reported)

**BACKGROUND:** Whole Body Vibration (WBV) is an innovative therapy that preliminary research has indicated may be effective for reducing chronic pain associated with diabetic peripheral neuropathy (DPN), although no mechanism has been identified. Decreased blood flow has been cited as a risk factor for impaired nerve conduction which may be related to pain associated with DPN. Conditioning research has indicated that WBV facilitates blood flow to the leg. Therefore decreased DPN-associated pain may be related to maintaining nerve function through enhancing blood flow.

**PURPOSE:** To test the efficacy of WBV on pain associated with DPN, blood flow and nerve conduction velocity in the diabetic foot.

**METHODS:** 20 subjects (9 male, 11 female) with a mean age of 58.51± 10.69 yrs and a mean BMI of 33.60±8.20 kg/m<sup>2</sup> were assigned to a control (n=8) or treatment (n=12) group in a pre-post design. Pain was assessed with a 10 point visual analog pain scale (VAS). Motor nerve conduction velocity (MNCV) was measured at the posterior tibial nerve via electromyography using a surface stimulator probe. Blood flow in the foot was assessed via the toe-brachial index (TBI), which compares systolic pressure in the brachial artery and the great toe. Treatment consisted of six vibration sessions over two weeks. Each session consisted of 12 minutes of vibration (4 bouts of 3 minutes). The control protocol was identical but with sham vibration. All variables were analyzed with a 2 (group) x 2 (time) repeated measure ANOVA, alpha 0.05.

**RESULTS:** VAS scores of the treatment group decreased significantly pre-post ( p=0.001; 2.7±1.7 to 1.6 ±1.0) and were significantly different from control at post testing (p= 0.028). No significant differences were found for TBI or MNCV (p> 0.05)

**CONCLUSION:** WBV is effective for reducing DPN-associated pain. However, the reductions were not associated with changes in peripheral blood flow or in motor nerve conduction velocity as measured in this study. This indicates that the mechanism responsible for DPN-associated pain relief associated with WBV does not appear to involve changes in blood flow or motor nerve conduction to the foot.

Supported by: The Willamette University Center for Sustainability Fred Wert Collaborative Research for Sustainability Grant.

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2042 Board #88 MAY 31 9:00 AM - 10:30 AM

**Influence Of Objectively Measured Physical Activity On Change In Fitness In A Weight Loss Intervention**

Renee J. Rogers<sup>1</sup>, Kelli K. Davis<sup>1</sup>, Deborah F. Tate<sup>2</sup>, Kristen Polzien<sup>2</sup>, John M. Jakicic, FACSM<sup>1</sup>. <sup>1</sup>University of Pittsburgh, Pittsburgh, PA. <sup>2</sup>University of North Carolina-Chapel Hill, Chapel Hill, NC.  
(No relationships reported)

Moderate-to-vigorous physical activity (MVPA) accumulating to at least 1,000 kcal/wk or 150 min/wk is recommended to improve fitness in adults, and activity should be accumulated in bouts of at least 10 minutes. However, little is known about the contribution of shorter duration MVPA or lower intensity activity on change in fitness.

**PURPOSE:** To examine the pattern and intensity of objectively measured physical activity on change in fitness in obese adults across a behavioral weight loss intervention (BWL).

**METHODS:** Subjects were 216 adults (age: 42.8±9.2, BMI: 32.6±3.6 kg/m<sup>2</sup>) participating in an 18-month BWL. BWL includes prescription to decrease energy intake to 1200-1500 kcal/d, and increase PA to 300 min/wk. PA and fitness were assessed at 0, 6, and 18 months. PA was assessed objectively using an armband that provided minute-by-minute data for a period of 7 days (SenseWear Pro Armband™, BodyMedia, Inc). Fitness was assessed using a graded exercise test, with fitness defined as time to achieve 85% of age-predicted maximal heart rate (85%HRmax). MVPA was defined as bouts that were ≥10 minutes in duration and ≥3.0 METS. MVPA was also defined as total minutes ≥3.0 METS regardless of length of bout (MVPA-MIN). LPA was defined as minutes of activity between 1.5 to 2.9 METS.

**RESULTS:** Change in time to achieve 85%HRMAX from 0 to 6 months was correlated with MVPA-MIN (r=.29, p<.001) and MVPA (r=.36, p<.001), with LPA was not associated (r=.07). In regression analysis, MVPA was a significant predictor (β=.517, t=3.504, p=.001) of change in time to 85%HRmax, whereas neither MVPA-MIN nor LPA were not. At 18 months, change in time to 85%HRmax was correlated with LPA (r=.203, p=.003), MVPA-MIN (r=.374, p<.001) and MVPA (r=.426, p<.001). In regression analysis both MVPA (β=.604, t=4.078, p<.001) and LPA (β=.185, t=2.625, p=.009) were significant predictors of changes in time to 85%HRmax.

**CONCLUSIONS:** During the initial 6 months of BWL, total MVPA performed in bouts of at least 10 min in duration is associated with improvement in fitness. However, both MVPA and LPA contribute to improvement in fitness observed at 18 months. These findings suggest that need for BWL to include strategies to improve participation in both MVPA and LPA for overweight and obese adults.

Supported by the National Institutes of Health (HL008840)

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**C-28 Free Communication/Poster - Correlates of Exercise and Physical Activity**

MAY 31, 2012 7:30 AM - 12:30 PM

ROOM: Exhibit Hall

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2043 Board #89 MAY 31 8:00 AM - 9:30 AM

**The Relationship Exercise Habits And Sleep In The Person Who Underwent The Health Checkup**

Yoshinori Kitabatake, Toshiya Nagamatsu, Tsutomu Kuchiki, Yasuo Suyama. *Meiji Yasuda Life Foundation of Health and Welfare, Shinjuku-ku, Tokyo, Japan.*  
(No relationships reported)

Recent reports produced in Europe and the United States show that physical activity may improve quality of sleep, especially sleep disorders such as insomnia. Exercise, however, has not yet met established efficacy standards although some studies have shown improvements in sleep disorders with exercise. In Japan, there is a lack of evidence regarding the effects of exercise on sleep disorder and insomnia. We need data examining whether physical exercise improves sleep disorders. The number of people suffering depression has increased in Japan and previous studies have reported that insomnia is considered to be a risk factor leading to depression. We hypothesize that physical exercise improves sleep quality and reduces sleep complaints.

**PURPOSE:** To explore the relationship between physical exercise habits and sleep patterns in people who underwent a health checkup.

**METHODS:** This study was cross-sectional with 15,590 subjects (male n= 8314, mean age 49 years, female n=7276, 47 years), all of whom underwent a medical checkup. The following information regarding exercise habits was gathered via a questionnaire: exercise timing, intensity, length, and frequency. The question, "Can you get rest by sleep?" was asked (Yes=1 or no=0). The subjects were asked about their smoking and drinking habits, and the number of meals eaten per day. Height and weight were also measured. To examine the association between exercise habits as the independent variable and status of sleep as the dependent variable, odds ratios (ORs) and 95% CIs were calculated using multilevel logistic regression analysis (Covariate: age, BMI, smoking, drinking and the number of times of a meal).

**RESULTS:** The exercise habit shows 70.1 in male and 64.4 % in female. The subjects who are satisfied with sleep were 75.3% in male and 79.0% in female. The exercise habit was related to satisfaction with sleep. Odds ratios (95% CI) were 1.66 (1.47-1.86) in male and 1.48 (1.31-1.66) in female.

**CONCLUSIONS:** These results suggest that exercise may be effective in producing sound sleep. We further posit that exercise may prevent depression via the improvement of sleep. However, this study data doesn't necessarily indicate a causal relationship. We must, therefore, conduct a data longitudinal study to confirm the relationship between sleep and depression.

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2044 Board #90 MAY 31 8:00 AM - 9:30 AM

**Physical Activity Preferences Among a Population-Based Sample of Colorectal Cancer Survivors**

Erin McGowan<sup>1</sup>, Amy Speed-Andrews<sup>1</sup>, Chris Blanchard<sup>2</sup>, Ryan Rhodes<sup>3</sup>, Christine Friedenreich<sup>4</sup>, Nicole Culos-Reed<sup>5</sup>, Kerry Courneya<sup>1</sup>. <sup>1</sup>University of Alberta, Edmonton, AB, Canada. <sup>2</sup>Dalhousie University, Halifax, NS, Canada. <sup>3</sup>University of Victoria, Victoria, BC, Canada. <sup>4</sup>Alberta Health Services, Calgary, AB, Canada. <sup>5</sup>University of Calgary, Calgary, AB, Canada.  
(No relationships reported)

Physical activity (PA) is associated with improvements in health in colorectal cancer (CRC) survivors, however participation rates are low. A better understanding of how to promote PA in this population is needed.

**PURPOSE:** The purpose of this study was to identify the key PA programming and counseling preferences of CRC survivors.

**METHODS:** Participants were 600 CRC survivors (34% response rate) identified through the Alberta Cancer Registry who returned completed mailed surveys that included measures of self-reported PA, medical and demographic variables, and PA preferences.

**RESULTS:** Most CRC survivors indicated that they were interested (78.3%) and able (81.4%) to participate in a PA program. The most common PA preferences of CRC survivors were to receive PA counseling from a fitness expert at a cancer centre (44.3%), receive PA information in the form of print materials (59.8%), start a PA program after cancer treatment (68.9%), do PA at home (53.3%), and walk in both the summer and winter (48.5% and 36.8% respectively). Chi-square analyses identified that age, education, annual family income, and current PA were the demographic variables most consistently associated with PA preferences.

**CONCLUSION:** The majority of CRC survivors expressed an interest in PA program participation and key PA preferences were identified. These preferences may be useful for developing and implementing successful PA interventions for CRC survivors.

Supported by CIHR Grant SPO-83173.

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2045 Board #91 MAY 31 8:00 AM - 9:30 AM

**Associations Between Stage Of Behavior Change, Physical Activity, And Self-efficacy In Prenatal Women**

Jacquelyn A. Nagle, Bridget Melton, Elaine Marshall, Helen Bland. *Georgia Southern University, Statesboro, GA.* (Sponsor: John M. Jakicic, FACSM)  
(No relationships reported)

Physical activity (PA) is an important component of health promotion, although most pregnant women do not meet the recommended levels. Consequently, there has been recent interest in developing intervention programs encouraging lifestyle behavior changes among pregnant women. Interventions tailored to an individual's readiness to change are known to be more effective than traditional approaches to physical activity and researchers have confirmed the application of the Transtheoretical Model of Behavior Change (TTM) to the uptake of physical activity among a variety of populations. However, the model has scarcely been examined among pregnant women in recent literature.

**PURPOSE:** To examine the relationships among stages of physical activity behavior change and self-reported physical activity behavior, as well as other TTM constructs such as self-efficacy.

**METHODS:** Participants included 88 women, primarily in the second or third trimester, from the southeastern United States recruited from regional obstetrical offices. Measures modified for pregnancy included stages of exercise adoption (SEA) and self-efficacy for exercise (SEE). PA was also assessed using the short-form of the IPAQ.

**RESULTS:** Based on the self-selected SEA, women were categorized into early (Precontemplation, Contemplation, and Preparation) or late (Action and Maintenance) stage groups. Results revealed statistically significant differences in PA ( $p = 0.03$ ) when categorized into levels (low, moderate, high) from the IPAQ, such that women in the late stages were more likely to be in the moderate PA category, and women in the early stages were more likely to be in the low physical activity group. Results also reveal significantly higher levels of SEE ( $p = 0.037$ ) in the late stage group than the early stage group, as well as significant differences among groups when stratified out to the original 6 SEA ( $p = 0.028$ ), with women in the Action stage ( $M = 41.8$ ,  $SD = 5.83$ ) having higher SEE than women in Precontemplation ( $M = 35.33$ ,  $SD = 5.85$ ).

**CONCLUSIONS:** Overall results indicate consistency with current evidence such that people at later stages of change are more physically active than those in the earlier stages. Furthermore, those who are more physically active have higher SEE, indicating that prenatal PA interventions ought to focus on improving SEE.

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2046 Board #92 MAY 31 8:00 AM - 9:30 AM

**Peer Victimization and Physical Activity Attitudes and Behavior in Transgendered and Cisgendered Individuals.**

Megan M. Muchicko. *Kent State University, Kent, OH.* (Sponsor: Ellen Glickman, FACSM)  
(No relationships reported)

**BACKGROUND:** Transgendered (TG) individuals are more likely to be the targets of peer victimization than their cisgendered (CG, i.e., non-transgendered) counterparts. Emerging research has demonstrated a potential negative link between peer victimization and physical activity behavior. No studies that we are aware of have examined physical activity behavior of TG individuals much less its association with measures of peer victimization.

**PURPOSE:** To examine self-reported peer victimization, physical activity behavior and attitudes regarding physical activity in TG and CG adults.

**METHODS:** Thirty-five ( $N = 17$  TG, and 18 CG) adults ( $35.5 \pm 13.8$  years old) completed validated questionnaires assessing; peer victimization, physical activity behavior, social support for physical activity and self-efficacy for physical activity. Participants also self-reported height and weight and body mass index (BMI) was calculated. The peer victimization questionnaire asked participants about their peer interactions as children and contained the following sub-scales: Overt Victimization Subscale (OVS), Relational Subscale (RS) and Pro-social Receipt Subscale (PRS). The OVS assessed how frequently peers harmed or threatened to harm the individual's physical well-being. The RS assessed how often peers attempted to harm the individual's relationships with other peers. The PRS assessed how often the individual was the recipient of supportive acts by peers. Each of these subscales was summed individually.

**RESULTS:** TG individuals had a significantly ( $p \leq 0.05$ ) greater BMI ( $28 \pm 7$  TG,  $23 \pm 4$  CG), OVS ( $13 \pm 4$  TG,  $9 \pm 3$  CG) and RS ( $15 \pm 4$  TG,  $12 \pm 4$  CG) and lower PRS ( $12 \pm 3$  TG,  $17 \pm 3$  CG), physical activity ( $23 \pm 29$  TG,  $45 \pm 19$  CG), social support for physical activity ( $29 \pm 4$  TG,  $51 \pm 16$  CG) and self-efficacy for physical activity ( $31 \pm 14$  TG,  $41 \pm 8$  CG) than CG adults. Self efficacy ( $r = 0.6$ ), social support ( $r = 0.5$ ), PRS ( $r = 0.4$ ) and BMI ( $r = -0.4$ ) were significantly ( $p \leq 0.04$ ) correlated to physical activity. OVS ( $r = -0.3$ ) and RS ( $r = -0.1$ ) were not ( $p \geq 0.1$ ) correlated to physical activity.

**CONCLUSIONS:** TG individuals were less physically active, received less social support, had lower self-efficacy, were more victimized and had a greater average BMI than CG individuals. Additional research into physical activity behavior of TG individuals is very much needed.

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2047 Board #93 MAY 31 8:00 AM - 9:30 AM

**Exercise Habits and Exercise Self-Efficacy among College Students Majoring in Exercise Science and Physical Education**

John McLester, FACSM<sup>1</sup>, Cherilyn N. Hultquist<sup>1</sup>, Virginia Frederick<sup>2</sup>, Jihan Williams<sup>1</sup>, Matthew Seitler<sup>1</sup>. <sup>1</sup>*Kennesaw State University, Kennesaw, GA.* <sup>2</sup>*The University of Tennessee, Knoxville, TN.*  
(No relationships reported)

The next generation of health and fitness professionals and educators has the responsibility to promote a healthy lifestyle to children and adults. Leading by example and having a favorable fitness profile are ways to be a positive influence. However, it is known that college students do not get adequate amounts of regular exercise and one of the variables strongly associated with long-term exercise adherence is exercise self-efficacy (ESE).

**PURPOSE:** To describe the current physical activity habits, body fat % (BF%), and ESE of a sample of college students majoring in Exercise Science (ES) and Physical Education (PE).

**METHODS:** Participants consisted of 132 students (ES = 99, PE = 31), (males = 67, females = 64) aged  $23.7 \pm 5.0$  yrs who volunteered to fill out questionnaires, the Barriers Specific Exercise Self-Efficacy Scale and have BF% measured with Dual Energy X-ray Absorptiometry.

**RESULTS:** Overall, 120 subjects self-identified as regular exercisers and 91 indicated that they were "fit." They engaged in  $4.0 \pm 3.7$  d/wk of aerobic exercise and  $2.6 \pm 1.7$  d/wk of strength training. This sample had a mean body mass index (BMI) of  $24.7 \pm 4.0$  kg/m<sup>2</sup> and a mean ESE score of  $61.5 \pm 19.9$ . When comparing self-estimated BF% to measured BF%, all subjects underestimated their BF% by  $4.0 \pm 5.6\%$  ( $P < 0.001$ ). When compared by sex, there was a difference for BMI with males falling into the overweight category ( $25.9 \pm 4.2$  kg/m<sup>2</sup>) and females into the normal category ( $23.5 \pm 3.5$  kg/m<sup>2</sup>) ( $P = 0.001$ ), for ESE males scored higher than females,  $68.7 \pm 15.8$  and  $54.9 \pm 20.14$  respectively ( $P < 0.001$ ) indicating that males were more confident in their ability to continue to exercise when faced with adverse situations. Males also engaged in strength training an average of  $3.0 \pm 1.5$  d/wk compared to females engaging  $2.2 \pm 1.7$  d/wk ( $P = 0.005$ ). When compared by major, PE was older than ES ( $26.4 \pm 8.5$  and  $22.9 \pm 2.9$  yrs, respectively) ( $P = 0.001$ ) but there were no differences in ESE, BMI, BF% or days participating in aerobic or strength exercises ( $P > 0.05$ ).

**CONCLUSION:** This sample of ES and PE majors did not exercise according to ACSM guidelines are equally challenged with their confidence to exercise in adverse situations indicating that exercise behavior management skills may be an important part of future curriculums to better prepare these students to be leaders in their field.

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2048 Board #94 MAY 31 8:00 AM - 9:30 AM

**Posture Effects Energy Expenditure and Postural Preference when Playing Active and Non-active Video Games**

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(Sponsor: Ellen L. Glickman, FACSM)  
(No relationships reported)

Energy expenditure is greater when playing physically-active video games (AVG) than traditional, sedentary video games. In previous studies, these games are played per manufacturer instructions with participants standing during AVG play and seated during sedentary game play. It is not known if individuals prefer to play these games seated or standing and what the effect of these postural differences have on energy expenditure during game play.

**PURPOSE:** To assess energy expenditure during and preference for two different postural conditions (seated, standing) while playing two AVGs using the Nintendo Wii, a traditional sedentary video game using the Sony Playstation 2 (PS2) and a resting condition.

**METHODS:** Oxygen consumption ( $VO_2$ ) was assessed as the measure of energy expenditure in 25 participants ( $22.5 \pm 2.0$  years old,  $N = 11$  females) during four 20-minute conditions; resting, PS2 Madden Football 2011, Wii-Sports Boxing and Wii Madden Football 2011 completed in a random order. These 20-minute conditions were divided into two separate postural conditions (10 minutes seated and 10 minutes standing). After completion of each 20 minute condition, participants indicated if they preferred playing the game seated or standing.

**RESULTS:** Standing  $VO_2$  ( $4.1 \pm 0.7$  ml·kg<sup>-1</sup>·min<sup>-1</sup> rest,  $4.4 \pm 0.2$  ml·kg<sup>-1</sup>·min<sup>-1</sup> PS2,  $4.6 \pm 0.1$  ml·kg<sup>-1</sup>·min<sup>-1</sup> Wii Madden,  $6.8 \pm 0.3$  ml·kg<sup>-1</sup>·min<sup>-1</sup> Wii Boxing) was significantly ( $p \leq 0.001$ ) greater than seated  $VO_2$  ( $4.0 \pm 0.6$  ml·kg<sup>-1</sup>·min<sup>-1</sup> rest,  $4.0 \pm 0.1$  ml·kg<sup>-1</sup>·min<sup>-1</sup> PS2,  $4.2 \pm 0.1$  ml·kg<sup>-1</sup>·min<sup>-1</sup> Wii Madden,  $6.1 \pm 0.3$  ml·kg<sup>-1</sup>·min<sup>-1</sup> Wii Boxing) for the resting and gaming conditions. Mean  $VO_2$  was greater ( $p \leq 0.001$ ) during Wii Boxing ( $6.5 \pm 1.5$  ml·kg<sup>-1</sup>·min<sup>-1</sup>) than all other conditions. Mean  $VO_2$  was greater ( $p \leq 0.05$ ) during Wii Madden ( $4.4 \pm 0.6$  ml·kg<sup>-1</sup>·min<sup>-1</sup>) than PS2 Madden ( $4.2 \pm 0.7$  ml·kg<sup>-1</sup>·min<sup>-1</sup>) and rest ( $4.0 \pm 0.6$  ml·kg<sup>-1</sup>·min<sup>-1</sup>). Mean  $VO_2$  was not significantly different ( $p = 0.077$ ) between PS2 Madden and rest. Participants preferred ( $p \leq 0.001$ ) to stand while playing Wii Boxing but preferred to sit for all other conditions.

**CONCLUSIONS:** Playing video games while standing increases energy expenditure to a greater extent than playing the same games in a seated position. Participants preferred to sit for every condition except for Wii Boxing which was also the most physiologically challenging game.

**2049** Board #95 MAY 31 8:00 AM - 9:30 AM

### Determinants of Physical Activity in Physical Education Teacher Education Students

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(No relationships reported)

The National Association of Sports and Physical Education has recently implemented program accreditation standards ensuring physical education teacher education (PETE) majors achieve and maintain healthy fitness standards throughout the program. However college students have found to be vulnerable to weight gain and a decrease in physical activity.

**PURPOSE:** To provide a descriptive analysis of determinants of physical activity in PETE majors.

**METHODS:** Seventy-nine PETE majors ( $22.5 \pm 3.8$  yrs) at Towson University completed the Social Support from Family and Friends for Physical Activity and Self-Efficacy for Physical Activity surveys. Students filled out a questionnaire providing demographic information and physical activity barrier and determinant feedback. Height and weight were also measured.

**RESULTS:** Factors most likely to motivate students to be physically active included improving physical fitness (87%) and enjoyment (74%). Factors least likely to affect motivation included social support (22%) and losing weight (39%). Students with a higher BMI were more motivated by losing weight ( $r = 0.38$ ,  $p = 0.001$ ). Major barriers to exercise included too much homework (53%) and not enough time (60%). Only 18% of students felt that economic inflation had impacted their ability to be physically active. Compared to other factors of self-efficacy, students were least confident they could motivate themselves to be physically active if they had to study less. Higher grade level was associated with being more confident they could study less to exercise ( $r = -0.26$ ,  $p = 0.02$ ). Social support for physical activity was higher from friends than family on questions regarding exercising with them and changing schedules to exercise together. Higher grade level was associated with being more likely to provide information to family and friends about physical activity ( $r = 0.25$ ,  $p = 0.028$ ). Students with a lower BMI felt their family was more likely to change their schedule to exercise with them ( $r = -0.23$ ,  $p = 0.04$ ).

**CONCLUSIONS:** New accreditation standards are making fitness and physical activity in PETE students a variable to be considered when designing curriculum. The following descriptive analysis was able to provide direction in terms of motivating factors and barriers to increasing physical activity levels in these students.

**2050** Board #96 MAY 31 8:00 AM - 9:30 AM

### Remembered Affect And Leisure Activity: Associations With Gender, Current Activity Level, And Type Of Activity

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(No relationships reported)

Prior work has found affective responses to exercise to be predictive of subsequent physical activity participation. However, the nature of this association has not been thoroughly explored in naturalistic settings.

**PURPOSE:** To assess the relationship between leisure activity (active vs. passive) and remembered energetic mood change using a modified Day Reconstruction Method. Method: Energetic mood ratings were compared for male ( $N = 87$ ) and female ( $N = 397$ ) participants who reported engaging in at least 20 minutes of physically active leisure ( $N = 201$ ), or at least 20 minutes of passive leisure ( $N = 284$ ). Participants were asked to rate how energetic they remembered feeling before and after a leisure activity using the energy sub-scale of the Thayer Activation/Deactivation Adjective Checklist. Participants also reported how frequently they engaged in physical activity using the Godin Leisure Time Questionnaire (GLTQ).

**RESULTS:** Interactions between type of leisure, GLTQ scores (zero centered), and gender, were explored in multiple regression analysis with change in energy pre- to post-activity as the dependent variable. The set of predictors accounted for a significant proportion of the variability in energy change scores  $R^2 = .101$ ,  $F(7, 421) = 6.374$ ,  $p < .001$ . Individual regression slopes revealed significant main effects of type of leisure,  $b = .442$ ,  $t(421) = 3.70$ ,  $p < .00$  and sex,  $b = -.383$ ,  $t(421) = -2.13$ ,  $p = .033$ ; however, these results were qualified by a significant three-way interaction between sex, type of leisure activity, and GLTQ scores,  $b = .019$ ,  $t(421) = 2.319$ ,  $p = .021$ . The two-way interaction between sex and type of leisure was non-significant at this centered level of the GLTQ. Two additional regression models were calculated to explore the sex by type of leisure interaction at one standard deviation (SD) above and below the mean on the GLTQ. At one SD above the mean on GLTQ, there was a significant sex by type of leisure interaction  $t(421) = 2.71$ ,  $p = .007$ ; however this relationship was not significant at one SD below the mean on the GLTQ.

**CONCLUSIONS:** Among individuals who exercise most frequently the pattern of remembered energy change from pre- to post activity differed across sex and across type of leisure activity. Frequent exercisers remember greater energetic mood boosts compared to those who exercise less.

**2051** Board #97 MAY 31 8:00 AM - 9:30 AM

### Exercise Barriers And Costs For Cancer Survivor: Two Distinct Elements Of Behavioral Change Process

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(No relationships reported)

Although scientific evidence supports the role of physical activity as an effective intervention for improving health, the majority of cancer survivors do not comply with public health guidelines (i.e. at least 150 minutes per week of moderate-to-vigorous intensity). Among the determinants of non adherence, barriers to participation are a well-known problem (Brawley et al., 2002). However, the lack of consensus in the definitions and measurements of barriers led to puzzling interpretation. For instance, authors indifferently mentioned exercise barriers and exercise costs. Moreover, in a meta-analysis on exercise (Marshall & Biddle, 2001), the authors reported that the patterns of change in cons were more diverse than in pros. This instability can be explained by the conceptualization and methodology used to measure costs.

**PURPOSE:** The aim of this study was to distinguish between perceived barriers and perceived costs of exercise in cancer survivors.

**METHODS:** Two hundred and sixty one cancer survivors completed a series of questionnaires including decisional balance (DB), perceived barriers and stages of change.

**RESULTS:** Two ANOVAs were carried out with stages of change score as within-subject factor (Precontemplation PC, Contemplation C, Preparation PR, Action/Maintenance A/M) and barriers and costs as dependent variables. For each Anova, significant effect of stages of change was found on barriers and cons. For perceived barriers, post-hoc tests revealed significantly higher mean scores for PC ( $M = 2.76$ ), C ( $M = 2.83$ ) and PR ( $M = 2.46$ ) than for A/M ( $M = 1.58$ ) stage. For perceived costs, post-hoc tests showed significantly higher mean scores for PC ( $M = 3.21$ ) than for C ( $M = 3.82$ ), PR ( $M = 4.19$ ) and A/M stages ( $M = 4.26$ ).

**CONCLUSION:** Perceived barriers remain relatively high and stable from PC to PR compared to perceived costs that significantly decrease from PC to PR. These results suggest that to stimulate movement from the early stages of change, a greater emphasis may be needed on reducing perceptions of barriers. Whether interventions suggest increasing pros to get people to think about change, followed by decreasing cons to allow the behavior to change, decreasing the perceived barriers should be a first step to allow individuals to considering a given behavior, mainly with sedentary persons.



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**2052**    *Board #98*    **MAY 31**    **8:00 AM - 9:30 AM**  
**Parental Style and Sedentary Behavior in Preschool-Aged Children**

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(No relationships reported)

Parents play an important role in their children's health behaviors. However, no studies have examined the association between parenting style and preschool children's sedentary behaviors. Given the reported high levels of sedentary behavior among preschool children, there is a need to examine the potential link between parenting style and sedentary behaviors within this age group.

**PURPOSE:** To examine the association of parenting style on sedentary behaviors among preschool-aged children.

**METHODS:** Two hundred and one parents completed an online survey assessing different parenting styles (i.e., neglectful, permissive, authoritarian, and authoritative) and they estimated the amount of time that their child (mean age: 3.9 yrs) spent in different sedentary activities (i.e., "screen time" and quiet play) during weekdays and weekends. Comparisons between sedentary activities and the four parenting styles were examined using one-way ANOVAs. Significant main effects were followed-up by Scheffe post-hoc tests and effect size ( $\eta^2$ ) was calculated to estimate the magnitude of the main effect.

**RESULTS:** Parents who employed a permissive parenting style reported that their child engaged in more screen time (i.e., sedentary behaviors; watching TV, playing videogames or on the computer) on weekdays compared to authoritative parents (1.78 hr/d vs. 1.26 hr/d, respectively;  $p = 0.006$ ). Authoritative parents also reported that their child engaged in less screen time on the weekends in comparison to neglectful and permissive parents (1.61 hr/d vs. 2.15 hr/d vs. 2.29 hr/d, respectively;  $p < 0.05$ ). The effect sizes for both weekdays and weekends was small ( $\eta^2 = 0.06$ ). Additionally, there were no detectable differences between quiet play and parental style for either weekdays or weekends.

**CONCLUSION:** Although additional research is needed, this set of observations suggests that parenting style may influence the amount of screen time preschool children engage in.

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**2053**    *Board #99*    **MAY 31**    **8:00 AM - 9:30 AM**  
**Sports Participation in Young Adult Cancer Survivors**

Lisa J. Belanger<sup>1</sup>, Ronald C. Plotnikoff<sup>2</sup>, Alexander M. Clark<sup>1</sup>, Kerry S. Courneya<sup>1</sup>. <sup>1</sup>University of Alberta, Edmonton, AB, Canada. <sup>2</sup>University of Newcastle, Newcastle, Australia.  
(No relationships reported)

Physical activity improves health outcomes in young adult cancer survivors (YACS) but participation rates are low. Sport is an understudied strategy for increasing physical activity in cancer survivors.

**PURPOSE:** To examine the prevalence and correlates of sports participation in YACS. .

**METHODS:** A provincial, population-based mailed survey of YACS in Alberta, Canada, was completed in May, 2008 and included measures of sport participation, medical variables, and demographic variables.

**RESULTS:** A total of 588 YACS completed the survey. Almost a third (32.5%) of YACS reported participating in a sport in the past month with the most common sport being golf (40.8%) followed by hockey (8.3%), tennis (7.3%), soccer (5.7%) and swimming (5.2%). YACS reporting sport participation in the past month reported an average frequency of 1.7 (SD=1.0) days/week and an average duration of 140 minutes (SD=132) per session for a total weekly minutes of sport participation of 279 (SD=379). In multivariate regression analysis, 8.5% ( $p < 0.001$ ) of the variance in sport participation was explained by being male ( $\beta = .17$ ;  $p < 0.001$ ), Caucasian ( $\beta = .15$ ,  $p = 0.001$ ), in better general health ( $\beta = .15$   $p < 0.001$ ), and having a normal body mass index score ( $\beta = -.10$   $p = 0.024$ ).

**DISCUSSION/CONCLUSIONS:** Sport participation may be a useful strategy for increasing physical activity in YACS, however, some health conditions and demographic groups may warrant particular attention.

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**2054**    *Board #100*    **MAY 31**    **8:00 AM - 9:30 AM**  
**Treadmill Exerts Stronger Influence than Setting on Running Speed and Heart Rate in College Runners**

Michael T. Nodzenski, Elizabeth J. Queathem. Grinnell College, Grinnell, IA.  
(No relationships reported)

Exercisers in outdoor settings have been found to have significantly higher running speeds and heart rates than in indoor settings. To our knowledge, these studies have not separated the influences of treadmills and outdoor settings on response variables. This study sought to tease apart these conflated effects.

**PURPOSE:** Separate the influences of outdoor and treadmill settings on runners' heart rate, running speed, attention, affect, and activation.

**METHODS:** We used a fully factored 2x2 design with condition (treadmill, trail/track) and location (indoors, outdoors) as within group variables and average heart rate and running speed as dependent measures. We also included time after running (0, 10, 20, 30 minutes) as a within group variable when attention (association minus dissociation scores), affect, and activation (tranquility minus fatigue scores) were used as response variables.

**RESULTS:** Running speed was significantly higher in the non-treadmill ( $M = 11.335$ ,  $SE = 0.267$ ) than treadmill condition ( $M = 10.578$ ,  $SE = 0.225$ ; ANOVA,  $F = 17.62$ ,  $p < 0.001$ ), as was average heart rate (ANOVA,  $F = 9.37$ ,  $p = 0.003$ ) (Non-treadmill:  $M = 130.29$ ,  $SE = 1.63$ ; Treadmill:  $M = 125.03$ ,  $SE = 1.67$ ). Activation was significantly higher in treadmill sessions ( $M = 1.605$ ,  $SE = 0.315$ ) than non-treadmill sessions ( $M = 0.513$ ,  $SE = 0.346$ ; ANOVA,  $F = 9.61$ ,  $p = 0.002$ ), suggesting greater fatigue in non-treadmill sessions. Location did not significantly affect running speed, heart rate, or activation, but its effect on change in affect approached significance, with outdoor values ( $M = 0.934$ ,  $SE = 0.209$ ) higher than indoor values ( $M = 0.493$ ,  $SE = 2.72$ ; ANOVA,  $F = 3.62$ ,  $p = 0.058$ ). Attention was significantly more dissociative outdoors ( $M = -10.5$ ,  $SE = 2.01$ ) than indoors ( $M = -4.39$ ,  $SE = 1.98$ ; ANOVA,  $F = 5.87$ ,  $p = 0.019$ ).

**CONCLUSION:** Running speed and heart rate were significantly lowered by treadmill running compared to non-treadmill, but did not vary significantly by location. Outdoor locations yielded higher affective response values and corresponded to more dissociation. These findings suggest that the physiological aspects of running may be more strongly influenced by whether runners use a treadmill or track/trail, while the psychological aspects may be more strongly influenced by location.

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**2055**    *Board #101*    **MAY 31**    **8:00 AM - 9:30 AM**  
**Effect Of Level Of Autonomy On The Amount Of Physical Activity In Young Children**

Judith A. Juvancic-Heltzel<sup>1</sup>, Gabriel J. Sanders<sup>2</sup>, Megan L. Williamson<sup>2</sup>, James N. Roemmich, FACSM<sup>3</sup>, Denise M. Feda<sup>4</sup>, Jacob E. Barkley<sup>2</sup>. <sup>1</sup>The University of Akron, Akron, OH. <sup>2</sup>Kent State University, Kent, OH. <sup>3</sup>Department of Agriculture, Northern Plains Area, Grand Forks, ND. <sup>4</sup>State University of New York University at Buffalo, Buffalo, NY.  
(No relationships reported)

Emerging research has indicated that providing choice of exercise options increases the amount of physical activity children perform. However, these studies have not yet assessed this effect using physical activities children typically have access to in a naturalistic setting.

**PURPOSE:** To assess physically active and sedentary behaviors of children in a naturalistic setting under two conditions: one that provided high autonomy through choice (HC) of eight physical activity options, and one that provided minimal autonomy by providing choice of two active options (LC).

**METHODS:** Ten boys (age  $6.3 \pm 1.6$  y) and seven girls (age  $5.7 \pm 1.3$  y) completed HC and LC conditions in a gymnasium. The order of the conditions was randomized. During HC participants had access to three obstacle courses, jump-rope, various balls and targets and a table of sedentary activities (games, toys, coloring sheets, books and crayons) for 30 minutes. During LC participants had access to two physical activity equipment options (one obstacle course, one ball with targets) and the same sedentary activities. During each condition participants

were free to participate in the physical and/or sedentary activities as they chose for the entire session. Physical activity intensity was monitored via accelerometer. Average per-minute accelerometer counts were converted to METs. The amount of time allocated to sedentary activity was monitored via observation and stopwatch. Participants reported their liking of each condition via a visual analog scale.

**RESULTS:** Mixed-model analysis of variance demonstrated a significant ( $p < 0.04$ ) sex (boys, girls) by condition (HC, LC) interaction for average physical activity intensity (METs). Boys increased ( $p = 0.002$ ) average physical activity intensity from the LC ( $5.8 \pm 3.3$  METs) to HC ( $6.9 \pm 2.8$  METs) condition. Girls did not alter ( $p \geq 0.6$ ) average physical activity intensity across conditions ( $5.8 \pm 4.7$  METs LC,  $5.5 \pm 4.4$  METs HC). There were no significant ( $p \geq 0.3$ ) main or interaction effects for differences in time allocated to sedentary activities or liking.

**CONCLUSIONS:** Increasing the variety of physical activity equipment options in a naturalistic setting increased average physical activity intensity in young boys but not young girls.

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**2056** Board #102 MAY 31 8:00 AM - 9:30 AM

### Understanding Physical Activity in Kidney Cancer Survivors Using the Theory of Planned Behavior

Linda Trinh<sup>1</sup>, Ronald C. Plotnikoff<sup>2</sup>, Ryan E. Rhodes<sup>3</sup>, Scott A. North<sup>4</sup>, Kerry S. Courneya<sup>1</sup>. <sup>1</sup>University of Alberta, Edmonton, AB, Canada. <sup>2</sup>University of Newcastle, Callaghan, NSW, Australia. <sup>3</sup>University of Victoria, Victoria, BC, Canada. <sup>4</sup>Cross Cancer Institute, Edmonton, AB, Canada.  
(No relationships reported)

Physical activity (PA) improves quality of life, physical functioning, and fatigue in several cancer survivor groups including kidney cancer survivors (KCS). Despite the established benefits of PA, over half of KCS are completely sedentary and only a quarter are meeting PA guidelines. This highlights the need to identify and understand the determinants of PA in this understudied survivor population. To the best of our knowledge, no study to date has examined the determinants of PA in KCS.

**PURPOSE:** To determine the social cognitive correlates of PA intention and behaviour in KCS using the Theory of Planned Behaviour (TPB).

**METHODS:** All 1,985 KCS diagnosed between 1996 and 2010 identified through a Canadian provincial Registry in Alberta, Canada were mailed a self-report survey that consisted of the Godin Leisure Time Exercise Questionnaire and standard TPB items for intention, perceived behavioural control (PBC), affective and instrumental attitudes, and descriptive and injunctive norms. Standard demographic and medical variables were also collected.

**RESULTS:** Completed surveys were received from 703 of 1,654 (43%) eligible KCS. Briefly, the mean age was  $65.0 \pm 11.1$ , 62.9% were male, mean BMI was  $28.5 \pm 5.2$ , and mean number of months since diagnosis was  $69.0 \pm 55.5$ . The TPB was tested using structural equation modelling and demonstrated an adequate-to-good fit to the data [ $\chi^2 = 151.57$ ,  $p < 0.001$ ; TLI = 0.96; CFI = 0.98; RMSEA = 0.07, 90% CI = 0.06-0.08]. There were significant model pathways to intention from affective ( $\beta = 0.16$ ,  $p = 0.03$ ) and instrumental attitude ( $\beta = 0.24$ ,  $p = 0.03$ ), descriptive norm ( $\beta = 0.08$ ,  $p = 0.01$ ), and PBC ( $\beta = 0.51$ ,  $p = 0.02$ ). In addition, there were significant pathways to PA from PBC ( $\beta = 0.18$ ,  $p = 0.01$ ) and intention ( $\beta = 0.49$ ,  $p = 0.01$ ). Overall, the TPB accounted for 69% and 41% of the variance in intention and PA behaviour respectively.

**CONCLUSION:** The TPB appears to be a useful model for explaining PA in KCS. All TPB constructs except injunctive norm were useful for explaining intention with PBC emerging as the largest correlate. As expected, both PBC and intention were significant correlates of PA with intention emerging as the largest correlate. Developing PA behavior change interventions based on the TPB may be effective in promoting PA in KCS and may lead to important improvements in health.

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**2057** Board #103 MAY 31 8:00 AM - 9:30 AM

### Psychosocial Mediators Of The Association Between Acculturation And Leisure-time Physical Activity Among Korean Americans

Hyo Lee, Bradley J. Cardinal, FACSM, Sombat Onsiri. Oregon State University, Corvallis, OR.  
(No relationships reported)

Ethnic minorities', including Korean Americans', leisure-time physical activity (LTPA) participation is less than ideal. Eliminating physical activity disparities in ethnic groups is important. Empirical studies suggested that acculturation may be an important factor explaining physical activity disparity, but there is a scarcity of studies testing psychosocial mediators by which the association between acculturation and leisure-time physical activity can be better understood.

**PURPOSE:** This study tested: 1) the theory of planned behavior's (Ajzen, 1991) four psychosocial constructs (attitude, subjective norm, perceived behavioral control, and behavioral intention) as potential mediators of the association between acculturation and LTPA in Korean Americans; and 2) whether the relationships among variables vary by gender.

**METHODS:** Four hundred forty nine Korean Americans (216 males and 223 females; age  $30.42 \pm 10.41$  years) participated in a survey for this study. A multiple-sample structural equation modeling was used to test gender invariance and associations among the constructs.

**RESULTS:** Factor structures and associations among the factors were invariant by gender. The final model fit to data well, CFI = .970, TLI = .969, RMSEA = .043. Acculturation was positively associated with perceived behavioral control (PBC;  $\beta = .31$ ,  $p < .001$ ), but inversely associated with subjective norm ( $\beta = -.23$ ,  $p < .001$ ). In turn, PBC ( $\beta = .46$ ,  $p < .001$ ), subjective norm ( $\beta = .15$ ,  $p < .001$ ), and attitude ( $\beta = .24$ ,  $p < .001$ ) were positively associated with behavioral intention ( $R^2 = .40$ ); and intention ( $\beta = .42$ ,  $p < .001$ ), perceived behavioral control ( $\beta = .22$ ,  $p < .01$ ), and acculturation ( $\beta = .11$ ,  $p < .05$ ) were significantly associated with LTPA ( $R^2 = .33$ ).

**CONCLUSIONS:** The association between acculturation and LTPA can be at least partially understood by the meditative effects of PBC, subjective norm, and behavioral intention. Korean Americans' cultural assimilation to the US mainstream enhance their belief about behavioral controllability and level of confidence, but decrease perception of social pressure to participate in LTPA. Practically, this study suggests that culturally relevant intervention programs to promote Korean Americans' LTPA should target to mitigate the negative impact of acculturation on subjective norm.

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**2058** Board #104 MAY 31 8:00 AM - 9:30 AM

### Psychological Needs Mediate The Relationship Between Physical Exertion Barriers And Body Fat Percent In College-Aged Mexican-American Women

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(No relationships reported)

In the last several decades, there has been a wave of interest in the overweight/obese population in the United States. However, little research has focused on the association between exercise barriers and psychological needs in college-aged Mexican-American females.

**PURPOSE:** To investigate the relationships between exercise barriers, psychological needs for exercise, and obesity among college-aged Mexican-American females.

**METHODS:** Body fat measures were recorded on 91 female students ( $M = 22.8 \pm 5.1$ ). The Exercise Benefits and Barriers Scale (EBBS) was used to determine perceived barriers. The EBBS examined Exercise Milieu (EM), Time Expenditure (TEB), Physical Exertion (PEB), and Family Discouragement (FDB) for perceived barriers to exercise. The Psychological Need Satisfaction in Exercise Scale (PNSE) was used to examine the degrees of perceived Competence (PCo), Autonomy (PAu), and Relatedness (PR) as they pertain to an individual's motivation to exercise.

**RESULTS:** The mean body fat score indicated 28.6 % ( $n = 26$ ) of the sample were overweight, and 50.6 % ( $n = 46$ ) were obese. There were significant correlations observed between PCo ( $r = .35$ ,  $p = .00$ ) and PAu ( $r = -.25$ ,  $p = .02$ ) with reduced BF %. PCo ( $r = -.22$ ,  $p = .04$ ) and PAu ( $r = -.23$ ,  $p = .01$ ) negatively associated with PEB. PEB ( $r = .24$ ,  $p = .02$ ) significantly correlated with increased BF %. Mediation analysis indicated that PCo and PAu influenced the relationship between PEB and BF % in college-aged Mexican-American females.

**CONCLUSIONS:** The findings indicate that women who continue to perceive exercise as being strenuous lack intrinsic motivation which may lead to physical inactivity; thus unhealthy accumulation of BF is likely. In order to overcome such perceptions, practitioners should target the enhancement of psychological needs to reduce perceived barriers. Therefore, successful intervention programs need to focus on increasing competency and autonomy for exercise with the actual exercise program in Mexican-American women.

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2059 Board #105 MAY 31 8:00 AM - 9:30 AM

**Self-reported Peer Victimization And Objectively Measured Physical Activity Behavior In Overweight/obese And Non-overweight Boys**

Jacob E. Barkley<sup>1</sup>, Melissa A. Rittenhouse<sup>2</sup>. <sup>1</sup>Kent State University, Kent, OH. <sup>2</sup>James Madison University, Harrisonburg, VA. (Sponsor: Ellen L. Glickman, FACSM)  
(No relationships reported)

**BACKGROUND:** Emerging evidence has indicated a negative association between self-reported peer victimization and physical activity behavior in youth. However, these previous studies have relied on survey instruments to assess physical activity and no studies have examined this relationship in a controlled environment.

**PURPOSE:** To assess peer victimization and its relationship to objectively-measured physical activity in boys in a controlled environment.

**METHODS:** Twenty-four overweight/obese (N=12) and non-overweight boys (10.4±1.5 years old) completed one experimental session. Children first completed a peer victimization questionnaire that included an overt victimization subscale (OVS) assessing how frequently other students have harmed or threatened to harm their physical well-being and a relational subscale (RS) assessing how often students have attempted to harm peer relationships. Children were then taken to a gymnasium where they had free-choice access to physical activities (e.g. balls and goals) and/or sedentary alternatives (e.g. crossword puzzles and magazines) for a period of 30-minutes. Children could participate in any of these activities, in any sequence they chose, for the entire 30-minute activity session. Physical activity during the activity session was assessed via accelerometry. A stop watch was used to record children's time allocation to sedentary activities.

**RESULTS:** Overweight/obese children (11.5 ± 3.9 OVS, 11.8 ± 4.7 RS) reported greater ( $p \leq 0.04$ ) scores in the OVS and RS subscales of the questionnaire than non-overweight children (7.6 ± 2.6 OVS, 8.2 ± 3.1 RS). Overweight/obese children (9.0e+4 ± 3.9e+4 counts, 7.7 ± 6.6 minutes) also accumulated fewer accelerometer counts and allocated more time ( $p \leq 0.01$  for all) to sedentary activity than non-overweight children (13.7e+4 ± 4.6e+4 counts, 1.2 ± 3.7 minutes) during the 30-minute activity session. The OVS and RS subscales were significantly and positively ( $r \geq 0.41$ ,  $p \leq 0.05$ ) correlated to sedentary activity time. There was a trend towards a negative ( $r \geq -0.36$ ,  $p \leq 0.07$ ) correlation between the two subscales and accelerometer counts.

**CONCLUSIONS:** These results support a potentially harmful link between peer victimization and decreased, objectively-measured physical activity behavior in boys.

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2060 Board #106 MAY 31 8:00 AM - 9:30 AM

**Gender, Weight Status And Socioeconomic Differences In Psychosocial Correlates Of Physical Activity In Schoolchildren**

Ana C. Seabra<sup>1</sup>, André Seabra<sup>1</sup>, Denisa Mendonça<sup>2</sup>, José Maia<sup>1</sup>, Gregory Welk, FACSM<sup>3</sup>, Robert Brustad<sup>4</sup>, António M. Fonseca<sup>1</sup>. <sup>1</sup>Research, Education, Innovation and Intervention in Sport, Faculty of Sport, University of Porto, Porto, Portugal. <sup>2</sup>Institute of Public Health (ISPUP), Institute of Biomedical Sciences Abel Salazar, University of Porto, Porto, Portugal. <sup>3</sup>Nutrition and Wellness Research Center, Iowa State University, Iowa, IA. <sup>4</sup>College of Natural & Health Sciences, Sport and Exercise Science, University of Northern Colorado, Greeley, CO.

(No relationships reported)

Childhood obesity is a major public health problem and a sedentary lifestyle is implicated in the development of this condition. Psychosocial factors are major correlates of children's participation in physical activity (PA). The number of studies that have examined demographic and biological differences in these psychosocial correlates is very limited.

**PURPOSE:** To assess differences in the attraction to PA, perceived physical competence and parental influences across gender, body mass index (BMI) and socioeconomic status (SES) in Portuguese primary school children.

**METHODS:** 683 children, 8-10 years of age, were surveyed. Attraction to PA, perceived physical competence and parental influences were assessed via standardized questionnaires. Family SES was estimated with a questionnaire. The prevalence of overweight and obesity was calculated using BMI, and the cut-off points suggested by Cole et al. Statistical procedures included three-way ANOVA.

**RESULTS:** (1) Normal-weight girls like more to participate in vigorous PA than overweight and obese girls ( $F=3.73$ ,  $p=0.025$ ). (2) High and medium SES children recognize more importance to PA than low SES children ( $F=4.97$ ,  $p=0.007$ ). (3) Boys enjoy more games and sports than girls ( $F=4.14$ ,  $p=0.042$ ). (4) Obese children consider to be less accepted by peers' in games and sports than normal-weight and overweight children ( $F=3.88$ ,  $p=0.021$ ). (5) High SES girls like more exertion aspects of PA than low SES girls ( $F=5.91$ ,  $p=0.003$ ). (6) Boys ( $F=19.18$ ,  $p<0.001$ ) and normal-weight ( $F=3.17$ ,  $p=0.043$ ) children perceiving themselves as being more successful and physically competent, than girls and obese children. (7) High SES children consider, more significantly, their parents as role models ( $F=4.55$ ,  $p=0.011$ ) and perceived them as having more fun ( $F=5.61$ ,  $p=0.004$ ) and enjoyment doing PA ( $F=8.42$ ,  $p<0.001$ ) than lower SES children.

**CONCLUSIONS:** These results suggest that intervention should focus on girls, obese and lower SES children who were less attracted to PA, perceived as less physical competent and less influenced by their parents which put them at higher risk for inactivity.

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**C-29 Free Communication/Poster - Effects of Footwear on Gait**

MAY 31, 2012 7:30 AM - 12:30 PM

ROOM: Exhibit Hall

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2061 Board #107 MAY 31 9:00 AM - 10:30 AM

**Effects Of Different Footwear On Peak Impact Force And Time During A Depth Drop**

Joe W. LaPorta, James J. Tufano, Vanessa L. Cazas, Jeremy G. Tan, Leah Truong, Lee E. Brown, FACSM. California State University, Fullerton, Fullerton, CA.

(No relationships reported)

**PURPOSE:** The purpose of this study was to determine the effects of different footwear on force absorption characteristics during a depth drop.

**METHODS:** Twenty seven female volunteers (23±2.2 yrs, 162.94±7.37 cm, and 62.02±8.79 kg) performed a five minute warm-up on a cycle ergometer and were then randomly assigned to one of two conditions (minimalist shoes, or barefeet). Subjects then performed three depth drops off an 18 inch box, then repeated the same protocol for the remaining condition. Peak S-gradient RFD, S-gradient force, and S-gradient time were measured on a force plate. A paired samples t-test compared the two conditions.

**RESULTS:** There was no significant ( $p>0.05$ ) difference in the peak S-gradient RFD (barefeet= 96427.3519 + 44785.139 N/s, minimalist shoe= 90916.5148 + 40157.80640 N/s) or peak S-gradient force (barefeet=1914.2616 + 764.18553 N, minimalist shoe=1806.6647 + 730.51036 N) between the two conditions. Peak S-gradient time was significantly ( $p<0.05$ ) longer in the minimalist footwear (0.0391 + 0.00851 sec) condition than in barefeet (0.0391 + 0.01058 sec).

**CONCLUSIONS:** It appears that during the depth drop neither rate of force development or peak force are affected by minimalist footwear. However, force absorption time is significantly longer in minimalist footwear. The minimalist footwear condition may allow individuals to reach the S-gradient over a slightly longer period of time, thus leading to greater force absorption. However, at this time, a change in footwear is not warranted to improve force absorption characteristics.

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2062 Board #108 MAY 31 9:00 AM - 10:30 AM

**Four Weeks Familiarisation To Simulated Barefoot Running Significantly Improves Running Economy Compared To Shod Running**

Joe P. Warne, Giles D. Warrington, FACSM. Dublin City University, Dublin, Ireland.

(No relationships reported)

Despite the increased popularity of barefoot (BR) and simulated barefoot running (SBR), the physiological responses to different footwear conditions is largely unexplored and the process of adaptation and familiarisation to BR or minimalist SBR remains to be determined.

**PURPOSE:** The purpose of this study was to evaluate the effects of a 4 week familiarisation period of SBR (Vibram Five Fingers, VFF) on running economy (RE) and compare this to running in a traditionally shod (SR) condition.

**METHODS:** 15 male national level middle distance athletes (age:  $24 \pm 4$  yrs; stature:  $177.2 \pm 6.21$  cm; mass:  $67.99 \pm 7.36$  kg and  $VO_2$  max  $70.2 \pm 5.2$  ml/kg/min) were recruited to participate in the study. Subjects completed two RE tests; 24 hours apart, in both the VFF or SR condition, in a random order (pre-test) at 11 and 13km/h. Oxygen uptake ( $VO_2$ ), blood lactate (Bl<sub>a</sub>), heart rate (HR), and stride frequency (SF) were measured during each test. Subjects then completed a 4 week familiarisation period of running in VFF's, before repeating the 2 running economy tests in a random order (post-test).

**RESULTS:** Following the 4 week familiarisation a significant improvement in RE was observed at both velocities in the VFF condition ( $p=0.006$ ), the improvement in RE was 7.7% between the pre-test and post-test ( $46.34 \pm 1.29$  v  $43.02 \pm 1.1$  ml/kg/min;  $p=0.006$ ). There was also a non-significant improvement in RE of 2.4% in the SR condition between over time ( $47.52 \pm 0.94$  v  $46.43 \pm 0.88$  ml/kg/min;  $p=0.087$ ). At the pre-test, RE was 2.2% lower in the VFF compared to the SR condition but this was not found to be significant ( $p=0.231$ ). In contrast, following the familiarisation period (post-test), when compared to shod RE was significantly improved in the VFF condition ( $p=0.006$ :  $45.884 \pm 42.69$  v  $42.69 \pm 1.21$  ml/kg/min: 7.5% difference). SF was significantly higher (2.5%) in the VFF condition across both time points ( $p=0.01$ ).

**CONCLUSIONS:** The results of the current study support previous research suggesting that SBR improves running economy when compared to SR, which may in part be explained by a change in running mechanics associated with an increase in SF and consequent reduction in stride length. The study findings also suggest that being fully habituated to running in VFF's may further improve RE in the VFF condition and to a lesser extent the SR condition also.

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**2063** Board #109 MAY 31 9:00 AM - 10:30 AM

**Comparison of Physiological Variables During Barefoot and Shod Treadmill Running in Inexperienced Barefoot Runners**

Joel R. De Paoli, Matt Lee, Marialice Kern, FACSM. *San Francisco State University, San Francisco, CA.*

*(No relationships reported)*

**PURPOSE:** To examine differences in physiological variables between barefoot (BF) and shod (SH) treadmill running in a group of inexperienced BF runners.

**METHODS:** Twelve participants with no previous BF running experience (mean age  $24.8 \pm 0.9$  yr; 6 males, 6 females) engaged in 6-minute running bouts of both BF and SH at 6 mph and 1% grade (randomly assigned). Oxygen consumption ( $VO_2$ ), heart rate (HR), respiratory exchange ratio (RER), pulmonary ventilation (VE), and Rating of Perceived Exertion (RPE) were recorded during both conditions. Video data was also collected to examine stride rate (SR) and stride length (SL). Data was averaged over the last 2 minutes of each condition. A 2 x 2 (sex x condition) repeated measures ANOVA was used to examine differences in variables between sex and conditions. A significance level of 0.05 was used for all tests.

**RESULTS:** The ANOVA revealed significant main effects of condition on  $VO_2$ , VE, RER, SL, and SR. This was such that  $VO_2$ , VE, and RER were lower during BF compared to SH ( $34.5 \pm 1.0$  vs.  $36.1 \pm 0.9$  ml/kg/min,  $55.3 \pm 4.0$  vs.  $58.8 \pm 4.2$  liters/min and  $0.92 \pm 0.1$  vs.  $0.94 \pm 0.02$ , respectively). Additionally, SL was lower ( $0.89 \pm 0.02$  vs.  $0.97 \pm 0.01$  m) and SR was greater ( $181.0 \pm 3.6$  vs.  $166.4 \pm 2.7$  strides/min) during BF compared to SH. Furthermore, there was a sex x condition interaction on HR such that HR was greater during BF in females ( $177.0 \pm 3.2$  vs.  $172 \pm 3.5$  bpm), while it was lower during BF in males ( $159.2 \pm 2.7$  vs.  $164 \pm 1.7$  bpm). Lastly, there was a trend for a main effect of condition on RPE such that it was lower during BF ( $11.6 \pm 0.3$  vs.  $12.3 \pm 0.4$ ;  $p=0.086$ ). Overall, the  $VO_2$  of running was 4.2% lower during BF compared to SH (males: 4.5%; females: 3.9%).

**CONCLUSIONS:** This data suggests that barefoot running is more economical than shod running in inexperienced barefoot runners. Additionally, BF results in shorter strides and a greater stride frequency, giving further merit to the notion that the economical differences, in part, result from the kinematic changes that occur when running barefoot. The different responses of HR between sexes during BF and SH warrants further investigation.

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**2064** Board #110 MAY 31 9:00 AM - 10:30 AM

**A Comparison of 1-Mile Times in Experienced and Inexperienced Minimalist Footwear Runners**

Adam M. Coughlin, Allie Langwald. *Adrian College, Adrian, MI.*

*(No relationships reported)*

Minimalist footwear running, including barefoot running, has become increasingly popular as new technology and recent research has emerged. Research shows that traditional running footwear causes sudden loading of the lower extremities in contact with the weight bearing surface, producing an extremely sharp rise of vertically transmitted force impact. Barefoot running mechanics allows for adaptations that provide impact absorption. Little is known about running performance between shod and minimalist footwear.

**PURPOSE:** Determine the effects running in Vibram Five Finger (VFF) Bikilas on one-mile run times of both inexperienced and experienced barefoot runners on an indoor track.

**METHODS:** Twenty runners (8 experienced minimalist runners) conducted two separate one-mile time trials. Trials were performed in a traditional running shoe and another trial while running in VFF Bikilas. Weights of the shoes were also collected.

**RESULTS:** As a group, participants ran faster in VFF Bikilas (VFF  $7.17 \pm 1.04$  min, shod  $7.36 \pm 1.06$  min,  $p = 0.004$ ). Experienced minimalist participants also ran faster in VFF Bikilas (VFF  $6.63 \pm 1.20$  min, shod  $6.94 \pm 1.33$  min,  $p = 0.015$ ). Inexperienced minimalist participants ran an average of 6.4 seconds faster while wearing VFF Bikilas, but this was not statistically significant (VFF  $7.53 \pm 0.79$  min, shod  $7.63 \pm 0.78$  min,  $p = 0.12$ ). The difference in the weight of the shoe only accounted for 18% ( $R^2 = 0.1846$ ) of the variance between the difference two time trials.

**CONCLUSION:** As a whole, runners had significantly faster times in the VFF Bikilas. Experienced minimalist runners ran significantly faster in the VFF trial than the traditionally shod trial, while the inexperienced minimalist runners also ran faster in the VFF trial, although not statistically significant.

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**2065** Board #111 MAY 31 9:00 AM - 10:30 AM

**Effect of Minimalist Shoes Versus Bare Feet on Deceleration from a Vertical Jump**

Vanessa L. Cazas, James J. Tufano, Joe LaPorta, Jeremy G. Tan, Leah Troung, Lee E. Brown, FACSM. *California State University Fullerton, Fullerton, CA.*

*(No relationships reported)*

Females have been shown to have a higher rate of ACL injuries in comparison to males. Newly developed footwear may alter deceleration during jump landings, thereby decreasing the risk of injury.

**PURPOSE:** The purpose of this study was to investigate the effect of minimalist shoes vs. bare feet on deceleration from a vertical jump.

**METHODS:** Twenty-seven recreationally trained females ( $23 \pm 2.2$  yrs,  $162.9 \pm 7.3$  cm, and  $62 \pm 8.7$  kg) performed a 5-minute cycling warm-up, then completed three vertical jumps while wearing either minimalist shoes (MS; Fila Skele-toes) or with bare feet (BF). All vertical jumps were performed on a force plate in a counter-movement fashion with hands placed on the hips. Deceleration time (DT), peak deceleration velocity (PDV) and deceleration (PDV/DT), were directly measured on an AMTI force plate sampling at 1000Hz.

**RESULTS:** Paired t-tests showed no significant ( $p > 0.05$ ) differences in deceleration between MS (mean:  $11.11$  m/s<sup>2</sup>, SD: 4.32) and BF (mean:  $11.02$  m/s<sup>2</sup>, SD: 4.51) or in DT MS (mean:  $0.25$  s, SD: 0.14) and BF (mean:  $0.23$  s, SD: 0.08) or in PDV MS (mean:  $-2.20$  m/s, SD:  $-0.21$ ) and BF (mean:  $-2.20$  m/s, SD:  $-0.20$ ).

**CONCLUSION:** Minimalist shoes do not appear to effect deceleration when compared to bare feet. This suggests that wearing minimalist shoes may not decrease the risk of injury when landing from a vertical jump.

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2066 Board #112 MAY 31 9:00 AM - 10:30 AM

**Speed Dependent Changes In Emg Patterns In Minimalistic Footwear; Effects Of Footstrike Pattern: Preliminary Results**

Jasper Reenalda, Wiebe De Vries, Bart Freriks, Jaap Buurke. *Roessingh Research and Development, Enschede, Netherlands.*  
(No relationships reported)

There has been growing interest lately in barefoot running and many runners attempt to run barefoot or in new shoe concepts such as minimalistic footwear. It can be assumed that minimalistic footwear requires adaptation in running style mainly due to lack of cushioning. Especially of interest are effects of running speed, as ground reaction is known to increase with increasing running speed. Different adaptations in muscle activation patterns (EMG) can be expected between runners who are habitually running with a Rear Foot Strike (RFS) or with a Mid Foot or Fore Foot Strike (MFS/FFS).

**PURPOSE:** To investigate speed dependent changes in EMG patterns during running in minimalistic footwear in relation to foot strike pattern.

**METHODS:** 6 competitive runners ( $42 \pm 10$  years,  $183.8 \pm 1.2$  cm, and  $75.4 \pm 8.1$  kg), 3 of them were running with a RFS and 3 with a MFS/FFS, performed one minute trials at a treadmill at 6 different running speeds (10-15 km/h) while wearing minimal footwear. Surface EMG was measured at 1000 Hz according to the SENIAM protocol on the m. Tensor Fascia Latae (TF), m. Rectus Femoris (RF), m. Semitendinosus (ST), m. Tibialis anterior (TA), m. Peroneus longus (PL), m. Soleus (SL) and m. Gastrocnemius medialis (GM). Raw EMG data was filtered with a 3rd order high-pass filter with a cut-off frequency of 25 Hz. Smooth Rectified EMG (SRE) was filtered with a 3rd order low-pass filter with a cut-off frequency of 20 Hz. SRE was re-sampled to 100 HZ. Data was averaged over 10 gait cycles. SRE was integrated to obtain integrated-EMG (iEMG). 3-d Motion capturing was used to determine stance time as the time between initial contact and toe off.

**RESULTS:** Stance time decreased from 49 to 42% (mean  $45.5 \pm 2.6$ ) of gait cycle in RFS and from 44 to 38% (mean  $41 \pm 2.1$ ) in MFS/FFS with increasing speed. For maximal amplitude, highest increases of 46% were found for the RF in the RFS condition and of 32% for ST and SL in the MFS/FFS condition. iEMG increased 32% (range 17-55%) on average for all muscles in the RFS condition and 24% (range 16-37%) in the MFS/FFS condition.

**CONCLUSIONS:** Speed dependent changes in EMG patterns were found in runners who were novice to running in minimalistic footwear. Adaptation strategies were different between runners habitually running with a RFS or a MFS/FFS.

Supported by EC FP7 grant no. 222468

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2067 Board #113 MAY 31 9:00 AM - 10:30 AM

**Kinematic Comparison Of Treadmill Running While Barefoot And In Standard And Zero-drop Running Shoes**

Michael Bohne, Kelli Roach, Justin Tranchell, Jeff Wartena, Jason Slack, Andrew Creer. *Utah Valley University, Orem, UT.* (Sponsor: Scot Drum, FACSM)  
(No relationships reported)

**INTRODUCTION:** Evidence suggests that barefoot running may protect the feet and lower limbs from impact related injuries by producing a fore to mid-foot strike, which generate smaller collision forces with the ground. Barefoot running may protect feet from impact forces, running barefoot may not always be practical. Companies have developed shoes with minimal damping material in the heel of the shoe to decrease the offset between the heel and forefoot, resulting in a fore-foot to mid-foot strike. Although these designs are based on the benefits of barefoot running, no research has shown that running in this type of shoe is better than standard running shoes of a similar mass.

**PURPOSE:** Determine if a zero-offset shoe offers similar kinematics to running barefoot and different from standard running shoes.

**METHODS:** Nine well trained distance runners ( $25.7 \pm 3.5$  yrs,  $178.6 \pm 5.9$  cm,  $67.6 \pm 8.5$  kg,  $72.0 \pm 5.2$  ml/kg/min) Participants performed three, six minute run intervals on a treadmill at 16.0 km/hr at 1% grade. Three intervals were performed in standard running shoe (SR), zero-offset shoe (ZD), and barefoot (BF). The order of the intervals was randomized for each subject, and a rest period was provided between each interval to change shoes. During each interval joint kinematics were collected using reflective markers on the hip, knee, ankle, toe, heel, shoulder and head. Participants were filmed at 250 Hz using a Fastec Inline camera (Fastec Imaging, San Diego, CA). The video footage was digitized using MaxTraq software (Innovision Systems, Columbiaville, MI). Data were analyzed repeated measures ANOVA ( $\alpha=0.05$ ) **RESULTS:** There was a significant difference for the foot angle at touchdown between SR and both ZD and BF conditions. ( $p=0.07$ ). Additionally, there is an increase in the stance time between both shoe conditions and BF. ( $p=.040$ )

**CONCLUSIONS:** The ZD shoes showed a similar position at foot strike, leading to the belief that the ZD shoes may better mimic the "natural" running technique. It is believed that the increase in stance time will allow for greater absorption of the forces experienced during running, allowing for reduced injury rates in runners. Further research is needed to examine the joint characteristics of the lower extremity in the ZD condition to further illustrate the adaptations made during the running stride.

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2068 Board #114 MAY 31 9:00 AM - 10:30 AM

**Running Injury & Adaptation to Footwear**

Stacey A. Meardon<sup>1</sup>, Alicia Deurst<sup>1</sup>, Timothy R. Derrick<sup>2</sup>. <sup>1</sup>University of Wisconsin - La Crosse, La Crosse, WI. <sup>2</sup>Iowa State University, Ames, IA. (Sponsor: Thomas Kemozek, FACSM)  
(No relationships reported)

Running in the real world requires runners to adapt to changing conditions. Injured runners have been reported to have decreased variability in running mechanics and therefore may lack adaptability. Failure to adapt to footwear or environmental conditions by making kinematic adjustments to attenuate impacts may result in elevated impacts or loading rates.

**PURPOSE:** to determine response to midsole hardness change in runners with a history of injury that has interrupted training for more than one week in duration **METHODS:** 20 injured (INJ) & 20 non-injured (CON) runners matched on gender, speed and limb dominance ran over a force platform at a self-selected pace in 3 randomized midsole hardness conditions: 45 (soft), 57 (medium) and 70 (hard) durometer. Force platform data were collected and synchronized with 3D motion capture data. The effects of group and condition on key biomechanical variables were assessed using ANOVA. The average loading rate of the vertical GRF in the first 20% of stance (VLR) served as the outcome variable and sagittal plane joint angles at contact served as the performance variables to determine responses to midsole hardness.

**RESULTS:** VLR differed between the three conditions ( $p<0.01$ ) but not between groups. No significant interaction was observed ( $p=.18$ ). VLR was lower in the soft condition ( $57.3 \pm 20.5$  BW/s) compared to the medium ( $60.6 \pm 20.4$  BW/s;  $p=0.03$ ) and hard conditions ( $60.3 \pm 20.6$  BW/s;  $p=.04$ ). A significant group X condition interaction was found for knee flexion angle ( $p=0.04$ ). CON runners adjusted knee angle across conditions whereas the INJ runners did not. Hip flexion and ankle flexion angles did not differ between groups or conditions ( $p>.05$ ).

**CONCLUSIONS:** CON runners made kinematic adjustments at the knee that may, in part, account for the observed reduction in VLR during the hard and soft conditions. On the contrary, INJ runners made little kinematic adjustment and displayed higher VLR in the hard condition and lower VLR in the soft condition suggesting that the cushioning properties of the shoe may have aided in the reduction in loading rates. However, since no significant condition X group interaction for VLR was observed, INJ may have made adaptations in other planes of motion. Overall, INJ runners appear to be less adaptable in the sagittal plane to acute changes in midsole hardness.

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2069 Board #115 MAY 31 9:00 AM - 10:30 AM

**Walking On High-heels - A Challenge For Balance**

Tine Alkjaer, Peter Raffalt, Nicolas C. Petersen, Erik B. Simonsen. *University of Copenhagen, Copenhagen N, Denmark.*  
(No relationships reported)

Walking with high-heeled shoes constitutes an unstable condition, which can be hazardous to balance. The human locomotor system is flexible and enables humans to move without falling even under less optimal conditions. This property of the human locomotor control system can be explained by the principle of optimality in movement variability. In this model the movement variability has a deterministic structure reflecting the adaptability of the system to environmental stimuli.

**PURPOSE:** To explore the movement variability of high-heeled walking in order to investigate how the movement behavior of human walking is affected by the unstable condition created by

high-heeled shoes. We hypothesized that the movement variability of high-heeled walking would be characterized by a more complex and less predictable pattern than barefooted walking.

**METHODS:** Eleven female subjects (mean (SD): age: 27.5 (5.4) years, height: 1.70 (0.04) m, body mass: 58.1 (5.1) kg) were exposed to two different walking conditions while they walked at 4.0 km/h on a motor driven treadmill. One condition was barefooted walking while the other was high-heeled walking. In each condition the soleus (SO) H-reflex was elicited by stimulating the tibial nerve every two seconds. Surface EMG was recorded from the SO and tibialis anterior (TA) muscles and the ankle joint position was recorded by goniometry. The movement variability of the ankle joint angle was quantified by calculation of the approximate entropy (ApEn) in the angle joint signal obtained over 60 s of walking.

**RESULTS:** The ApEn of the ankle joint angle was significantly higher ( $p < 0.01$ ) during high-heeled ( $0.38 \pm 0.08$ ) than barefooted walking ( $0.28 \pm 0.07$ ). During high-heeled walking the EMG results showed increased coactivation between the SO and TA muscles prior to heel strike and the H-reflex was significantly increased prior to toe off and in terminal swing by 40% ( $p < 0.01$ ).

**CONCLUSION:** The results confirmed that high-heeled walking was characterized by a more complex and less predictable pattern than barefooted walking. The increase in movement variability during high-heeled walking may very likely reflect that the human locomotor system was more dependent on sensory feedback in the high-heeled condition in order to control balance.

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2070 Board #116 MAY 31 9:00 AM - 10:30 AM

**Foot Orthoses Accelerate Muscle Onset Times In Chronic Ankle Instability Subjects**

Bart Dingenen<sup>1</sup>, Louis Peeraer<sup>2</sup>, Kevin Deschamps<sup>1</sup>, Luc Janssens<sup>3</sup>, Filip Staes<sup>1</sup>. <sup>1</sup>KU Leuven, Leuven, Belgium. <sup>2</sup>Katholieke Hogeschool Kempen, Geel, Belgium. <sup>3</sup>Groep T Leuven, Leuven, Belgium.

(No relationships reported)

**PURPOSE:** Foot orthoses (FO) are widely used to improve function in various lower extremity pathologies, including chronic ankle instability (CAI). The mechanism behind the clinical effectiveness remains unclear. Alterations in neuromuscular control might be important. The purpose of this study was to evaluate the influence of FO on lower extremity muscle activation onset times in subjects with CAI.

**METHODS:** Nine male and 6 female young adults with CAI wearing FO were recruited. Muscle activation onset times of 13 lower extremity muscles were recorded using surface electromyography during the transition from double-leg to single-leg stance, performed with eyes open (EO) and with eyes closed (EC). Both legs were tested in 4 experimental conditions: (1) barefoot (BF), (2) shoes only (SO), (3) shoes with standardized FO (SSFO), and (4) shoes with customized FO (SCFO).

**RESULTS:** Based on a full-factorial (condition-region-leg-vision) linear model for repeated measures, we found a significant condition effect ( $p < 0.0001$ ). Muscle activation onset times in SCFO were significant earlier compared to BF ( $p < 0.0001$ ), SO ( $p = 0.0188$ ) and SSFO ( $p = 0.0191$ ). Differences between conditions did not depend on the leg and/or the vision condition. Based on a two-way (condition-muscle) linear model within each region (ankle-knee-hip), we found significant differences between conditions for peroneus longus ( $p = 0.0001$ ), tibialis anterior ( $p = 0.0048$ ), vastus medialis ( $p = 0.0313$ ) and vastus lateralis ( $p = 0.0018$ ). No significant differences were found for the hip muscles.

**CONCLUSIONS:** Earlier muscle activation onset times were most apparent in the shoes with customized foot orthoses conditions for ankle and knee muscles, but not for hip muscles. These findings might help to better understand how foot orthoses can improve lower extremity function in subjects with chronic ankle instability.

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2071 Board #117 MAY 31 9:00 AM - 10:30 AM

**The Effects of Snowshoe Frame Shape on the Energetics and Kinematics of Snowshoe Walking**

Wayne J. Board, David I. Weber, Raymond C. Browning, FACSM. Colorado State University, Fort Collins, CO.

(No relationships reported)

Snowshoeing is an increasingly popular form of winter physical activity. Modern snowshoes are lightweight and provide traction, flotation and stability. The greater metabolic rate during snowshoeing vs. overground walking may be partly due to altered lower extremity kinematics associated with the extended tail of the snowshoe. Thus, snowshoe frame design may influence metabolic rate and kinematics. However, no studies have simultaneously quantified metabolic rate and biomechanics of snowshoeing to determine the effects of snowshoe frame design.

**PURPOSE:** To determine the effect of snowshoe frame shape on metabolic rate and lower extremity kinematics during level snowshoeing.

**METHODS:** Twelve healthy adult participants,  $26.5 \pm 5.3$  yrs,  $1.72 \pm 0.07$  m,  $67.9 \pm 10.4$  kg, with previous snowshoe experience participated in this study. We measured oxygen consumption via portable indirect calorimetry and lower extremity kinematics via inertial measurement units as participants walked with snowshoes on level packed snow. We tested five different snowshoe frame shapes of equivalent length and mass (1.0kg): one conventional (C) and four with varying degrees of rocker (frame curvature, R). Thus, participants completed five 6-minute trials at a set speed of 1.4m/s. We used a one-way repeated-measures ANOVA to determine if there were significant differences in metabolic rate or kinematics across snowshoe frame shapes.

**RESULTS:** Metabolic rate was similar across snowshoe frame shapes (overall mean  $6.8 \pm 0.7$  W/kg ( $p = 0.199$ )). Walking speed and stride characteristics were similar ( $p > 0.05$ ) across trials: speed,  $1.47 \pm 0.10$  m/s; stride frequency,  $0.93 \pm 0.04$  Hz; stride length,  $1.58 \pm 0.12$  m. When using R vs. C snowshoes, participants walked with greater hip flexion at heel-strike ( $53.9 \pm 1.0$  vs.  $45.4 \pm 0.9$ ,  $p < 0.05$ ) and throughout swing ( $45.1 \pm 0.8$  vs.  $37.8 \pm 0.8$ ,  $p < 0.05$ ), greater knee flexion throughout swing ( $64.2 \pm 1.4$  vs.  $57.1 \pm 1.1$ ,  $p < 0.05$ ), and more dorsiflexed ankle during stance ( $65.4 \pm 0.7$  vs.  $61.1 \pm 1.3$ ,  $p < 0.05$ ) and at toe-off ( $49.9 \pm 0.5$  vs.  $47.9 \pm 1.0$ ,  $p < 0.05$ ).

**CONCLUSION:** Snowshoe frame shape does not affect metabolic rate but does influence lower extremity kinematics. These results suggest that metabolic rate during snowshoeing may be more affected by the mass of the snowshoe than by the frame design.

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## C-30 Free Communication/Poster - Fitness and Performance Testing II

MAY 31, 2012 7:30 AM - 12:30 PM

ROOM: Exhibit Hall

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2072 Board #118 MAY 31 8:00 AM - 9:30 AM

**Reliability and Validity of the Velotron Racermate™ Cycle Ergometer to Measure Anaerobic Power**

Todd A. Astorino, Trisha A. Cottrell. California State University--San Marcos, San Marcos, CA.

(No relationships reported)

The Wingate Test is frequently used by sport scientists to assess anaerobic power using the Monark mechanically-braked cycle ergometer. However, the advent and popularity of electrically-braked cycle ergometers to administer the Wingate Test merits a comparison of Wingate-derived data across ergometers.

**PURPOSE:** This study assessed the reliability and validity of the Velotron Racermate™ cycle ergometer to assess anaerobic power.

**METHODS:** Men (9 cyclists and 13 recreationally-active) and women (17 recreationally-active and 1 cyclist) (age =  $24.7 \pm 4.2$  yr) performed two Wingate tests on the Velotron or three Wingate tests (two on the Velotron and one on the Monark Peak Bike) over a 7 - 14 d period. Peak power, mean power, minimum power, fatigue index, heart rate, and peak and minimum cadence were assessed. Intraclass correlation and coefficient of variation were used to assess test-retest reliability of data obtained on the Velotron, and standard error of measurement and minimum difference were calculated to obtain the typical error. Repeated measures ANOVA was used to identify differences in variables across all trials, and Bland-Altman plots were created to examine measurement agreement between ergometers.

**RESULTS:** Results revealed significant test-retest reliability for mean power ( $r = 0.90$ ,  $p < 0.01$ ), minimum power ( $r = 0.79$ ,  $p < 0.05$ ) and peak power ( $r = 0.70$ ,  $p < 0.05$ ) with repeated bouts on the Velotron. Peak power was significantly higher ( $p < 0.05$ ) on the Velotron ( $9.95 \pm 1.39$  W/kg) versus the Monark ( $9.13 \pm 1.26$  W/kg); however, mean power was higher ( $p < 0.05$ ) on the Monark ( $6.95 \pm 0.89$  W/kg) versus the Velotron ( $6.11 \pm 0.52$  W/kg and  $6.25 \pm 0.59$  W/kg). Although peak and minimum cadence differed ( $p < 0.05$ ), no differences ( $p > 0.05$ ) in fatigue index, heart rate, or minimum power were revealed between ergometers.

**CONCLUSIONS:** Data reveal significant test-retest reliability for Wingate-derived mean and peak power from the Velotron Racermate, yet multiple variables differ between the Velotron and the Monark mechanically-braked cycle ergometer. Overall, determinations of mean or peak power from the Velotron cannot be used interchangeably with those obtained from the Monark mechanically-braked ergometer.

**2073 Board #119 MAY 31 8:00 AM - 9:30 AM**

**Validation of Off-season Physiological Tests with Ski Ranking in Elite Male Junior Cross-Country Skiing**

Magnus Carlsson<sup>1</sup>, Tomas Carlsson<sup>1</sup>, Daniel Hammarström<sup>2</sup>, Johan Granath<sup>3</sup>, Jens Westergren<sup>2</sup>, Christer Malm<sup>1</sup>, Michail Tonkonogi<sup>2</sup>. <sup>1</sup>Dalarna University and Umeå University, Falun and Umeå, Sweden. <sup>2</sup>Dalarna University, Falun, Sweden. <sup>3</sup>Regional Sports Federation of Dalarna, Falun, Sweden. <sup>4</sup>Umeå University, Umeå, Sweden. (Sponsor: Carl Foster, FACSM)  
(No relationships reported)

Validated physiological test provides an important feedback for coaches and athletes. This information is of paramount importance for junior cross-country skiers' which are in an age-stage where the potential training adaptation is great. Physiological tests performed in sport science laboratories are often expensive and time consuming. Hence, there is a need for inexpensive validated off-season physiological tests which can be performed in the skier's daily training environment and therefore repeatable during the year.

**PURPOSE:** To validate off-season physiological test parameters with International Ski Federation's ranking points for distance (FISdist) and sprint (FISsprint) performances as well as create multiple regression models for FISdist and FISsprint.

**METHODS:** Twenty four elite male Swedish junior cross-country skiers (age: 18.5 ± 0.9 years [mean ± SD]) volunteered to the study. Ranking points FISdist and FISsprint were used as performance data (FISdist: 178 ± 90 points; FISsprint: 242 ± 105 points). During a period of three days (June 5-7th 2011) the subjects completed a test battery consisting of six physiological tests: 3 km flat running time trial (TTRun); 2 min all-out double poling on a ski ergometer (DP120); squat jump (SQJ); general strength (sum of completed repetitions for: chins, vertical sit-ups, and dips) (GS); 2 km moderate uphill double poling roller skiing time trial (TTDP) and 2 km uphill diagonal roller skiing time trial (TTDiag). Correlations were established using Pearson's correlation analysis with Bonferroni correction. Regression models were created using standard multiple linear regression analysis. Level of statistical significance was set at  $p < 0.05$ .

**RESULTS:** For FISdist and FISsprint significant correlations were found with TTRun, TTDP and TTDiag (all  $p < 0.05$ ). Regression models found for FISdist and FISsprint consist of TTRun combined with either TTDiag or TTDP explaining from 82 to 73 % of the variance in performance.

**CONCLUSIONS:** When evaluating junior cross-country skiers' performance capacity and training status; outside running and roller skiing time trials are adequate off-season tests. The regression models state that the running and roller skiing tests reflect different physiological abilities important for success in junior cross-country skiing.

**2074 Board #120 MAY 31 8:00 AM - 9:30 AM**

**Validation of a Snorkel Prototype for Measuring Gas Exchange Parameters during Swimming**

Carlo Baldari, FACSM<sup>1</sup>, Ricardo J. Fernandes<sup>2</sup>, João Ribeiro<sup>2</sup>, Marco Meucci<sup>1</sup>, João P. Vilas-Boas<sup>2</sup>, Laura Guidetti<sup>1</sup>. <sup>1</sup>University of Rome "Foro Italico", Rome, Italy. <sup>2</sup>CIF2D, Faculty of Sport, University of Porto, Porto, Portugal.  
(No relationships reported)

To assess  $\text{VO}_2$  in swimming a snorkel device is needed to convey gasses. Toussaint (1987) validated a snorkel device connected to Douglas bag. Conversely, when a snorkel was connected to K4b2 (Cosmed, Rome, IT), the validation studies (Keskinen 2003, Gayda 2010) reported some low systematic differences versus the use of K4b2 with the standard facemask (Mask).

**PURPOSES:** To find a possible explanation of these systematic errors, we detected the air temperature at the turbine to validate a snorkel prototype. Also, the snorkel prototype with 2 (SV2) and 4 (SV4) valves was compared with a Mask connected with K4b2.

**METHODS:** Nine subjects performed trails on a 25m swimming pool and on bike ergometer on separate days at 3 constant loads (low, medium, high). Trails were performed in random order: with SV2 and SV4 while swimming; with Mask, SV4, and SV2 while cycling. Air temperature at the turbine of the K4b2 system was measured at each condition.

**RESULTS:** Considering each parameter [ $\text{VO}_2$ ,  $\text{VCO}_2$ ,  $\text{V}_E$  (table) and also  $\text{V}_T$ ,  $\text{F}_{\text{E}}\text{O}_2$ ,  $\text{F}_{\text{E}}\text{CO}_2$ ] and comparing the different conditions [SV4 vs SV2 both in swimming (table) and cycling, Mask vs SV4, Mask vs SV2 (table)] by Passing-Bablok regression analysis, the 95% CI always contained the value 1 for the slope and the 0 for the intercept, thus rejecting the proportional and the systematic difference hypothesis.

| Parameters                                   | R2    | Slope [95% CI]         | Intercept [95% CI]           |
|--|-------|------------------------|------------------------------|
| <b>SV4 vs SV2 (N = 27, Swimming)</b>         |       |                        |                              |
| $\text{VO}_2$ (mL.min <sup>-1</sup> , STPD)  | 0.991 | 0.995 [0.950 to 1.040] | -12.705 [-119.201 to 81.186] |
| $\text{VCO}_2$ (mL.min <sup>-1</sup> , STPD) | 0.996 | 0.992 [0.965 to 1.022] | 8.227 [-53.300 to 61.519]    |
| $\text{V}_E$ (L.min <sup>-1</sup> , BTPS)    | 0.992 | 0.992 [0.957 to 1.023] | -0.514 [-2.382 to 1.817]     |
| <b>Mask vs SV2 (N = 27, Cycling)</b>         |       |                        |                              |
| $\text{VO}_2$ (mL.min <sup>-1</sup> , STPD)  | 0.994 | 1.001 [0.967 to 1.043] | -6.126 [-90.863 to 56.145]   |
| $\text{VCO}_2$ (mL.min <sup>-1</sup> , STPD) | 0.996 | 1.012 [0.978 to 1.044] | -42.292 [-104.030 to 23.499] |
| $\text{V}_E$ (L.min <sup>-1</sup> , BTPS)    | 0.992 | 1.008 [0.960 to 1.044] | -0.252 [-2.283 to 2.098]     |

**CONCLUSION:** Temperature measure at the turbine is needed since, as erroneously believed by others, the turbine do not have any temperature sensors so that the manufacturer recommends adjusting it to the ambient value when a snorkel is used. We prove that data must be adjusted to the real temperature of expired gases in order to have valid gas exchange values. Also, SV2 and SV4 snorkel were both valid, being the SV2 more comfortable.

**2075 Board #121 MAY 31 8:00 AM - 9:30 AM**

**Upper-body Work Capacity Assessed by Bench Press and Push-up Exercises.**

Alexander W. Purdy, William F. Brechue, FACSM. United States Military Academy, West Point, NY.  
(No relationships reported)

The bench press (BP) and push-up (PU) exercise are used to assess and develop upper-body muscular strength and work capacity.

**PURPOSE:** To compare the BP and PU for assessing upper-body work capacity during performance of repetitions-to-failure (RTF) tests.

**METHODS:** Subjects (n=10; age: 21±2 yr; ht: 177.3±3.4 cm; wt: 84.1±8.4 kg) performed BP one-repetition maximum (1RM) and RTF tests were performed at 0.9, 0.8, 0.7, 0.6 and 0.4 of 1RM BP and at 0.7 body mass (M) to simulate the load of the push-up test. Push-up RTF was also conducted; 2-min Army Physical Fitness Test). Work capacity (WC) was calculated as RTF x load.

**RESULTS:** 1-RM BP was 101±15 kg and 1.18±0.18 expressed per M. RTF and WC were 4.5±2.1 and 425±195 (0.9 RM), 9.5±2.5 and 767±215 (0.8 RM), 13.3±1.4 and 940±240 (0.7 RM), 21.4±2.5 and 1296±237 (0.6 RM), and 54.3±8.0 and 2137±327 (0.4 RM), respectively. At 0.7 M, which corresponded to 0.61±0.09 of 1RM, RTF was 17.3±4.9 and WC was 1039.8±321.1 kg reps. For push-ups, subjects completed 76±14 reps on the 2-min test; WC was 4282±1197 kg reps. There was an exponential relationship between BP RTF and %1RM ( $y=507.1e^{-0.053x}$ ;  $R^2=0.877$ ). WC increased linearly with %RM ( $y=-38.9x+3983$ ;  $R^2=0.772$ ). 1RM BP and push-up RTF were moderately correlated ( $r=0.783$ ).

**CONCLUSIONS:** The 2-min push-up test appears to represent upper-body muscular strength determined by the 1RM; however, WC at 40% 1RM BP appears to better indicate push-up WC than the 0.7 M model.

2076 Board #122 MAY 31 8:00 AM - 9:30 AM

**Intrasession Reliability and the Relationship Between the Explosive Bench Press and Medicine Ball Chest Pass Assessments of Upper Extremity Power**

Jayne D. Eitner, G Ken Limbaugh, George J. Davies, Bryan L. Riemann. *Armstrong Atlantic State University, Savannah, GA.* (Sponsor: T. Jeff Chandler, FACSM)  
(No relationships reported)

The bench press throw and explosive bench press (EBP) test have recently received increased attention; however, both of these tests require specialized apparatus and instrumentation which limits their utilization in many settings. Medicine ball chest pass (MBCP) distance is a field test that also attempts to measure upper extremity power, however the optimal load has not been established.

**PURPOSE:** To determine the relationship between EBP peak power and MBCP test distance using 2kg, 3kg and 4kg loads and to determine the intrasession reliability of both tests.

**METHODS:** Twenty-seven healthy collegiate-level baseball players (20.5±1.5yrs; 1.82±0.06m; 84.7±8.7kg) performed three MBCP trials using 2kg, 3kg, and 4kg MB loads. Instructions were given to hold medicine ball at shoulder level with feet shoulder width apart and knees straight, and to press the MB for maximal distance without countermovement. Initial impact sites of each trial determined distance. For the EBP trials, a standard 16kg barbell was loaded with and additional 14kg. Each subject was allowed a warm-up of 8 repetitions. Subjects then performed three maximum velocity bench press trials. An electromagnetic sensor (Motion Monitor, IST, Inc) offset from the bar with PVC pipe determined bar displacement. Displacement was then used to determine velocity, when coupled with the bar mass, provided power across each repetition. Both peak power and MBCP distance were averaged across three trials.

**RESULTS:** Strong intrasession reliability was revealed for the bench press and MBCP tests (ICC range=.933 to .977) Although correlational coefficients for 3kg (r=.647, 95% CI=.355 to .824) and 4kg (r=.612, 95% CI=.303 to .804) loads were slightly higher than 2kg (r=.482, 95% CI=.135 to .728) there was no significant difference between the three coefficients (P>.05).

**CONCLUSIONS:** Both the EBP and MBCP tests had strong intrasession reliability. If the EBP test is not feasible, then the slightly stronger relationships support using the 3kg or 4kg loads for the MBCP test as an alternative method of assessing upper extremity power. It should be recognized that although statistically significant, the relationships revealed were only moderate strength, suggesting that the tests may be measuring different aspects of upper extremity power.

2077 Board #123 MAY 31 8:00 AM - 9:30 AM

**Determination and Validation of Maximal Aerobic Speed**

Nidhi Gupta<sup>1</sup>, Govindasamy Balasekaran, FACSM<sup>1</sup>, Visvasuresh Victor Govindaswamy<sup>2</sup>, Naveen Agrawal<sup>3</sup>. <sup>1</sup>National Institute of Education, Nanyang Technological University, Singapore, Singapore. <sup>2</sup>Texas A&M University, Texarkana, TX. <sup>3</sup>GE Water & Process Technologies, John F. Welch Technology Centre, Bangalore, India.  
(No relationships reported)

Maximal aerobic speed (MAS) is usually determined at the velocity at VO<sub>2max</sub> (vVO<sub>2max</sub>). However the accuracy may be questioned since MAS at vVO<sub>2max</sub> elicits a higher amount of anaerobic energy.

**PURPOSE:** To determine and validate the criteria of MAS at a speed which elicits maximal and minimum contribution of aerobic and anaerobic energy.

**METHODS:** 9 sprint trained (ST) (age = 26.89±9.39 yrs, BMI = 23.09±2.07 kg•m<sup>-2</sup>) and 12 endurance trained (ET) (age = 31.67±7.24 yrs, BMI = 21.34±1.27 kg•m<sup>-2</sup>) athletes participated to determine MAS. 19 healthy participants (age = 29.74±8.31 yrs, BMI = 22.01±2.12 kg•m<sup>-2</sup>) were also selected to validate the criteria of MAS. To determine MAS, athletes performed four to five treadmill sessions as follows: Astrand modified running test, submaximal discontinuous test, VO<sub>2</sub> till exhaustion (T<sub>lim</sub>) test at vVO<sub>2max</sub> and Vsub%95 [vΔ50 (median of vVO<sub>2max</sub> and velocity at lactate threshold; vLT) or vΔ50+5%vVO<sub>2max</sub>]. To validate the criteria of MAS, participants also performed T<sub>lim</sub>MAS. Using the hyperbolic non linear relation, MAS was determined at its duration (MAS<sub>dur</sub>) which was calculated by eventually adding the T<sub>lim</sub>VO<sub>2max</sub> converted in T<sub>lim</sub>Vsub%95 using the following equations: T<sub>lim</sub>VO<sub>2max</sub> converted (s)=(T<sub>lim</sub>VO<sub>2max</sub>vVO<sub>2max</sub> \* vVO<sub>2max</sub>)/Vsub%95, MAS<sub>dur</sub>=T<sub>lim</sub>Vsub%95-(T<sub>lim</sub>VO<sub>2max</sub> converted).

**RESULTS:** The MAS was at 92.45±1.47%vVO<sub>2max</sub> and 89.27±3.56%vVO<sub>2max</sub> among ET and ST cohorts, respectively. The ET athletes achieved significantly (p<.001) higher MAS (16.07±1.58km•h<sup>-1</sup>) at shorter duration (MAS<sub>dur</sub> = 678.59±165.44s, p<.05) than ST athletes (MAS=12.77±.81km•h<sup>-1</sup>; MAS<sub>dur</sub>=840.28±164.97s). To validate the criteria of MAS, the oxygen uptake at MAS (50.69±4.69ml•kg<sup>-1</sup>•min<sup>-1</sup>; 96.08±2.51%VO<sub>2max</sub>) was not significantly (p≥.05) different from 95%VO<sub>2max</sub> among all participants. The blood lactate (mmol•L<sup>-1</sup>) at MAS (7.80±1.52) was significantly (p<.01) lower than at vVO<sub>2max</sub> (9.11±2.50) and VO<sub>2max</sub> (8.59±1.62).

**CONCLUSION:** The determination of MAS required a subtraction of T<sub>lim</sub>VO<sub>2max</sub> converted from T<sub>lim</sub>Vsub%95 as it eliminated some anaerobic energy contribution. In addition, MAS may be more accurate if measured at %vVO<sub>2max</sub> and not at vVO<sub>2max</sub>. The MAS at 91.08%vVO<sub>2max</sub> among athletes may be accurate as it represents maximal aerobic energy with minimal contribution from anaerobic energy sources.

2078 Board #124 MAY 31 8:00 AM - 9:30 AM

**Specific Critical Interval Test Can Determine The Aerobic Capacity In Karate**

Ramon M. Oliveira<sup>1</sup>, Cleiton A. Libardi<sup>2</sup>, Fúlvia B. Manchado-Gobatto<sup>1</sup>. <sup>1</sup>Methodist University of Piracicaba - UNIMEP, Piracicaba, Brazil. <sup>2</sup>University of Sao Paulo - USP, Sao Paulo, Brazil.  
(No relationships reported)

Karate training consists of many repetitions of short sequences (bursts techniques and hopping movement) interrupted by a recovery periods (Ravier et al., 2009) and depends to aerobic and anaerobic conditioning. The critical power model (Monod & Scherrer, 1965) was adapted for different sports to estimate the aerobic capacity, but still not was used in karate.

**PURPOSE:** To adapt the non-invasive critical power model to karate, using the interval recovery between punch sequences to determine the aerobic capacity of athletes (critical interval - CI) and compare these results to the maximal lactate steady state intensity (MLSSi).

**MATERIAL AND METHODS:** Twelve well trained karate athletes (6 men and 6 women; 26 ± 2 yrs) were submitted to five tests at different intensities, separated by 24 hrs. In each test, the athletes accomplished guyaku-zuki sequence until exhaustion, with active hopping movement between the sequences. The intensities were imposed based on interval recovery between punch sequences (2 to 6 seconds) expecting the exhaustion to occur between 1 and 10 min. The linear "interval versus 1/time to exhaustion" model was used to determine the CI (y-intercept). In order to verify the MLSS, the athletes were submitted to 30 min of continuous exercise at three random intensities (10% below of CI, CI and 10% above of CI), with blood lactate concentration (BLC) determined at each 5 min.

**RESULTS:** The results are expressed in mean ± SEM. The CI was obtained at 16.7±2.9s, with significant linear fit (R<sup>2</sup> = 0.95±0.01). In continuous exercise below CI (higher interval), all athletes presented BLC stabilization (2.24 ± 0.36 mM). The same results occurred at CI intensity. In higher intensity (shorter interval), there was a progressive increase in BLC. The MLSS was observed at CI for 75% of athletes, with BLC stable at 3.59 ± 0.44 mM.

**CONCLUSION:** The specific critical interval test can determine the aerobic capacity of karate athletes considering that there was MLSS at this intensity.

Monod H, Scherer J. (1965). *Ergonomics* 8, 329-38.

Ravier G et al. (2009). *Scand J Med Sci Sports* 19. 687-694.

2079 Board #125 MAY 31 8:00 AM - 9:30 AM

**Validity of a Vertical Jump Mat for Determining Vertical Jump Height**

Charles M. Forsythe. *University of Kansas, Boise, ID.*  
(No relationships reported)

Vertical jump (VJ) height is related to athletic performance and is a common test for coaches and personal trainers. Several devices are available to measure VJ height.

**PURPOSE:** To determine the validity of a VJ mat used for measuring flight time, when compared to VJ heights using either a Vertec VJ tester or a force plate.



**METHODS:** 17 men and 18 women (age = 20.9±0.7 yrs., ht. = 176.1±0.9 cm, wt. = 72.6±13.5 kg) served as subjects. Subjects performed counter-movement vertical jumps (CMVJ) standing on a uni-directional force plate (Rough Deck, Rice Lake, WI) sampling at 1000 Hz (BioPac Systems, Goleta, CA), and a VJ mat (Probotics Inc., Huntsville, AL). Each subject reported for a familiarization session followed by one test session. Standing reach was assessed using a one-arm reach with both feet flat on the ground. During VJ testing session, subjects performed three to seven CMVJ, with the best jump recorded for statistical analysis. One-way ANOVAs with Scheffe post-hoc tests were used to determine differences between VJ measures (i.e., jump mat, force plate flight time). An independent t-test was used to compare flight times between the force plate and the VJ mat. Linear regression was used to establish explained variances ( $r^2$ ) and agreement between the VJ mat data and the criterion measures from the force plate ( $p < 0.05$ ).

**RESULTS:** A significant correlation was observed between flight time measured from the force plate and the VJ mat ( $r = 0.99$ ). When compared to the force plate, the VJ mat revealed greater values in VJ height (VJ mat = 0.50±0.12 m, force plate = 0.34±0.10 m) and flight time (VJ mat = 0.629±0.078 s, force plate = 0.524±0.077 s).

**CONCLUSION:** The VJ mat compared favorably with the Vertec but not the force plate. This is to be expected since the force plate determines changes in center of mass, not VJ reach. The resulting regression equations suggest further study on high performance athletes may be warranted since jump height may be underestimated at high performance.

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**2080** Board #126 MAY 31 8:00 AM - 9:30 AM

### Accuracy, Validity And Reliability Of GPS-Technology Within Selected Sprint Running Speeds

Margot Niessen, Elisabeth Hohmann, Vanessa Martinez Lagunas, Mario Hermsdorf, Ulrich Hartmann. *Faculty of Sport Science, Universität Leipzig, Leipzig, Germany.* (Sponsor: Ralph Beneke, FACSM)

(No relationships reported)

During the last decade novel innovative technologies provide tools to monitor running velocity ( $v_{run}$ ) continuously. For outdoor running purposes light weight portable global positioning systems (GPS) have been developed.

**PURPOSE:** The study aimed to assess the accuracy of the GPS device and its reliability and validity under different sprint running speed conditions.

**METHODS:** Within a study relating GPS technology ( $n=10$  female competitive athletes (S1): 20±5 yrs, 162±5 cm, 59±6 kg;  $n=10$  male competitive athletes (S2): 25±3 yrs, 182±6 cm, 81±6 kg) the physical performance during altered running events on a track (S1: 3x70 m & 2x400 m, range  $v_{run}$ : 4.5-7.1 m/s; S2: selected sprints between 20-300 m ( $n=62$ ), range  $v_{run}$ : 6.4-9.3 m/s) was captured and analysed. Therefore the GPS sensor system, placed in the upper back, operated and collected the position data with 5 Hz, reaching 9.0±1.1 satellites simultaneously. Additionally a single light beam system and a digital measuring wheel were used as gold standard for completed distance and time. Descriptive and group-specific parametric statistical data analysis was applied.

**RESULTS:** The mean GPS distance divergence in S1 against reference constant value of the 70 m sprint was 67.8±2.1 m (-3.1 %;  $p \leq 0.001$ ), the reliability was good (coefficient of variation 3.1 %;  $p \leq 0.483$ ). Over sprint splits and 400 m in S1 the underestimation of GPS grows up to 3.5 % (-14.8 m). The non-linear curve error was less than 0.0003 m into 400 m and therefore negligible. In S2 mean GPS results showed distance deviations for short sprint runs (< 50 m,  $v_{run}$ : 7.5±0.6 m/s) of -0.7±2.2 % ( $n=20$ ), for sprints between 50 m and < 100 m ( $v_{run}$ : 8.4±0.4 m/s) of -0.2±1.0 % ( $n=19$ ) and for sprints  $\geq 100$  m until 300 m ( $v_{run}$ : 8.3±0.5 m/s) of -0.1±0.6 % ( $n=23$ ).

**CONCLUSIONS:** The GPS receivers are a valid and reliable method of measuring distance at sprinting intensities in both studied groups. The GPS device showed a good reproducibility (S1) and accuracy of measured distance for sprinting speeds (>6 m/s) in S2. Due to some weaknesses (e.g. quality and frequency of signal reception) the GPS-distance was underestimated in short sprints and somewhat less in longer sprints (> 100 m). Within exercise science, the use of GPS can assist field research even at higher movement intensities into exercise physiology, metabolism, and biomechanics.

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**2081** Board #127 MAY 31 8:00 AM - 9:30 AM

### A New Utility Of Breath-holding Maneuver To Determine Resting Heart Rate

Flávio A. Lemos, Vanessa P. Frias, Tony M. Santos. *Gama Filho University, Rio de Janeiro, Brazil.*

(No relationships reported)

**PURPOSE:** The precise determination of resting heart rate (RHR) is very important for exercise testing and prescription based on reserve method. Traditionally, RHR is determined after a minimum of 5-min rest. Many researchers have investigated the heart rate variability under breath-holding maneuver. However, this procedure has not been used to determine RHR. The aim of this study was to use breath-holding maneuver to predict RHR with and without controlled breathing.

**METHODS:** Eighteen healthy subjects (nine male) 27.6 ± 5.0 year; 24.2 ± 2.9 kg·m<sup>-2</sup>; 43.3 ± 7.5 mL·kg<sup>-1</sup>·min<sup>-1</sup> (estimated) performed the breath-holding maneuver twice. The duration of maneuver was 10 s with a 1 min recovery between trials. After that, the subjects have been laying rest under two experimental situations: a) with respiratory controlled of 7.5 breaths·minute<sup>-1</sup> and b) without respiratory controlled. In both conditions, heart rate (HR) subjects were continuously monitored in milliseconds (POLAR RS800, USA). The lower HR observed at each experimental condition were utilized for further analysis (One-way ANOVA, Bland-Altman plot and regression analysis).

**RESULTS:** The subject's HR after breath-holding maneuver (57 ± 9 bpm) and rest laying with (54 ± 8 bpm) and without (56 ± 8 bpm) respiratory controlled has not been significant different ( $p < 0.05$ ). The Bland-Altman plot showed a 95% limit of agreement between -9.12 to 4.12 bpm and -8.89 to 8.89 when laying with and without respiratory controlled, respectively. The linear regression showed the high relationship between the RHR in respiratory controlled to breath-holding maneuver ( $r^2 = 0.848$ ; CI 95% 0.684 to 1.080, SEE 3 bpm) and lower relationship between the RHR without in respiratory controlled ( $r^2 = 0.684$ ; IC 95% 0.489 to 1.039 in 95%, 4 bpm).

**CONCLUSION:** Our results support the present approach as a substitute strategy to determine RHR in a procedure with 2 min long.

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**2082** Board #128 MAY 31 8:00 AM - 9:30 AM

### Self- And Observer-rated Talk Test For Exercise Prescription Versus Free Exercise Training

Christian Thiel<sup>1</sup>, Carl Foster, FACSM<sup>2</sup>, Lutz Vogt<sup>1</sup>, Katharina Schmidt<sup>1</sup>, Andreas Bernardi<sup>1</sup>, Frieder Krause<sup>1</sup>, Winfried Banzer<sup>1</sup>. <sup>1</sup>Goethe-University, Frankfurt, Germany. <sup>2</sup>University of Wisconsin, La Crosse, WI.

(No relationships reported)

**PURPOSE:** Tools for exercise prescription need to be simple, economic and adequately precise to find widespread application. The Talk Test appears to be a simple way of achieving recommended exercise intensities. However, the relationship of Talk Test-based exercise prescription and intuitively selected exercise intensity has not been studied, and it is unclear whether instead of the subject, an outside observer could also rate appropriate intensity. The present study compared exercise intensities derived from an internal and an external rating of the Talk Test with self-selected exercise intensity and a reference intensity at the MaxLass.

**METHODS:** Fifteen well-trained subjects (5 f, 10 m; 24.9±2.4 yrs; 23.2±2.2 kg·m<sup>-2</sup>; VO2max 50.6±5.6 mL·kg<sup>-1</sup>·min<sup>-1</sup>; 7.1±4.1 hrs of exercise/wk) performed a self-paced training session for 30 minutes, a Talk Test incremental treadmill protocol, and separate MaxLass tests. During the last 20 seconds of each stage of the Talk Test, subjects recited a standard text and were asked if they could speak comfortably. Concomitantly, an observer recorded his impression of the subject's level of speech comfort.

**RESULTS:** Last positive Talk Test (LP TT), free pace, first equivalent TT (EQ TT) and first negative TT (N TT) equalled 82±14%, 92±10%, 94±13% and 109±14% of MaxLass (12.1±1.4 km/h), based on subject rating. Compared to free pace, 95%CI of differences indicated that LP TT tended to be slower (-19%;0%), while EQ TT was not different (-6%;+12%), and N TT was faster (+10%;+29%). Observer rating did not systematically differ from subject rating at LP TT (95% CI: -14%;+4%), at EQ TT (-11%;+3%) and at N TT (-6%;+4%).

**CONCLUSIONS:** When non-competitive athletes can speak comfortably, they are running well below MaxLass velocity, and still slower than in a short free-paced exercise bout. If they cannot speak comfortably, athletes are exercising slightly above MaxLass and far above intuitively-paced exercise. No consistent bias occurred whether the subject or an outside observer rated the Talk Test, suggesting that it may also be a useful tool for coaches to prescribe exercise intensity with minimal athlete burden. The Talk Test should be further tested in physically active and inactive healthy subjects, as well as in clinical populations.

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**2083** Board #129 MAY 31 8:00 AM - 9:30 AM

**Ability of an Incremental Field Test to Evaluate Aerobic Capacity on Young Male Athletes**

Luis M. Gómez-Miranda<sup>1</sup>, Claudia E. Carrasco-Legleu<sup>2</sup>, Ofelia Urita<sup>2</sup>, Lidia G. De Leon<sup>2</sup>. <sup>1</sup>University of Baja California, Tijuana, B.C., Mexico. <sup>2</sup>University of Chihuahua, Chihuahua, Chih., Mexico.  
(No relationships reported)

Field tests have been recognized as an economical, practical and feasible way to determine performance in athletes; however, to be valid in terms of maximal aerobic capacity, workloads should be incremental and progressive, as ergometric tests. Maximal oxygen uptake (VO<sub>2</sub>max) is a widely used parameter to determine aerobic capacity and specific to validate field tests, but its direct measurement is difficult, unpractical and expensive. Heart rate maintains a direct relationship with oxygen uptake, is a very sensitive variable and technically easier and practical to evaluate the effort.

**PURPOSE:** To determine the ability of the 20-meters Multistage Shuttle Run field test (20mMST) to evaluate the aerobic capacity of elite male athletes, using the heart rate as an indicator of the performance.

**METHODS:** Ten male athletes 18 to 31 years old, from two elite aerobic sport groups, were measured by height, weight and body mass index (BMI). Each participant performed two different maximal stress tests: a progressive shuttle run field test and an ergometric treadmill test. Oxygen uptake (VO<sub>2</sub>) was directly obtained during treadmill protocol, or calculated from the charts provided by the field test. Heart rate (HR) was measured by a telemetric device in both tests. Parameters were recorded every minute. Descriptive statistics, linear regression and Pearson coefficient correlation at a p<0.05 significance level were used.

**RESULTS:** Athletes were 22.6 ± 4.3 years old and 21.2 ± 2.2 kg/m<sup>2</sup> of BMI. VO<sub>2</sub>max was higher in treadmill (65.4 ± 6.4 mL.kg<sup>-1</sup>.min<sup>-1</sup>) than in 20mMST (54.3 ± 5.9 mL.kg<sup>-1</sup>.min<sup>-1</sup>), p=0.002. Maximal HR was similar in ergometric than in field test (188.6 ± 9.3 vs 190.0 ± 9.0 beats/min respectively, p=0.743). Linear regression showed a different but directly proportional relationship of HR to VO<sub>2</sub> in treadmill (y = 2.332x + 43.07, R<sup>2</sup> = 0.874 P <0.001) compared with 20mMST (y = 1.339 + 115.7, R<sup>2</sup> = 0.987 P <0.001), evidencing a higher work in ergometric protocol. A high correlation of HR between tests was observed (r = 0.978, R<sup>2</sup> = 0.957, P <0.001).

**CONCLUSIONS:** 20mMST is a valid test to determine aerobic capacity in athletes demonstrated by the similar increment of HR in both protocols. Nevertheless, the higher work evidenced in ergometric test, may suggest that 20mMST underestimates the VO<sub>2</sub> value for each level of effort.

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**2084** Board #130 MAY 31 8:00 AM - 9:30 AM

**Validity and Reliability of an Audio Headset Earbud Sensor for Heart Rate Measurements During Exercise**

Meir Magal, FACSM<sup>1</sup>, L Chris Eschbach<sup>1</sup>, Rebekah J. Cain<sup>1</sup>, Jen Bunn<sup>2</sup>. <sup>1</sup>North Carolina Wesleyan College, Rocky Mount, NC. <sup>2</sup>Campbell University, Buies Creek, NC.  
(No relationships reported)

Heart rate (HR) measurement during exercise plays a pivotal role in the determination of exercise intensity. Commonly, such a measure requires the use of a chest strap which could be perceived by some as uncomfortable and somewhat invasive. Earbud technology using light sensing algorithms (earbud sensor) for the measurement of HR would eliminate the need for the chest strap.

**PURPOSE:** To assess the validity and reliability of the earbud sensor for measurement of HR during indoor exercise.

**METHODS:** Forty participants (21 males, 19 females, age = 29.7 ± 10.6 yr, height = 171.8 ± 9.7 cm, weight = 76.5 ± 13.2 kg, BMI = 25.9 ± 3.7 kg·m<sup>-2</sup>) completed two identical trials, 14 days apart, consisting of a 15.5 minutes of sitting, standing, walking and running on the treadmill. Throughout the trials, HR was monitored and recorded using an earbud sensor and a twelve lead ECG. HR data was collected and computed at a recording interval of 5-seconds (7440 data points).

**RESULTS:** A significant positive correlation (P < 0.001) was observed between the earbud sensor and the twelve leads ECG. Bland-Altman analysis demonstrated that 7070 earbud data points (95.0%) were within a 95% confidence interval. The earbud sensor reliability was determined using 35 subjects by way of intraclass correlation coefficients (ICC([3,1]) >0.9) indicating a strong level of reliability.

**CONCLUSION:** The results of the study demonstrated that the earbud sensor is a valid and reliable instrument for the measurements of HR during various activities ranging from sitting quietly to jogging on the treadmill. Further, the earbud sensor may be used effectively during rest and exercise as an alternative to ECG or chest strap monitors.

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**2085** Board #131 MAY 31 8:00 AM - 9:30 AM

**Intra-session And Inter-session Reliability Of A Modified Trunk Rotation Flexibility Test**

Laura H. Moore, Bryan L. Riemann, George J. Davies. *Armstrong Atlantic State University, Savannah, GA.*  
(No relationships reported)

While trunk rotational flexibility is an important measure of functional flexibility in active populations, many tests measuring rotational flexibility are hard to implement or require specialized instrumentation/training. Previous research established the reliability of a protocol to measure active rotation in standing using minimal instrumentation. To minimize contribution of hip rotation to rotational flexibility when standing, a seated protocol was developed to isolate and measure trunk rotation flexibility.

**PURPOSE:** To examine the intra- and inter-session reliability of a seated trunk rotation flexibility test and determine whether bilateral differences exist between rotation towards the dominant (D) and non-dominant (ND) limbs.

**METHODS:** 20 recreationally-active adults (10 males, 10 females; 33.4±8.3 yrs, 1.6±.1 m, 73.2±13.3 kg) performed three maximal seated trunk rotations each to D and ND sides. Subjects were seated on a backless chair with a metal rod held across the back of the shoulders. Subjects were encouraged to rotate as far as possible without shifting their hips. At maximal rotation, the rod was leveled and using a plumb bob, the location was marked on the floor. The angle of rotation was later measured using a long-arm goniometer. Subjects repeated the protocol 30 minutes later. Intraclass correlation coefficients (ICC, 2,k) and the standard error of measure (SEM) were calculated across the three repetitions in each direction for intra-session and across the average of the two sessions for intersession reliability. An independent t-test was used to compare D versus ND rotation.

**RESULTS:** Intra-session ICC and SEM were .960 and 2.32° for ND, and .950 and 2.41° for D, respectively. Inter-session ICC and SEM were .876 and 4.05° for ND and .922 and 3.02° for D, respectively. No significant differences were noted between D and ND rotation (P=.294) with additional analyses demonstrating equal numbers of subjects having greater rotation in each direction (D, ND).

**CONCLUSIONS:** The seated trunk rotation flexibility test is a reliable way to assess trunk rotational flexibility in an active population. Because minimal instrumentation or time is required, it is an ideal assessment for practitioners needing a reliable tool to assess isolated trunk rotational flexibility in patients or athletes.

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**2086** Board #132 MAY 31 8:00 AM - 9:30 AM

**Intra- And Inter- Day Reliability Of Rasterstereography**

Valerio Bonavolontà, Alessandro Tito, Maria Chiara Gallotta, Carlo Baldari, FACSM, Laura Guidetti. *University of Rome "Foro Italico", Rome, Italy.*  
(No relationships reported)

The Formetric 4D allows the tridimensional evaluation of the spine through rasterstereographic analysis of the back surface. It is used in follow-up to verify the effectiveness of a therapy, allowing a reduction of x-ray exposition.

**PURPOSE:** To determine the intra-day and inter-day reliability of Formetric 4D with and without markers.

**METHODS:** 50 healthy volunteers (age 22 ± 2) were divided in two groups: one group (M, n= 26) had two markers manually placed by the same expert in correspondence of vertebra prominens (VP) and of the rima ani (SP), while the other group (NM, n=24) was assessed without markers. All participants were analyzed in Average 4D modality two times in the same day, two hours apart each other, and one more time on a separate day, one week apart. Subjects were asked to not perform any physical activity before the evaluations. The following parameters were measured: Trunk length VPDM, Kyphotic angle (ICT-ITL max), Lordotic angle (ITL-ILS max), Pelvic inclination, Kyphotic and Lordotic Apex, Right and Left Lateral deviation VPDM,

Cervical and Lumbar fleche, Trunk imbalance (° and mm), Pelvic tilt (° and mm), Pelvic inclination-dimples, Inflection point ITL and ILS, Rotation correction-pelvis, Right and Left Surface rotation, Pelvic torsion DL-DR (°), Trunk torsion. Intraclass correlation coefficient (ICC) and Cronbach  $\alpha$  were calculated.

**RESULTS:** In M group, for intra-, inter-day, and overall evaluations the higher reliability coefficients were 0.971, 0.963, 0.958 (for ICC) and 0.987, 0.983, 0.985 (for Cronbach  $\alpha$ ) respectively; while in NM group were 0.978, 0.982, 0.972 and 0.989, 0.991, 0.991; in M group ICC and Cronbach  $\alpha$  lower values were 0.958, 0.515, 0.534 and 0.742, 0.682, 0.784 respectively, while in NM group 0.561, 0.537, 0.461 and 0.731, 0.695, 0.729.

**CONCLUSION:** Highest values for both ICC and Cronbach  $\alpha$  were found for unvariant parameters i.e. not dependent on the subject's positioning respect to the machine. The reliability of most of parameters was excellent, it was also found an acceptable reliability even for the lowest values, both with and without markers.

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**2087** Board #133 MAY 31 8:00 AM - 9:30 AM

**Validating The Adidas Micoach For Estimating Pace, Distance, And Energy Expenditure During Outdoor Over-ground Exercise**

Justin P. Porta, Angelica N. Lehker, Derek J. Acosta, Sean T. Miller, Joe Tomaka, George A. King. *The University of Texas at El Paso, El Paso, TX.*

(No relationships reported)

The Adidas miCoach was developed as a personal training system to estimate pace, distance and energy expenditure (EE) but has yet to be validated.

**PURPOSE:** To validate the Adidas miCoach for estimating pace (min/km), distance (km) and EE (kcal/min) during outdoor over-ground walking and running for two different sensor configurations.

**METHODS:** Six male and 8 female moderately endurance trained participants (mean  $\pm$  SD age: 28.2  $\pm$  8.5 y; height: 167.4  $\pm$  7.8 cm; mass: 60.9  $\pm$  11.1 kg; VO<sub>2max</sub>: 54.4  $\pm$  5.5 mL/kg/min) completed this validation study. The protocol consisted of walking at 53.6, 80.4, and 107.2 m/min and running at 134.0, 160.8, 187.6, and 214.0 m/min on an outdoor track while wearing a portable metabolic measurement unit (Cosmed K4b<sup>2</sup>). A miCoach sensor was attached to the right shoelaces (Laces) and a second miCoach sensor was inserted in the right insole of the shoe (Midsole). Estimated pace, distance and EE were compared to values determined by criterion methods (Actual). Data were analyzed using a repeated-measure ANOVA (pace, distance) or ANCOVA (EE) to evaluate significant differences.

**RESULTS:** A significant main effect ( $P < 0.035$ ) was observed for speed indicating an increase in measured values at each subsequent speed for pace, distance, and EE. For pace at all speeds, the laces and midsole miCoach estimated pace were significantly different from each other ( $P < 0.01$ ), and from actual pace ( $P < 0.02$ ). For distance, the laces and midsole miCoach estimates were similar for all speeds; however, significant differences were observed for the midsole at 53.6 m/min ( $P = 0.003$ ) and for both laces and midsole at 80.4 and 107.2 m/min ( $P \leq 0.05$ ) compared to actual distance. For walking speeds, miCoach estimated EE was significantly different between laces and midsole ( $P < 0.04$ ), and compared to actual EE ( $P < 0.001$ ); however, midsole at 160.8 m/min ( $P = 0.035$ ) and both laces and midsole at 187.6 and 214.4 m/min ( $P < 0.01$ ) were significantly different from actual EE.

**CONCLUSION:** These data indicate that the Adidas miCoach is accurate for estimating distance. However, it lacks the ability to accurately estimate pace and EE across a range of walking and running speeds. Additionally, it appears that the laces configuration produced more accurate estimates than the midsole.

Partially supported by UTEP CHS graduate enhancement funds.

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**2088** Board #134 MAY 31 8:00 AM - 9:30 AM

**Validating The Nike+ Sport Kit For Estimating Pace, Distance, And Energy Expenditure During Treadmill Exercise**

Derek J. Acosta, Sean T. Miller, Justin P. Porta, Angelica N. Lehker, Joseph W. Tomaka, Rebecca J. Reed-Jones, George A. King. *The University of Texas, El Paso, TX.*

(No relationships reported)

The Nike+ Wireless Sport Kit was developed to allow athletes of all skill levels to observe their pace, distance, and energy expenditure during walking or running.

**PURPOSE:** To validate the accuracy of the Nike+ Wireless Sport Kit to estimate pace (min/km), distance (km), and energy expenditure (EE) (kcal/min) during treadmill walking and running, and for two different sensor configurations.

**METHODS:** Nine male and 9 female moderately endurance trained volunteers (mean  $\pm$  SD age: 28.83  $\pm$  1.90 y; height: 168.72  $\pm$  1.86 cm; body mass: 62.19  $\pm$  2.58 kg; VO<sub>2max</sub>: 54.36  $\pm$  1.15 mL/kg/min) completed a) a maximal oxygen consumption test and b) the Nike+ validation protocol comprised of level treadmill walking at 53.6, 80.4, and 107.2 m/min, and level treadmill running at 134.0, 160.8, 187.6, and 214.0 m/min. A Nike+ unit was attached to the left shoelaces and a second unit was placed within the left midsole of a compatible shoe. Nike+ estimated pace, distance, and EE were compared to actual values determined by criterion methods. Data were analyzed by conducting two repeated-measures ANOVAs, and one repeated-measures ANCOVA.

**RESULTS:** Each subsequent treadmill speed elicited a significant increase in pace ( $P \leq 0.037$ ), distance ( $P < 0.001$ ), and EE ( $P \leq 0.020$ ). The Nike+ significantly overestimated pace ( $P \leq 0.034$ ) and distance ( $P \leq 0.005$ ) at walking speeds (53.6 and 80.4 m/min) by 23% and 9%, respectively; and significantly underestimated pace ( $P \leq 0.034$ ) and distance ( $P \leq 0.005$ ) at higher running speeds (160.8, 187.6, and 214.0 m/min) by 6% (pace only - laces), 10% and 15%, respectively. Compared to the criterion indirect calorimetry, the Nike+ significantly underestimated EE ( $P \leq 0.022$ ) by 24%, 10%, and 12% for 107.2, 187.6 and 214.0 m/min, respectively. There appears to be no marked difference between the laces and midsole sensor configurations for pace, distance, or EE.

**CONCLUSION:** Compared to actual, estimates of EE were most accurate; speculating that the device's prediction equation is more suited for estimating EE. The sensor configuration affixed to the laces is a viable alternative to that of purchasing a Nike+ compatible shoe.

Partially supported by UTEP CHS graduate enhancement funds.

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**2089** Board #135 MAY 31 8:00 AM - 9:30 AM

**Validating The Adidas miCoach For Estimating Pace, Distance, And Energy Expenditure During Treadmill Exercise**

Sean T. Miller, Derek Acosta, Angelica Lehker, Justin Porta, George King. *University of Texas at El Paso, El Paso, TX.*

(No relationships reported)

The use of accelerometry based physical activity monitors among recreational athletes to meet or exceed recommended physical activity guidelines has grown in popularity. In the interest of capitalizing on this demand, Adidas developed the miCoach Pacer System which allows the user to observe pace, distance, and energy expenditure during walking or running.

**PURPOSE:** To validate the accuracy of the Adidas miCoach activity monitor in estimating energy expenditure (EE) (kcal/min), pace (min/km), and distance (km) during treadmill walking and running, and for two different sensor configurations.

**METHODS:** Nine male and 9 female

moderately endurance trained volunteers (mean  $\pm$  SD age: 28.83  $\pm$  1.90 y; height: 168.72  $\pm$  1.86 cm; body mass: 62.19  $\pm$  2.58 kg; VO<sub>2max</sub>: 54.36  $\pm$  1.15 mL/kg/min) completed a maximal oxygen consumption test, and the miCoach validation protocol comprised of level treadmill walking at 53.6, 80.4, and 107.2 m/min, and level treadmill running at 134.0, 160.8, 187.6, and 214.0 m/min. A miCoach unit was attached to the right shoelaces (Laces) and a second unit was placed within the right midsole of a modified shoe (Midsole). MiCoach estimated pace, distance, and EE were compared to actual values determined by criterion methods (Actual). Data were analyzed using a repeated-measures ANCOVA (EE), or a repeated-measures ANOVA (pace, distance).

**RESULTS:** There was a significant increase in EE ( $P \leq 0.003$ ), pace ( $P \leq 0.001$ ), and distance ( $P < 0.001$ ) with each subsequent treadmill speed. The Adidas miCoach significantly overestimated actual EE for the midsole at 53.6 m/min ( $P = 0.045$ ), and for both laces and midsole at 80.4 and 107.2 m/min ( $P \leq .036$ ). No significant differences were observed for laces or midsole EE compared to actual EE at any running speeds. Further, no significant differences were observed for estimated pace or distance of laces or midsole compared to actual values.

**CONCLUSION:** The Adidas miCoach device appears to accurately estimate pace and distance across a range of treadmill walking and running speeds and accurately estimate EE during treadmill running. Additionally, these results suggest that either laces or midsole sensor configuration provides similar values. Partial support for this study was provided by UTEP CHS Graduate Enhancement Funds.

**2090 Board #136 MAY 31 8:00 AM - 9:30 AM**  
**Validating The Nike+ Sport Kit For Estimating Pace, Distance, And Energy Expenditure During Over-ground Exercise**

Angelica N. Lehker, Justin P. Porta, Derek J. Acosta, Sean T. Miller, George A. King. *The University of Texas at El Paso, El Paso, TX.*  
(No relationships reported)

The Nike+ Wireless Sport Kit was designed to estimate pace, distance, and energy expenditure (EE) during walking and running.

**PURPOSE:** To validate the Nike+ Wireless Sport Kit for estimating pace (min/km), distance (km), and EE (kcal/min) during walking and running on an outdoor track and to compare the accuracy of the Nike+ laces sensor to the midsole sensor configuration.

**METHODS:** The Nike+ was assessed for 6 male and 9 female moderately endurance trained participants (mean  $\pm$  SD age: 28.07  $\pm$  8.22 y; height: 167.13  $\pm$  7.62 cm; mass: 60.46  $\pm$  10.86 kg;  $VO_{2max}$ : 54.25  $\pm$  5.36 mL/kg/min) during walking at 53.6, 80.4, and 107.2 m/min and running at 134.0, 160.8, 187.6, and 214.0 m/min on an outdoor track. The Nike+ validation protocol involved wearing a portable metabolic measurement unit (Cosmed K4b<sup>2</sup>), one Nike+ sensor attached to the left shoelaces (Laces), and a second Nike+ sensor inserted in the left insole of a compatible shoe (Midsole). Pace, distance, and EE values estimated from the laces and midsole were compared to criterion measures (Actual). A repeated-measures ANOVA (pace, distance) or ANCOVA (EE) was used to evaluate data for statistical significance.

**RESULTS:** Each subsequent speed elicited a significant increase in pace ( $P < 0.005$ ), distance ( $P < 0.005$ ), and EE ( $P < 0.17$ ). However, compared to actual pace, both laces and midsole values were significantly different at 53.6, 80.4, 134.0 and 214.0 m/min ( $P < 0.03$ ), and midsole at 160.8 m/min ( $P < 0.001$ ). For distance, both laces and midsole values were significantly different at 53.6, 80.4, 134.0 and 160.8 m/min ( $P < 0.03$ ) and laces at 214.0 m/min ( $P = 0.002$ ). Significant differences were observed between estimated and actual EE for laces at 53.6 m/min ( $P = 0.043$ ), and for both laces and midsole at 80.4, 134.5, 160.8, and 187.6 m/min ( $P \leq 0.05$ ).

**CONCLUSIONS:** The Nike+ accurately distinguishes various intensities of walking and running on an outdoor track. Despite small but significant differences compared to actual values, these data indicate that the Nike+ provides similar estimates when mounted on the shoelaces as when inserted in a compatible shoe.

Partially supported by UTEP CHS graduate enhancement funds.

**2091 Board #137 MAY 31 8:00 AM - 9:30 AM**  
**Reliability Of The Actical Accelerometer As A Measure Of Activity During Front Crawl Swimming.**

Brian V. Wright<sup>1</sup>, Joel M. Stager<sup>2</sup>. <sup>1</sup>Austin College/Indiana University, Sherman, TX. <sup>2</sup>Indiana University, Bloomington, IN. (Sponsor: Joel M. Stager, FACSM)  
(No relationships reported)

**INTRODUCTION:** The use of accelerometers with competitive athletes provides a non-invasive, non-obtrusive method for monitoring training performance and adherence. For example, recent studies have utilized the Actical accelerometer to quantify swimming speed and distance in competitive swimmers (Wright et al., 2007, Hinman et al., 2008, Wright, Hinman, & Stager, 2010). These studies have shown the ability to use the Actical accelerometer to retrospectively quantify the swimming speed and swim distance of athletes during competitive training sessions.

**PURPOSE:** The purpose of this project was to assess the reliability of the Actical accelerometer during front crawl swimming in collegiate swimmers. More specifically, to examine the reliability in both the arm stroke and leg kicking motion during front crawl swimming when both swimming speed and swim distance are held constant.

**METHODS:** The Actical was assessed on 8 collegiate competitive swimmers (20.1  $\pm$  1.04 yrs.) during two 100 yard front crawl swims completed on separate days at the same swimming speed. Each subject wore an Actical accelerometer attached via watch strap to their right wrist and right ankle. Comparisons between the arm and between the leg Actical outputs (i.e. accelerometer counts) were examined using paired samples t-test.

**RESULTS:** The range of p-values from all sixteen comparisons was 0.49-0.98 (average 0.564). Only one case was shown to be significant different. Additional analysis using a One-way ANOVA comparing four separate swims within one subject displayed no significant difference between total (arm + leg) Actical output ( $F = 2.055$ ,  $p = .185$ ) or arm output ( $F = 0.562$ ,  $p = .655$ ). However, there was a significant difference between two of the four swims with regard to leg output (trial 2 = 1940.0 counts vs. trial 4 = 1217.3 counts;  $p = .029$ ).

**CONCLUSIONS:** The Actical accelerometer appears to have acceptable day to day reliability during front crawl swims. Furthermore, the Actical appeared to be most reliable when data was examined as the summated output (i.e. sum of arm and leg output) or arm output individually.

Acknowledgements: Philips Healthcare (Bend, OR)

**2092 Board #138 MAY 31 8:00 AM - 9:30 AM**  
**Validation of Exercise Workloads on Two Lower Extremity Ergometers**

James H. Ross, Allison J. Silverman, Daniel S. Clevenger. *Wake Forest University, Winston-Salem, NC.* (Sponsor: Peter H. Brubaker, FACSM)  
(No relationships reported)

**PURPOSE:** The purpose of this study was to verify the accuracy of workloads during exercise at three levels on an Airdyne ergometer and a LifeFitness 9500 HR recumbent ergometer.

**METHODS:** Each of the seven recruited subjects completed in randomized order, 5-minutes at 45, 60, and 75 watts on both ergometers. Data was collected with a Medical Graphics CPX Ultima metabolic analyzer. Oxygen uptake ( $VO_2$ ), ratings of perceived exertion, heart rate, caloric expenditure and respiratory exchange ratios were recorded during each stage. Average  $VO_2$  obtained during the fifth minute of each workload on both ergometers was compared to the  $VO_2$  predicted using the ACSM equation for leg ergometers ( $VO_2 = [(10.8 \times \text{watts}) / (\text{wt. in kg})] + 7$ ). A t-test was used to determine if  $VO_2$  was significantly different for subjects at each workload on both modalities.

**RESULTS:**  $VO_2$  was significantly different for all workloads on the Lifefitness and at 60 and 75 watts on the Airdyne compared to the ACSM leg ergometer equation.

| Workloads | VO2 ACSM leg ergometer equation | VO2 AD (CPX) | VO2 LF-9500 (CPX) |
|-----------|---------------------------------|--------------|-------------------|
| 45 watts  | 14.23                           | 13.77        |                   |
| 60 watts  | 16.64                           | 15.02**      | 13.62**           |
| 75 watts  | 19.05                           | 16.44**      | 16.38**           |

$VO_2$  in  $\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$

\*\*  $P < .05$

AD=Airdyne LF=Lifefitness 9500

**CONCLUSIONS:** These results suggest that the workloads provided by each ergometer during an exercise bout may not be accurate. When exercise is prescribed by MET level or  $VO_2$  the prescribed work rate may illicit a more variable physiological response than intended.

**2093 Board #139 MAY 31 8:00 AM - 9:30 AM**  
**Learning Effect With Repeated Use Of The Dynavision™ D2: Visual-motor Evaluation**

William P. McCormack, Nadia S. Emerson, David R. Williams, Adam J. Wells, Gerald T. Mangine, Adam M. Gonzalez, Maren S. Fragala, Jay R. Hoffman, FACSM.  
*University of Central Florida, Orlando, FL.*  
(No relationships reported)

**PURPOSE:** Recently a light-training reaction device has been developed to enhance sensory motor integration with the purpose of improving athletic performance. It has also been suggested that this system can serve as an evaluation tool for concussions and visual-field deficits that can provide information for a team's medical staff on issues related to return to play. However, in these circumstances it becomes critical to determine how many trials are needed to achieve a true baseline measure. Thus, the purpose of this study was to examine the effect of repeated trials on performance improvements using the Dynavision™ D2 reaction device.

**METHODS:** Twenty-one female division I college athletes (10 basketball and 11 volleyball) performed hand-eye reaction time tests of peripheral vision (PV), peripheral vision with number recall (PVNR), and visual-reaction (VR) on the Dynavision D2 (Dynavision, Ontario Canada). The PV and PVNR tests measured accuracy (hits) in reacting to light stimuli for one minute duration. The VR measured time in reacting to 5 separate visual stimuli with the dominant and non-dominant hands. Each volunteer completed four trials of each test. Differences between subsequent trials were analyzed with one-way repeated measures ANOVA.

**RESULTS:** Significant improvements in PV were seen between T1 ( $69.3 \pm 7.8$  hits) and T2 ( $77.3 \pm 12.5$  hits). No other significant differences were noted between testing sessions. Similarly, significant improvements were noted in PVNR between T1 ( $55.5 \pm 11.1$  hits) and T2 ( $65.6 \pm 10.9$  hits), but no additional improvements ( $p > 0.05$ ) were seen in subsequent testing sessions. No significant differences between trials were observed for VR in visual reaction time in dominant ( $0.40 \pm 0.07$  s) or non-dominant hands ( $0.41 \pm 0.10$  s), or in motor reaction time in dominant ( $0.37 \pm 0.14$  s) or non-dominant hands ( $0.38 \pm 0.13$  s). **CONCLUSIONS:**

Results indicate that competitive athletes should perform two trials to achieve baseline performance measures in PV or PVNR. In addition, both visual and motor reaction time does appear to be consistent with each testing trial, suggesting that there is a limited learning effect in VR observed during consecutive testing trials when assessing competitive athletes.

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**2094 Board #140 MAY 31 8:00 AM - 9:30 AM**  
**Longitudinal Morphological and Performance Profiles for NCAA Division I Football Linemen**

Bert H. Jacobson, FACSM, Oklahoma State University, Stillwater, OK.  
(No relationships reported)

**PURPOSE:** A premium is placed on strength and speed of American college football players in order to be competitive on the playing field. All universities competing in football maintain well equipped weight training facilities and employ specialist in the area of strength and conditioning. Excelling in the weight room and in speed/agility drills often differentiates between starters and other squad members. Previous studies have been largely cross sectional, but the few existing studies suggest that athletes continue to improve in strength measures as they progress through their college playing career. The aim of this study was to compile and analyze data on incoming freshmen Division I football players and to longitudinally track their performance variables over their college career.

**METHODS:** Following IRB approval and athletic department approval, pre-existing data was obtained on 38 offensive and defensive linemen from 2005 to 2011. Only August preseason testing data was used because it was assumed that this was the point at which the participants reported in top playing condition. Physical measurements consisting of height, weight, body composition, vertical jump (VJ), IRM bench press (BP), power clean (PC), squat (SQ), 225 lb. maximum bench press repetitions (MBP), and the 40 yd. sprint were compared by year of participation.

**RESULTS:** Freshmen gained an average of 20.5 lbs or 7.2% in body mass (284.2 lbs to 304.7 lbs) with an average loss of 3.9% body fat (25.1% to 21.2%) between freshman and senior years. Greatest weight gain and fat decrease occurred between the first and second years. Significant ( $p < 0.05$ ) improvements were recorded for PB, PC, SQ, and MBP between freshman and senior years, but not for the VJ, or 40 yd. sprint.

**CONCLUSIONS:** Freshmen linemen reported with a body composition near the obese level (25.1%), but steadily reduced body fat while increasing in lean body mass over time. All strength measures improved most rapidly from year 1 to year 2 and continued to steadily improve over the participants' career. Conversely, while measures of strength improved significantly from year to year, the aspects of power (VJ) and speed (40 yd) did not. These results suggest that voluntary muscular strength will significantly improve by training and that measures of power and speed may improve, but to a much lesser degree.

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**C-31 Exercise is Medicine/Poster - Health Promotion and Training**

May 31, 2012 7:30 - 12:30 PM  
ROOM: Exhibit Hall

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**2095 Board #141 May 31 9:00 AM - 10:30 AM**  
**Influence of Autonomic Function and Exercise Training on C-Reactive Protein Levels in Obstructive Sleep Apnea**

Christopher E. Kline<sup>1</sup>, E. Patrick Crowley<sup>2</sup>, Gary B. Ewing<sup>2</sup>, James B. Burch<sup>2</sup>, Steven N. Blair, FACSM<sup>2</sup>, J. Larry Durstine, FACSM<sup>2</sup>, J. Mark Davis, FACSM<sup>2</sup>, Shawn D. Youngstedt<sup>2</sup>. <sup>1</sup>University of Pittsburgh School of Medicine, Pittsburgh, PA. <sup>2</sup>University of South Carolina, Columbia, SC.  
(No relationships reported)

Various studies have documented a link between autonomic function and inflammation. However, little is known regarding this association in adults with obstructive sleep apnea (OSA), who commonly have both altered autonomic function and elevated inflammation. Furthermore, it is unknown whether improved autonomic function can reduce inflammation in adults with OSA.

**PURPOSE:** To evaluate the effect of exercise training on C-reactive protein (CRP), a marker of systemic inflammation, and variables associated with CRP reduction among overweight/obese adults with OSA. The cross-sectional association between CRP and heart rate recovery at 1-min post-exercise (HRR, a marker of vagal tone) was also examined.

**METHODS:** 43 overweight/obese (BMI > 25) and sedentary adults aged 18-55 yr with at least moderate-severity OSA (apnea-hypopnea index [AHI]  $\geq 15$ ) were randomized to 12 wk of moderate-intensity exercise training (EX; n=27) or low-intensity stretching control (STR; n=16). Before and following the intervention, CRP was measured from plasma, body composition was assessed with dual x-ray absorptiometry (DXA), and cardiorespiratory fitness (VO<sub>2</sub>peak) and HRR were assessed with a maximal exercise test.

**RESULTS:** Of 37 participants with baseline CRP levels available ( $5.08 \pm 0.78$  mg/L), 17 had values associated with elevated cardiovascular risk (i.e.,  $> 3.0$  mg/L). Baseline CRP was correlated with DXA fat % ( $r = -0.71$ ,  $P < 0.01$ ), VO<sub>2</sub>peak ( $r = -0.55$ ,  $P < 0.01$ ), and HRR ( $r = -0.34$ ,  $P = 0.03$ ), but not OSA severity (e.g., AHI). Compared with participants with low CRP (n=20), those with elevated CRP had a significantly blunted HRR ( $20.45 \pm 1.61$  vs.  $13.59 \pm 1.50$ ;  $P = 0.02$ ) independent of age, sex, body fat, fitness, and AHI. For those who completed the intervention (n=32), there was a trend ( $F_{1,31} = 2.89$ ,  $P = 0.09$ ) for CRP reduction following EX ( $-1.18 \pm 0.52$  mg/L; n=21) versus STR ( $+0.32 \pm 0.71$  mg/L; n=11). Post-intervention CRP reduction was not correlated with change in body fat, VO<sub>2</sub>peak, HRR, or OSA severity. However, VO<sub>2</sub>peak change was greater among those with the greatest CRP reduction ( $P = 0.04$ ; n=16).

**CONCLUSIONS:** CRP was independently associated with impaired autonomic function in adults with OSA. Larger trials are needed to examine whether exercise can reduce CRP in OSA and the mechanisms by which this may occur.

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**2096 Board #142 May 31 9:00 AM - 10:30 AM**  
**Body Warming Prior to Bedtime Fails to Affect Subjective Sleep Quality and Bedtime/Daytime Sleepiness**

Hermann J. Engels, FACSM, Jean E. Davis, Hossein N. Yarandi. Wayne State University, Detroit, MI.  
(No relationships reported)

The manipulation of body temperature prior to bedtime as a possible remedy to improve sleep-related problems in people with insomnia is receiving considerable research interest.

**PURPOSE:** This study served to examine the effects of acute endogenous and exogenous body warming interventions prior to sleep on subjective sleep quality, bedtime sleepiness, and daytime sleepiness throughout the following day.

**METHODS:** Eight postmenopausal women (age:  $55.3 \pm 5.9$  yrs; weight  $70.8 \pm 12.5$  kg; height  $160.4 \pm 6.0$  cm) who suffered from a sleep maintenance disorder completed an initial sleep adaptation and baseline sleep (BL) evaluation night. These were followed by three experimental treatment nights (spaced one week apart) in which they underwent three randomly assigned, 30-min body warming interventions prior to bedtime. Body warming treatments consisted of a moderate intensity (75% of HRmax) cycle ergometry exercise bout (EX), a 40°C seated whole body bath (WB), and a 40°C seated foot bath (FB). Changes in both core and skin (chest, foot) temperatures were measured using an ingestible core temperature capsule and dermal patches (Vitalsense, Mini-Mitter), respectively. Subjective sleep quality was assessed with the Subjective Sleep Quality Scale (SSQ; Davis, 1987) within 30 min of awakening. Sleepiness at bedtime and at four predetermined time points throughout the following day (10am, 1pm, 4pm, 7pm) were assessed with the Stanford Sleepiness Scale (SSS; Hoddes et al., 1973).

**RESULTS:** Pre-bedtime warming treatments were successful to produce significant intervention-specific changes in core and skin temperature recordings ( $p < 0.05$ ). However, repeated

measures MANOVA indicated no significant differences among trials for SSS scores (BL: 3.89±1.24; EX: 4.15±1.14; WB: 3.40±1.47; FB: 4.10±1.28), bedtime sleepiness (BL: 4.00±1.41; EX: 4.13±1.55; WB: 4.50±1.77; FB: 4.38±1.19), and the patterns of daytime sleepiness on the following day (BL: 2.81±0.58; EX: 2.84±1.32; WB: 2.75±1.04; FB: 2.72±0.89) (p>0.05).

**CONCLUSIONS:** These observations indicate no benefits of pre-bedtime endogenous (moderate intensity exercise) and exogenous (whole body and foot baths) body warming interventions on subjective sleep quality and bedtime/daytime sleepiness in postmenopausal women suffering from insomnia.

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**2097** Board #143 May 31 9:00 AM - 10:30 AM

**Level Evolution Of Physical Activity After Six Months Of Monitoring In Sedentary Individuals Through Emails**

Carolina Vicaria Rodrigues D'Aurea<sup>1</sup>, Carla Giuliano de Sá Pinto<sup>1</sup>, Marcio Marega<sup>1</sup>, Felipe Gambetta Carmona<sup>1</sup>, Aylton Figueira Júnior<sup>2</sup>, José Antônio Maluf de Carvalho<sup>1</sup>. <sup>1</sup>Hospital Israelita Albert Einstein, São Paulo, Brazil. <sup>2</sup>Universidade São Judas Tadeu, São Paulo, Brazil.

(No relationships reported)

Physical activity is an important intervention to the prevention, and treatment of cardiovascular diseases, hypertension, diabetes mellitus, stroke, some kinds of cancers, osteoporosis, depression and imbalance in the lipid profile. Counseling for physical activity has been poorly applied for the needs of individuals who should be encouraged to develop healthier lifestyle habits.

**PURPOSE:** To investigate the effect of counseling, for 6 months, through emails, on the level of physical activity in sedentary adults.

**METHODS:** The study sample consisted of 104 adults of both sexes who completed the protocol for Continuing Health Revision at the Center for Preventive Medicine of the Albert Einstein Hospital. To participate in this study, the clients should be defined as sedentary, considering the physical activity level (IPAQ), signing the informed consent and having participated in the monitoring program and answered the three IPAQs applied: on the day of RCS, after 3 months and 6 months follow-up. The monitoring was done by physical education teachers through periodic e-mails, sent at weeks 1, 2, 3, 4, 6, 8, 10, 12, 16, 20 and 24. Statistical analysis was performed, using the Statistical Package for Social Sciences (SPSS) v.15.0.

**RESULTS:** After 3 months of follow-up, 29.8% of this sample, began to be lazy and at the end of 6 months follow-up, 67.3% became active and 9.6% became very active (p <0.0001). After 6 months, compared with the initial physical activity level, there was a considerable increase in the number of active individuals, reaching the necessary recommendations to achieve a healthier lifestyle.

**CONCLUSIONS:** The counseling and monitoring conducted through periodic and individualized e-mails, proved to be very motivating and effective for sedentary individuals, which contribute to a change in their lifestyles, making them more active for the encouragement of regular physical activity practice.

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**2098** Board #144 May 31 9:00 AM - 10:30 AM

**Comparison Of Awareness Of ACSM Physical Activity Recommendations Between College Students And Other Population**

Luis Leite<sup>1</sup>, Dulce Leal Esteves<sup>2</sup>, Paulo Gonçalves Pinheiro<sup>3</sup>, Sérgio Vieira<sup>1</sup>, Kelly O'Hara<sup>2</sup>, Rui Brás<sup>2</sup>. <sup>1</sup>Beira Interior University, Covilha, Portugal. <sup>2</sup>Beira Interior University & CIDESD, Covilha, Portugal. <sup>3</sup>Beira Interior University - Research Unit in Business Sciences, Covilha, Portugal.

(No relationships reported)

Many health behaviors are established during late adolescence and early adulthood, when many attend college, so the decline in physical activity (PA) during college is a disturbing trend. Increasing efforts to promote college students PA have been made, but is not clear if college students have a better knowledge on adequate PA characteristics for health improvement than other population.

**PURPOSE:** This study aims to examine the extent to which knowledge of the ACSM PA recommendations has diffused through college students and compare with recommendations knowledge of the rest of population.

**METHODS:** The study included a randomly recruited sample of 848 subjects (54.5% M; 45.5% F), 42.0±19.6 y; and 200 undergraduate college students (31.0% M; 69.0%F) age 20.42±3.3. The awareness of ACSM PA Recommendations was assessed as indicated by Bennett et al., 2009.

**RESULTS:** There is not widespread knowledge of the ACSM PA recommendations neither for college students (only 28.5% know the recommendations) nor for the rest of population (26.3%). No statistic differences were found (p<.05) between these two groups.

**CONCLUSIONS:** Despite efforts to widespread knowledge on ACSM recommendations on college students, their knowledge is similar to the rest of population. This finding should highlight the limited ability to enhance knowledge from existing campaigns designed to college students and the need for more effective strategies to widespread

accurate information both for college students and for the rest of population. REFERENCE: Bennett, G., Wolin, K. et al. (2009) Awareness of National Physical Activity Recommendations for Health Promotion among US Adults. Med Sci Sports Exerc. 41(10), pp. 1849-1855.

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**2099** Board #145 May 31 9:00 AM - 10:30 AM

**Awareness Of ACSM Physical Activity Recommendations For Health Promotion: Assessing BMI And METS Differences**

Sergio Vieira<sup>1</sup>, Paulo Gonçalves Pinheiro<sup>2</sup>, Rui Brás<sup>3</sup>, Kelly O'Hara<sup>3</sup>, Ricardo Gouveia Rodrigues<sup>2</sup>, Dulce Leal Esteves<sup>3</sup>. <sup>1</sup>Beira Interior University, Covilha, Portugal. <sup>2</sup>Beira Interior University - Research Unit in Business Sciences, Covilha, Portugal. <sup>3</sup>Beira Interior University & CIDESD, Covilha, Portugal.

(No relationships reported)

Regular moderate physical activity (PA) has an important influence on health and well-being, but is not clear if adult population knows the adequate PA characteristics for health improvement.

**PURPOSE:** This study aims to examine whether knowledge of the American College of Sports Medicine (ACSM) physical activity recommendations varies with BMI and METS.

**METHODS:** The study included a randomly recruited sample of 848 subjects (54.5% M; 45.5% F), 42.0±19.6 years. The awareness of ACSM PA Recommendations for Health Promotion was assessed as indicated by Bennett et al., 2009. METS were estimated using IPAQ, validated to Portugal.

**RESULTS:** PA evaluation revealed 40.6% of low; 9.2% moderate and 50.2% high PA level. BMI (Kg/m<sup>2</sup>) assessment found 2.48% underweight (BMI< 18.5); 51.59% normal (18.5<BMI<24.99); 36.95% overweight (25<BMI<29.99) and 8.98% obese (BMI>=30). Less than a third of respondents (26.3%) were accurately knowledgeable of the ACSM PA recommendations. Recommendations knowledge increases with PA level (22.1%, 25.6% and 30.0% for low, average and high PA level, respectively) and with BMI (14.3%, 23.3%, 39.1% and 35.5% for underweight, normal, overweight and obese, respectively).

**CONCLUSIONS:** For almost three quarters of interviewed population there is not widespread knowledge of ACSM PA recommendations. Knowledge augments with PA level, what is an expected finding, and also with BMI: obese have a better knowledge of ACSM PA recommendations than underweight and normal weight. This unexpected result may be related with people with higher BMI could be alerted to the need of physical exercise to lose weight, so, their knowledge on exercise recommendations is better. REFERENCE: Bennett,

G., Wolin, K. et al. (2009) Awareness of National Physical Activity Recommendations for Health Promotion among US Adults. Med Sci Sports Exerc. 41(10), pp. 1849-1855.

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**2100** Board #146 May 31 9:00 AM - 10:30 AM

**Longitudinal Non-exercise Models For Estimating Cardiorespiratory Fitness Of Men And Women**

Andrew S. Jackson, FACSM<sup>1</sup>, Xuemei Sui<sup>2</sup>, Daniel P. O'Connor<sup>3</sup>, Duck-chul Lee<sup>2</sup>, Enrique G. Artero<sup>2</sup>, Timothy S. Church, FACSM<sup>4</sup>, Steven N. Blair, FACSM<sup>2</sup>.

<sup>1</sup>University of Houston, Onalaska, TX. <sup>2</sup>University of South Carolina, Columbia, SC. <sup>3</sup>University of Houston, Houston, TX. <sup>4</sup>Pennington Biomedical Research Center, Baton Rouge, LA.

(No relationships reported)

Low cardiorespiratory fitness (CRF) is associated with high risk of chronic diseases and mortality. CRF measured with a maximal or sub-maximal exercise test has limited application in clinical and public health settings due to time constraints and the need for specialized test equipment and trained administrators. Published cross-sectional, non-exercise (Non-Ex) models show that CRF can be estimated with reasonable accuracy, but cannot be generalized to changes in CRF associated with aging.

**PURPOSE:** To develop longitudinal Non-Ex models for men and women that accurately estimate CRF and changes in CRF associated with aging.

**METHODS:** The sample included 1,325 women (age range 20-78 y) and 10,040 men (age range 20-86 y) who completed from 2 to 21 maximum treadmill exercise tests from 1977 to 2005. The number of observations was: women, 3,816; and men, 38,716. The dependent variable was CRF measured with a maximal Balke treadmill test. The independent variables were age, body composition (body mass index and waist circumference), self-report physical activity (SR-PA), smoking behavior and resting heart rate. Linear mixed levels regression (LML) modeled the data and the standard error of estimate defined model accuracy.

**RESULTS:** the LML analyses found that all variables were independently related with CRF ( $p < 0.001$ ) and were used to construct the longitudinal models. The longitudinal model error estimates (95% CI) were: women, 1.51 METs (1.45, 1.58); and men, 1.66 METs (1.63, 1.68). These error estimates are congruent with published cross-sectional error estimates.

**CONCLUSIONS:** The longitudinal models provide accurate Non-Ex equations for estimating CRF with data routinely collected in public health settings. These results can be generalized to assessing changes in CRF associated with aging.

Supported by National Institutes of Health grants AG06945, HL62508, and R21DK088195; and an unrestricted research grant from the Coca Cola Company.

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**2101 Board #147 May 31 9:00 AM - 10:30 AM**

**Individuals With Physical Limitations Can Benefit From Training On A Motorized Elliptical For Community-based Exercise**

Judith M. Burnfield<sup>1</sup>, Marie C. Yeseta<sup>2</sup>, Thad W. Buster<sup>1</sup>, Adam P. Taylor<sup>1</sup>, Yu Shu<sup>1</sup>. <sup>1</sup>Madonna Rehabilitation Hospital, Lincoln, NE. <sup>2</sup>University of Southern California, Los Angeles, CA.

(J.M. Burnfield: Intellectual Property; Judith M. Burnfield, Yu Shu, Adam P. Taylor, and Thad W. Buster are co-inventors of the ICARE trainer (U.S. Patent 8,007,405). Remaining authors do not have a conflict of interest.)

The ICARE, an Intelligently Controlled Assistive Rehabilitation Elliptical, was developed to address barriers to physical activity that individuals with motor control, strength, and endurance limitations face. An elliptical trainer was adapted with a body weight support (BWS) system, ramp, steps, safety rails, footplate straps, and an adjustable seat to enhance access. A sensor controlled motor was integrated to initiate and sustain pedal motion for continuous training up to 65+ revolutions per minute (rpm). For community members with movement limitations who cannot use traditional equipment, the ICARE provides an option for engaging in meaningful exercise.

**PURPOSE:** This study assessed use of the ICARE trainer in a community-based fitness facility for individuals with chronic medical conditions.

**METHODS:** Ten community fitness facility members (ages 42-80) with varying neurologic, cardiovascular, and orthopedic diagnoses ICARE trained with a fitness instructor for 12 sessions. Velocity (VEL), stride length (SL), and BWS progressions were customized based on participant performance, with session duration (DUR) determined by their perceived exertion (RPE) and heart rate (HR) and blood pressure (BP). Paired t-tests (significance set at  $p < 0.05$ ) evaluated changes across the training program in VEL, SL, DUR, BWS, strides/session, vital signs (HR, BP), RPE, and functional measures of walking velocity (6 meter Walk Test), endurance (5-Minute Walk Test-5MWT), and balance (Timed Up and Go-TUG; Berg Balance Scale-BBS).

**RESULTS:** ICARE training performance improved from pre to post as evidenced by increases in VEL (34 vs. 39 rpm;  $p = 0.020$ ), DUR (15.4 vs. 18.8 min;  $p = 0.013$ ), SL (20 vs. 22 in;  $p = 0.014$ ), and strides/session (540 vs. 765;  $p = 0.012$ ) without significant changes in RPE (13 vs. 12). Improvements in fast walking velocity (43.5 vs. 48.1 m/min;  $p = 0.048$ ) and the 5MWT (710 vs. 798 ft;  $p = 0.013$ ) also were identified. Comfortable walking speed and BBS improvements were not significant.

**CONCLUSIONS:** The ICARE is a promising fitness modality for individuals in the community with activity limitations, as evidenced by increases in exercise tolerance and corresponding improvements in fast walking speed and endurance with training.

Supported by Department of Education, NIDRR grant #H133G070209

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**2102 Board #148 May 31 9:00 AM - 10:30 AM**

**Effects of a Desk Treadmill on Physical Activity in a Counseling Observation Room**

Michelle Dell'Orto, David Weber, Toni Zimmerman, Raymond C. Browning, FACSM. Colorado State University, Fort Collins, CO.

(No relationships reported)

The workplace environment can have a significant impact on the prevalence of obesity as well as the ability of individuals to obtain the recommended daily levels of physical activity (PA). One potentially feasible way to decrease sedentary time and increase overall physical activity levels is the introduction of a desk treadmill into a generally sedentary work environment.

**PURPOSE:** To determine whether the introduction of desk treadmills into a counseling observation room would lead to increases in objectively measured (via accelerometry) physical activity.

**METHODS:** Eight female, Center for Family Therapy counseling supervisors and assistant supervisors were asked to wear hip mounted Actical accelerometers during four study periods, baseline, Tm1, Tm2, and Tm3, from November 2010 until March 2011. Counseling observation periods occurred three times weekly for a period of four hours. After the three week baseline period, two desk treadmills were placed in the counseling observation room and PA was measured in two week intervals. Individuals were instructed in the use of the desk treadmill but were not required to use it. Accelerometer data were analyzed using cut-point values and divided into percent time in sedentary, light, and moderate-vigorous PA (MVPA). A comparison of percent time in different PA intensities was made with one-way repeated measures ANOVA.

**RESULTS:** No significant changes were seen in sedentary time or time engaged in PA between the four time periods. While not significant, percent time in sedentary activity decreased from 86% to 80% between baseline and Tm1, but returned to base line levels during Tm2 and Tm3. Conversely, percent time in MVPA increased slightly from 5% to 9% between baseline and Tm1, and remained above baseline for Tm2 and Tm3, 9% and 7%, respectively. Difficulties with noise level and a treadmill user interface were cited as potential barriers to treadmill use. In particular, participants cited that treadmill noise interfered with their ability to hear and concentrate on counseling sessions.

**CONCLUSIONS:** While the results did not demonstrate a significant increase in PA from the addition of two desk treadmills into an otherwise sedentary environment, the trend toward an increase in percent MVPA suggests that this type of intervention could help individuals increase daily PA.

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**2103 Board #149 May 31 9:00 AM - 10:30 AM**

**Musculoskeletal Injuries And Healthcare Needs Among Women With Or At-Risk For Breast-Cancer-Related Lymphedema In A Weight Lifting Exercise Trial**

Justin C. Brown, Andrea B. Troxel, Kathryn H. Schmitz, FACSM. University of Pennsylvania, Philadelphia, PA.

(No relationships reported)

**PURPOSE:** The purpose of our study was three-fold: 1) quantify and compare the incidence of musculoskeletal injury in a large cohort of BrCa survivors with or at-risk for developing breast cancer related lymphedema randomized to twice-weekly weight lifting or standard care for one-year; 2) compare the risk of musculoskeletal injury among BrCa survivors to apparently healthy women engaging in a similar weight lifting protocol and; 3) qualitatively identify the frequency and severity of healthcare needs that may require dose modification of weight lifting or medical referral.

**METHODS:** BrCa survivors with (n=141) or at-risk for (n=154) lymphedema were randomized to twice weekly weight lifting or standard care for one year. An injury survey and healthcare evaluation were

administered after one year, and in three-month intervals, respectively.

**RESULTS:** The cumulative incidence and rate of injury was higher in the weight lifting compared to the control group. The injury rates were 2.3 (95% CI: 2.0-2.6) and 0.3 (95% CI: 0.2-0.5) per 1000 bouts of weight lifting among BrCa survivors with versus at-risk for lymphedema, respectively. Among BrCa survivors with or at-risk for lymphedema, 19.6% in the weight lifting group had an encounter with a healthcare provider that required cessation or dose modification of weight lifting exercise.

**CONCLUSIONS:** Despite the demonstrated efficacy of weight lifting among BrCa survivors with or at-risk for lymphedema, musculoskeletal injuries, and other health needs do occur.

Health-fitness professionals working with BrCa survivors need the knowledge, skills, and abilities to encounter these healthcare needs and implement a system of referral to appropriate clinical experts for medical evaluation for healthcare events falling outside their scope of practice.

2104 Board #150 May 31 9:00 AM - 10:30 AM

**Obesity and Mobility: Outcomes From a Multidisciplinary Team Weight Management Program**

Mary E. Sanders, FACSM, Katie Lyons, Quang Nguyen, Maureen Blanford, Stacey Frattinger, Karmella Thomas, Ray Plodkowski, Hu Shien, Aimee Brock.  
University of Nevada, Reno, Reno, NV.  
(No relationships reported)

Mobility disability is prevalent in obese older populations, yet little is known about the effect of obesity and weight loss on mobility in younger populations.

**PURPOSE:** To determine the effect of a clinical weight loss program conducted by an integrated multidisciplinary team including physicians, registered dietitians, and clinical exercise physiologists on selected anthropometrics and mobility in obese patients.

**METHODS:** Program evaluation of patients (n=66); 46.6±8.3 y; 114kg ± 22; BMI= 41.3 kg/m<sup>2</sup>, enrolled in a 12 week weight loss program. Integrated team visits included medical, nutrition and physical activity assessments; weekly follow-ups included weight loss behavior education, lifestyle strategies, tracking and guidance. Physical activity visits included functional field assessments, pre-exercise screening, medical and current activity status. Patients received a pedometer with step tracking instructions and a First Step to Active Health® kit. An individualized home/gym exercise program based on ACSM guidelines was designed and progressed over time. Dietitians reviewed patient's food and step log/activity records. Physicians reviewed patient's health status, with intervention as needed.

**RESULTS:** The following table summarizes results.

| Assessment                         | Baseline  | 12 week    | Change (%) |
|------------------------------------|-----------|------------|------------|
| Weight (kg)                        | 114±21.8  | 107± 18**  | -6         |
| BMI (kg/m <sup>2</sup> )           | 41.3±18.2 | 38.9±16**  | -5.8       |
| Percent body fat (%)               | 43.8±7.1  | 41.9±5.8** | -4.3       |
| Muscle mass (kg)                   | 58.8±5.1  | 57.8±5.6** | -1.62      |
| Walking: Pedometer steps           | 5100±1574 | 8040±773** | +57.6      |
| Strength/lower: Sit to stands      | 11.6±4.9  | 14.7±5.8** | +26.7      |
| Strength/upper: Arm curls          | 17.3±4.6  | 20.4±5.2** | +17.9      |
| Balance (seconds)                  |           |            |            |
| Left leg                           | 26.4±9.3  | 27.8±5.8   | +5.3       |
| Right leg                          | 24.1±9.3  | 26.7±7.3*  | +10.7      |
| Flexibility: Back Scratch (inches) |           |            |            |
| Right arm                          | -7.0±5.1  | -5.1±4.6** | +28        |
| Left arm                           | -8.6±5.4  | -6.6±4.6** | +23        |

\* p<.05, \*\*p<0.0001

Measures revealed significant improvements in all areas except balance of the left leg. Baseline scores were below older adult (60-94 y) normative mobility scores and by 12 weeks, our patients exceeded all older adult normative mobility scores except for flexibility.

**CONCLUSIONS:** This multidisciplinary team weight management program is an approach that can help young obese patients lose weight and improve mobility.

2105 Board #151 May 31 9:00 AM - 10:30 AM

**Efficacy of the Walk for Health Program: A Physical Activity Intervention for Adults with Blindness**

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(No relationships reported)

It has been hypothesized that the pervasive comorbidity documented in adults with visual impairment (VI) may be largely attributable to physical inactivity. Nonetheless, relatively little is known concerning the extent to which physical activity (PA) level and health status can be improved in persons with VI.

**PURPOSE:** To document the effectiveness of Walk for Health, an adaptive community-based walking program, on daily step activity (DSA) and profiles of body composition (BC; body mass, body fat, waist circumference), cardiovascular health (CV; resting heart rate and blood pressure), and lipid function (LIP; triglycerides and total, HDL-, and LDL-cholesterol) in adults with blindness.

**METHODS:** Twenty-two adults (age = 46.7 ± 11.9 years) completed eight weeks of guided PA intervention (INT; n = 15) or served as control subjects (CON; n = 7). INT participants were provided with individually-tailored feedback designed to increase DSA by approximately 1,000 steps every two weeks and maintain these gains in PA during the final two weeks of the program.

**RESULTS:** Participants in the INT group displayed a mean increase of 73% in DSA (p< .01; 4,925 + 2,234 steps to 8,506 + 3,063 steps), while no changes in DSA were observed in the CON group (p = .90). No group-by-time effects were noted for BC (p = .10), CV (p = .07), or LIP (p = .56) variables.

**CONCLUSIONS:** The Walk for Health program was successful in substantially improving walking behavior in adults with VI, but health profiles remained unaltered. Future research should examine the impact of walking intensity and program length on physical health and quality of life in persons with varying levels of vision loss.

2106 Board #152 May 31 9:00 AM - 10:30 AM

**Upper-spinal Postural Alignment With Behavioral Modification (Dietary and Physical Exercises) Protocol**

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(No relationships reported)

Sedentary behavior and related overweight and sarcopenia are the major causes of postural alteration. Lifestyle changes with physical exercises and nutritional re-education are tools either for prevention and/or therapeutic care of these postural misalignments.

**PURPOSE:** To evaluate the effects of a protocol including supervised combined physical exercises and dietary counseling (lifestyle modification program; LSMP) on postural alterations in adults.

**METHODS:** From a community-based sample of 363 subjects (40-75 years old, most females) having thoracic kyphosis (148.3° ± 7.3°) as the main postural problem, 49 subjects fulfilled the ethical and inclusion criteria of attending the 24 weeks LSMP and to all evaluations. The LSMP included monthly dietary counseling and daily (5 X/wk) session of supervised physical exercises of walking (3 X/wk, 80 min, 60-70% VO<sub>2</sub>max) and strength (2 X/wk, 65-80% of one repetition maximal, 1RM) and assessments (baseline and end-study). Anthropometric assessment included waist circumference (WC), body weight and height for body mass index (BMI, kg/m<sup>2</sup>) calculation. Physical fitness tests included flexibility (sit and reach test) and 1RM exercises for seated bench press, pec deck flies, seated rows, back lat pulldowns, leg extensions and seated leg curls. The postural assessments by computerized photogrammetry (ALC image 2.1) were taken for cervical lordosis, thoracic kyphosis, lumbar lordosis and Q angle. The comparison between moments was analyzed by Student's t paired test and the correlation between variables through the Pearson's test, both in software Statistica 6.0 considering p<0.05.

**RESULTS:** The most prominent improvements with LSMP were observed in thoracic kyphosis (-7.98°) and lumbar lordosis (4.49°). Cervical (CL) and lumbar lordosis (LL) variations reversely correlated with WC loss and gained strength in the leg extensions. A significant reverse relationship between changes were observed for WC x CL (r=-0.320) and leg extensions x LL (r=-0.318).



2107 Board #153 May 31 9:00 AM - 10:30 AM

**Relationship between Body Mass Index and Percent Body Fat: Preliminary results from the Energy Balance Study.**

Vivek K. Prasad, Gregory A. Hand, FACSM, E Patrick Crowley, Kelly Kavanaugh, Jason R. Jagers, Robin P. Shook, Steven N. Blair, FACSM. *University of South Carolina, Columbia, SC.*  
(No relationships reported)

**PURPOSE:** The CDC has stated that "BMI provides a reliable indicator of body fatness for most people and is used to screen for weight categories that may lead to health problems." However, previous work has shown that BMI is not a reliable indicator in special populations including children, elderly, and some minorities. The purpose of this study was to examine in a healthy group of men and women the relationship between the BMI and body fat "cut points" for overweight and obesity.

**METHODS:** A group of healthy women and men were assessed for BMI and body fat percent (BF). BMI was calculated as weight in KG/ht in meters<sup>2</sup>. BF percentage was calculated as the percentage of total weight identified as fat tissue by dual x-ray absorptiometry (DXA). Descriptive statistics were calculated and a Pearson correlation was determined for BMI and BF percent by gender. BMI overweight and obese cut points were 25.0 to 29.9 and 30.0 and above, respectively. Obesity cut points for BF percent were 25 and 32 percent for men and women, respectively.

**RESULTS:** The population consisted of 55 healthy adults (22 men and 33 women; aged 21 to 35 years). Body weight ranged from 53.7 to 110.8 kgs (men: 83.66±14.55 kgs; women: 72.53±13.29 kgs) with a BMI range of 19.3 to 35.0 for men (26.7±4.14) and a range for women of 19.8 to 35.1 (26.45±4.46). BF percent for men ranged from 7.83 to 39.55 (24.72±7.36) and for women ranged from 16.39 to 50.54 (35.63±7.67). Pearson correlations were 0.816 (p<0.0001) and 0.793 (p<0.0001) for men and women, respectively. Of the 6 men in the BMI overweight range of 25 to 29.9, all were in the obese BF range of over 25%. Eleven women were in the BMI overweight range of 25 to 29.9, and 9 of those were in the obese range of over 32% BF.

**CONCLUSIONS:** These results indicate that the majority of men and women (100% and 82%, respectively) who were categorized as overweight by BMI cut points were in the obese BF range. The findings suggest that the correlation between BMI and percent BF is high, but nearly all individuals classified as overweight by BMI were obese by percent BF standards. The range of BF percentage is significantly higher than would be expected by BMI classification of the individuals. In this population, BMI does not accurately categorize individuals as overweight or obese. Supported by the Coca Cola Corporation and the NINR/NIH.

2108 Board #154 May 31 9:00 AM - 10:30 AM

**Effect Of Overestimated Resting Metabolic Rate (rnr): Preliminary Results From The Energy Balance Study**

Gregory A. Hand, FACSM, John C. Sieverdes, Kelly Kavanaugh, Madison DeMello, E. Patrick Crowley, Vivek K. Prasad, Jason R. Jagers, Robin P. Shook, Steven N. Blair, FACSM. *University of South Carolina, Columbia, SC.*  
(No relationships reported)

**PURPOSE:** Body weight control requires a balance of energy intake and energy expenditure (EE) that is regulated by physiological, behavioral, environmental, and genetic components. The largest portion of EE is resting metabolic rate (RMR). RMR has been defined as 1 MET and an oxygen consumption of 3.5 ml/kg body weight/minute. As energy requirements for activity are calculated as multiples of METs, an overestimation of RMR will result in greater error in estimating EE as intensity or duration increases. The purpose of this study was to determine the RMR of a group of healthy adults, and calculate the effect of overestimating EE.

**METHODS:** RMR was measured in 55 healthy adults. Participants arrived fasted for at least 12 hrs. and having refrained from alcohol or exercise for at least 24 hrs. Participants rested in a supine position under a ventilated hood for 15 minutes, followed by a 30 minute RMR gas collection period in which inflow and outflow of oxygen and carbon dioxide was measured. Height and weight were measured and BMI calculated as body weight (kgs)/height (meters)<sup>2</sup>. Descriptive statistics were calculated and a Pearson Correlation of BMI to RMR was determined.

**RESULTS:** The population consisted of 22 men and 33 women (aged 21 to 35 years). Body weight ranged from 53.7 to 110.8 kgs (men: 83.66±14.55 kgs; women: 72.53±13.29 kgs) with a BMI range of 19.3 to 35.4 (men: 26.7±4.14; women: 26.45±4.46). The RMR ranged from 0.15 to 0.32 L/min (men: 0.25±0.037; women: 0.21±0.03) resulting in a RMR per body weight range of 2.25 to 3.58 ml/kg/min (men: 2.99±0.33; women: 2.89±0.36). The Pearson Correlation analysis of BMI to RMR for men was -0.443 (p=0.039) and for women was -0.71 (p<0.001).

**CONCLUSIONS:** These results indicate that the inverse relationship between BMI and RMR is stronger in women than men. Further, both genders showed a significantly lower RMR than the standard estimate of 3.5 ml/kg/min. The findings suggest that using the standard RMR estimate would have overestimated EE of 1 MET by approximately 0.55 ml/kg/min. This error would overestimate resting energy consumption for this population by approximately 2.5 L oxygen/hr, or by 2134 kcal per week. This error would dramatically increase as MET minutes of activity, calculated as multiples of RMR, were added to the total EE. Supported by the Coca Cola Corporation and NINR/NIH.

2109 Board #155 May 31 9:00 AM - 10:30 AM

**Exercise is Medicine with Altitude**

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(No relationships reported)

The Exercise is Medicine on Campus campaign was adapted for the University of Colorado Colorado Springs (UCCS) and was titled Exercise is Medicine with Altitude (EIMA).

**PURPOSE:** To increase physical activity and its health benefits at UCCS through the implementation of EIMA.

**METHODS:** Students were recruited to participate in this descriptive study through flyers posted around campus, the student health center (SHC), the student recreation center (SRC), and social networking. The planning phase began in fall 2010 and included recruiting departments and developing implementation strategies. The campaign and data collection began February 1, 2011, consisting of a physical activity screening and referral process, health education flyers posted around campus, an EIMA team for a campus 5K, health and fitness assessments at the campus health fair, and a campaign mascot with his own Facebook page. The Physical Activity Vital Signs (PAVS) tool was used to screen for physical activity at the SHC. If the PAVS score resulted in a physical activity level below federal recommendations, a referral was made to the SRC for a free gym orientation, fitness assessment, and semester group fitness pass. To determine the effectiveness of the screening and referral process, PAVS scores and referral coupons were collected. The following ratios were calculated: patients screened/total number of SHC patients, patients referred/patients screened, and referrals used/referrals given. The number of Facebook friends and 5K EIMA team members were also collected.

**RESULTS:** 7.4% of SHC patients were screened, 81.4% of patients screened were referred to the SRC, and 8.6% of referrals made were used at the SRC. The campaign's mascot obtained 30 Facebook friends and the 5K team had 14 members.

**CONCLUSIONS:** This pilot study proved effective in collaborating with departments and gaining interest through the Facebook page and mascot. Although the campaign only reached a small portion of students, it still increased physical activity and increased awareness of physical activity benefits. The results from the screening and referral process highlighted the importance of communication between researchers and departments. Future efforts should aim for greater participation and more consistent implementation to help the campaign reach its full potential.

2110 Board #156 May 31 9:00 AM - 10:30 AM

**Venice Maps-s ( Measuring Activity Patterns Study - In Students)**

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(No relationships reported)

**PURPOSE:** Most Americans do not accumulate the amount of physical activity (>300 kcal/day) associated with a reduced risk of cardiovascular disease (CVD). The lower prevalence of CVD observed in the Mediterranean Region is generally attributed to a healthier diet, but the contribution of increased PA cannot be discounted. This study examined the effects of the built environment of Venice, Italy (a city with minimal automotive transportation) on PA levels in college students.

**METHODS:** This study compared the physical activity levels of 18 American students from Wake Forest University (WFU) before (AS@WFU) and during the semester they spent abroad in Venice, Italy (AS@VEN). A matched group of 12 Italian university students (IS@VEN) were recruited for comparison. Participants were instructed to wear a Lifecorder (Kenz) accelerometer

continuously for ten days. Daily physical activity energy expenditure (PAEE) and minutes of light (LPA), moderate (MPA), and vigorous (VPA) PA were determined for each group. T-tests, with a  $p < .05$  level of significance, were used to compare PA levels between groups.

**RESULTS:** Although not significantly different, daily PAEE levels were higher in AS@VEN (423.2 + 187.4 kcal) and IS@VEN (408.8 + 113.8 kcal) than AS@WFU (329.3 + 217.2 kcal). Furthermore, daily minutes of LPA (72.5 + 27.6 min, 66.5 + 21.5 min, 36.9 + 10.8, respectively) and MPA (57.3 + 25.8 min, 58.3 + 23.6 min, 34.0 + 14.0, respectively) were significantly higher in AS@VEN and IS@VEN vs. AS@WFU. There were no significant differences between AS@VEN and IS@VEN for LPA, MPA or VPA. In contrast, minutes of VPA were significantly higher in AS@WFU than AS@VEN or IS@VEN (17.8 + 26.1, 7.3 + 12.5, 3.9 + 3.8, respectively).

**CONCLUSIONS:** American students, while in Venice, achieved a PAEE level of  $>300$  kcal/day by adopting a similar pattern of PA, with greater reliance on LPA and MPA and less on VPA, as their Italian counterparts. In contrast, American students (at WFU) relied more on vigorous (i.e. structured bouts of exercise) than lifestyle PA and expended ~100 fewer kcal/day than VEN. These findings suggest that lifestyle PA (i.e. LPA and MPA) can produce a PAEE level that may contribute to the reduced prevalence of CVD observed in the Mediterranean region.

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**2111** Board #157 May 31 9:00 AM - 10:30 AM

**Risk Prediction to Graded Exercise Test in 40-49yr Chinese Men**

hao Su<sup>1</sup>, Minhao Xie<sup>1</sup>, Hui Wang<sup>2</sup>, Xintang Wang<sup>1</sup>, Jianmin Cao<sup>1</sup>, Liang Li<sup>3</sup>, Wengfei Zhu<sup>1</sup>, Tingting Li<sup>1</sup>, Yi Yan<sup>1</sup>. <sup>1</sup>Beijing Sport University, Beijing, China. <sup>2</sup>Jinggangshan University, Ji'an Jiang Xi Province, China. <sup>3</sup>Chinese University of Hong Kong, Hong Kong, China. (Sponsor: Lili Ji, FACSM)

(No relationships reported)

**PURPOSE:** To observe the relationships between the ECG and quiet biochemical, heart rate variability and EEG indicators, also to establish the Index system for the risk prediction to GXT in men from 40 to 49yr.

**METHODS:** 173 men from 40-49 year (44.0±3.5yr) without cardiovascular disease, diabetes and other diseases. They answered their PA by IPAQ. To test their BP, HR, PWV, TC, TG, HDL-c, LDL-c, myocardium enzymes, hCRP, OP of EEG and LF/HF of heart rate variability in the quiet and fasting state before the GXT at the same day. The GXT was performed on a cycle ergometer of Custo-med with incremental work loads starting with 25 w and adding 25 w at 2 min intervals until the subject reached the Vo<sub>2</sub>max or abnormal change in ST. The performance of GXT, ECG and Vo<sub>2</sub> were recorded. To analyze the relationships between indicators of ECG and other indicators by multiple regression analysis; To build the regression equations by stepwise regression. The significance was  $p < .05$ ; The highly significance was  $p < .01$ .

**RESULTS:** 28 men had abnormal change in ST; 145 men had normal change in ST during GXT. For the normal men, LDH1, LDH1/LDH, OP of EEG and PA in the quiet and fasting state had closed relationships to change in ST of ECG,  $p < .05$ . The risk prediction equation for the men of normal change in ST was  $Y = 0.022 - 0.001X_1 - 0.147X_2 + 0X_3 + 4.53 * 10^{-6}X_4$ . Y was the change of ST, X<sub>1</sub> was LDH1, X<sub>2</sub> was LDH1/LDH, X<sub>3</sub> was OP, X<sub>4</sub> was PA.  $R = 0.496, R^2 = 0.246$ . The forecast range of ST was -0.07-0.08mv. The correlation between the real values and the predictive value was 0.471( $p = 0.000$ ).

For the abnormal men, HDL-c, OP of EEG and DBP in the quiet and fasting state had closed relationships to change in ST of ECG,  $p < .05$ . The risk prediction equation for the men of abnormal change in ST was  $Y = 0.446 + 0.004X_1 - 0.042X_2 + 0.002X_3$ . Y was the change of ST, X<sub>1</sub> was DBP, X<sub>2</sub> was HDL-c, X<sub>3</sub> was OP.  $R = 0.733, R^2 = 0.538$ . The forecast range of ST was -0.24--0.1 mv. The correlation between the real values and the predictive value was 0.643( $p = 0.045$ ). We used the equation to predict the men of normal change of ST, the forecast range of ST was -0.1-0.14 mv.

**CONCLUSIONS:** The values of LDH1, LDH1/LDH, OP of EEG, PA in the quiet and fasting state can be used to predict the normal change of ST in 40-49yr Chinese men in GXT; 2. The values of HDL-c, DBP and OP of EEG can be used to predict the abnormal change of ST in 40-49yr Chinese men in GXT.

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**2112** Board #158 May 31 9:00 AM - 10:30 AM

**Aerobic Exercise Training Conserves Insulin Sensitivity for One Year Following Weight Loss in Overweight Women**

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(No relationships reported)

The objectives of this study were to: (i) identify the independent effects of exercise (aerobic or resistance training) and weight loss (WL) on whole body insulin sensitivity (SI) and (ii) determine if aerobic or resistance training would be more successful for maintaining improved SI one-year following WL. Subjects were 97 healthy, premenopausal women, BMI 27-30 kg/m<sup>2</sup>. Following randomized assignment to one of three groups (diet only, diet + aerobic-, or diet + resistance training) until a BMI  $< 25$  kg/m<sup>2</sup> was achieved. They continued their assigned exercise regimen, and participated in diet counseling sessions aimed at maintaining WL. Body composition, fat distribution, and SI were determined at baseline, in the weight reduced state, and at one-year follow up. The whole body insulin sensitivity index (SI) was determined using a frequently sampled intravenous glucose tolerance test. Results of repeated-measures ANOVA indicated a significant improvement in SI following WL. However there were no effects of group or group\*time. During the one-year follow-up period, the women showed an average weight change of +5.5 kg (range -3.3 kg to +23.7 kg). At one-year follow up, there were no significant main effects of time or group for SI, however there was a significant group\*time interaction. Post hoc analysis revealed that women in the aerobic training group showed a significant increase in SI from weight-reduced to one-year follow up ( $P < 0.05$ ), which was independent of intra-abdominal adipose tissue and % fat. No significant differences in SI from weight-reduced to one year follow up were observed for diet only or diet + resistance groups. These results suggest that long term aerobic exercise training may conserve improvements in SI following WL.

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**2113** Board #159 May 31 9:00 AM - 10:30 AM

**Using Digital Music Technology To Promote Healthy Walking In Non-traumatic Trans-tibial Amputees**

David A. Rowe, FACSM<sup>1</sup>, David McMinn<sup>2</sup>, Leslie Peacock<sup>1</sup>, Arjan W P Buis<sup>1</sup>, Rona Sutherland<sup>1</sup>, Emma Henderson<sup>1</sup>, Allan Hewitt<sup>1</sup>. <sup>1</sup>University of Strathclyde, Glasgow, United Kingdom. <sup>2</sup>University of Aberdeen, Aberdeen, United Kingdom.

(No relationships reported)

Non-traumatic lower limb amputees have elevated health risks due to pre-existing morbidity, and the potential effect of lower limb amputation on subsequent physical activity levels. A few studies have investigated walking pace of lower-limb amputees during short (10-60 meters) walk tests. Very limited evidence is available on typical walking pace or the ability to match walking cadence (step rate) to the beat of auditory stimuli (e.g., metronome or music) in this population, over longer distances. **PURPOSE:** To investigate self-selected and music-paced cadence in unilateral non-traumatic trans-tibial amputees.

**METHODS:** 17 participants (age=52±13 yr; height=1.66±0.16 m; weight=85.0±20.2 kg; BMI=31.5±9.6 kg/m<sup>2</sup>; 88% male) completed two treadmill walking trials, during which steady-state VO<sub>2</sub> was measured. They then completed two overground walking trials of at least 4 min. The first trial was self-paced following instructions to "walk briskly". The second trial was paced using a digital music track which was individually determined from the treadmill trials to be at a moderate cadence (≈3MET). Data were analyzed using RM t-test, Cohen's d, and Bland-Altman plot.

**RESULTS:** During the self-selected brisk walking trial (5.33±0.28 min), participants walked at a cadence of 113±13.5 steps/min (range = 88-139). Cadence during the music-paced walking trial (5.37±0.28 min) was significantly slower (104±13.2 steps/min; range = 80-122;  $p < .05$ ,  $d = 0.69$ ). This pattern occurred for all participants (range = 1 to 23 steps/min slower). From the Bland-Altman plots, 12 of 17 (71%) participants walked within 10 steps/min of the prescribed cadence. No participants walked slower than the prescribed cadence.

**CONCLUSIONS:** Non-traumatic trans-tibial amputees walk faster during self-selected "brisk" walking than during music-guided moderate intensity walking. Additionally, they are able to match a prescribed cadence by following an auditory stimulus relatively well. The use of auditory stimuli is therefore an effective way to prompt walking of a health-enhancing pace in this population, and they appear to be quite capable of walking above moderate intensity.

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2114 Board #160 May 31 9:00 AM - 10:30 AM

**Perceived Barriers To Physical Activity And Program Incentives In A University Wellness Program**

Elizabeth G. Groendal<sup>1</sup>, Samantha J. Danbert<sup>2</sup>, Jeremy L. Knous<sup>1</sup>, Joshua J. Ode<sup>1</sup>. <sup>1</sup>Saginaw Valley State University, University Center, MI. <sup>2</sup>Michigan State University, East Lansing, MI.  
(No relationships reported)

Exercise is Medicine on Campus (EIMC) is a national initiative aimed at improving physical activity (PA) and health on college campuses. One way to promote EIMC is through the development of a university employee wellness program, which can potentially lead to individual improvements in health and fitness. In order to enhance the effectiveness of a wellness program, both barriers to PA participation and appropriate program incentives for the participants should be evaluated.

**PURPOSE:** Therefore, the purpose was to evaluate fitness, perceived barriers to PA and appropriate program incentive levels among university employee wellness program participants.

**METHODS:** Participants included 150 employees enrolled in a wellness program. Fitness assessments included anthropometrics, body composition, flexibility, muscular endurance, muscular strength, and aerobic capacity. Survey evaluation included perceptions of PA barriers and program incentives. Perceived barriers to PA were assessed using a 5 point Likert scale and dichotomized for analysis. Program incentives were categorized as least, moderately, or most appealing. Descriptive data (mean±SD) were reported for fitness data. Barrier and program incentive prevalence was reported. Chi-square and T-test were used to assess gender differences.

**RESULTS:** Mean (±SD) age was 44.4±12 years with 63% of participants being female. 55% of the participants were considered overweight or obese by BMI, with a statistical difference ( $p \leq 0.05$ ) between males and females. Mean (±SD) for estimated VO<sub>2</sub>max was 35±9 ml/kg/min, percent fat 25±8, curl-ups 26±13, push-ups 26±14, grip strength 77±28kg, sit-and-reach 32±9cm. Estimated VO<sub>2</sub>max and grip strength values were higher in males than females, while percent fat and sit-and-reach values were lower. Lack of time due to work (46%) and feeling tired (27%) were the most common barriers. The greatest perceived program incentive was cash (36%) while additional vacation time was the least (14%).

**CONCLUSIONS:** Participants in this wellness program have a high prevalence of overweight/obesity and low aerobic fitness highlighting the need for university wellness programs. In order to maximize the effectiveness of these programs, lack of time as a barrier to physical activity and cash incentives for participation should be considered.

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2115 Board #161 May 31 9:00 AM - 10:30 AM

**Achieving Recommended Physical Activity Requirements For Elementary Aged Children In New Jersey**

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(No relationships reported)

**PURPOSE:** Childhood obesity has become a national issue. Over the past three decades, obesity has dramatically increased. Childhood obesity has been linked to a decrease in physical activity (PA) among children. The purpose of this study was to increase vigorous to moderate physical activity (VMPPA) into the school day in an attempt to meet the state mandated 150 minutes of required physical activity.

**METHODS:** Students in kindergarten and 1st grade participated in the program. They were surveyed on the amount of physical activity they participated in during five data collection weeks; baseline, first, second, third and fourth quarter. Following the baseline data collection week, the students began an eight month physical activity program. The program, structured recess was designed to infuse VMPPA into recess by providing a fun and age-appropriate program instructed by certified fitness instructors. The Coordinated Approach to Child Health (CATCH) was utilized for the structured recess. The program 30 min/ day provided 150 min/ wk of VMPPA.

**RESULTS:** A total of 909 students participated in the eight month program. At baseline, 890 students participated and achieved 49.98 min of PA. At the first quarter data collection week, 887 students participated for a mean of 203.62 min of PA per student. During the second quarter data collection week, 882 students participated for a mean of 211.06 min of PA per student. In the third quarter, 884 students participated for a mean 229.44 min of PA per student. The fourth quarter had 880 students participating for a mean of 240.28 min of PA per student. There was an increase in PA from baseline to the end of the fourth quarter of 79.58%.

**CONCLUSIONS:** Infusing structured PA into the school day ensured that the students received more than the 150 min state requirement for PA. The students also demonstrated a progressive increase in the amount of PA they were performing outside of the school day during the eight month program.

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2116 Board #162 May 31 9:00 AM - 10:30 AM

**Relationships Among Participation In A Worksite Wellness Program, Leisure-time Physical Activity, And Aerobic Capacity**

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(No relationships reported)

Studies have found worksite wellness programs to improve biometrics and employee behaviors, however their effect on aerobic capacity (VO<sub>2</sub>max) and leisure-time physical activity (LTPA) levels is not well established.

**PURPOSE:** Our purposes were to 1) describe active University worksite wellness participants and 2) determine the relationships between time spent in a worksite wellness program, LTPA levels, and fitness.

**METHODS:** Participants included faculty/staff enrolled in a worksite wellness program ranging from 1 to 72 months (n=68). Each received a fitness assessment (anthropometry, body composition, aerobic capacity, muscular strength, muscular endurance, and flexibility). In addition, participants' self-reported LTPA was assessed via the Global Physical Activity Questionnaire (MET.min/wk). Descriptive statistics were calculated using means and standard deviations. The sample was split into three groups based on time spent in the program (1-20, 21-36, >36 months). Relationships between time spent in the wellness program and 1) LTPA levels and 2) fitness measures were assessed via a one-way ANOVA.

**RESULTS:** Mean(±SD) age was 43.6 ± 10.3 years and 66% of participants were female. Participants reported engaging in strength and flexibility training an average of 2.2 ± 1.9 and 2.2 ± 2.0 times per week, respectively. Mean(±SD) BMI was 25.9 ± 5.1 kg/m<sup>2</sup>, % fat was 28.5 ± 8.1, VO<sub>2</sub>max averaged 34.7 ± 8.2 ml/kg/min, and MET.min/wk was 2103 ± 1769. VO<sub>2</sub>max of participants enrolled for 21-36 months was significantly lower (30.8 ml/kg/min;  $p \leq .05$ ) than those enrolled for 1-20 months (36.0 ml/kg/min) and >36 months (36.9 ml/kg/min). No significant differences were found in BMI, %fat, muscular strength, muscular endurance, flexibility, or MET.min/wk.

**CONCLUSIONS:** Knowing health and fitness characteristics of active worksite wellness participants may help to create effective programming to improve participation and fitness measures. Our results suggest that length of time spent in a worksite wellness program is not related to LTPA levels, but may have a relationship with aerobic capacity. Longitudinal data collected at consistent time points might help explain the observed differences in aerobic capacity.

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2117 Board #163 May 31 9:00 AM - 10:30 AM

**Physical Fitness Comparisons of Safety-Net Community Health Center and Medically Affiliated Fitness Center Older Adults**

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(No relationships reported)

Health outcome disparities may occur when socially disadvantaged populations experience differences in opportunities to achieve optimal health and fitness. Safety net community health centers (CHC) are community-based providers that offer health services to vulnerable populations. However, health disparities go beyond access to health care services and include limited opportunities and access for improving physical fitness (PF).

**PURPOSE:** To compare PF measures in adults who are members of a medically affiliated fitness center (FC) with patients of a safety net CHC.

**METHODS:** Males and females (aged >40 yr) who expressed interest in learning more about their PF were invited to participate. Each participant completed the Rikli and Jones Senior Fitness Test (SFT), which included assessments of: 1) upper-body endurance (UBE, mean number of arm curls); 2) lower-body endurance (LBE, mean number of chair stands); 3) aerobic endurance (AE, distance walked, yd); 4) lower body flexibility (LBF, mean distance reached, cm); 5) upper body flexibility (UBF, distance between finger tips, cm); and 6) percent body fat

(%BF).

**RESULTS:** There were 101 CHC participants (50 female, 51 male, mean education 12.14 + 2.5yr, mean age 53.9 + 8.1yr) and 100 FC participants (50 female, 50 male, mean education 16.34 + 2.6yr education, mean age 55.5 + 16.8yr). Multiple comparisons (mean±SD) showed that FC female participants performed significantly better on each PF measure compared to female CHC: UBE (CHC=13.6±4.2, FC=20.1±5.6, p<0.001); LBE (CHC=9.8±3.2, FC=17.1±3.1, p<0.001); AE (CHC=409.7±177.5, FC= 692.6 + 95.6, p<0.001); LBF (CHC=3.2±5.6, FC=2.3±4.6, p<0.001); UBF (CHC=-6.6±6.3, FC=0.7±0.7, p<0.001); and %BF (CHC=43.6±11.6, FC=32.1±10.0, p<0.001). Except for LBF (CHC=-1.5±5.6, FC=-0.4±5.6, p=0.7), FC men performed significantly better on all PF measures compared to CHC: UBE (CHC=17.6±6.6, FC=21.5±4.7, p<0.01); LBE (CHC=11.6±4.5, FC=17.3±4.6, p<0.001); AE (CHC=482.7±191.7, FC=698.9±89.2, p<0.001); UBF (CHC=-8.9±6.9, FC=-2.8±5.6, p<0.001); and %BF (CHC= 29.3±10.0, FC=24.0±8.0, p=0.05).

**CONCLUSIONS:** FC adults were more physically fit than CHC adults. Results support the need for access to fitness centers and professionals in disadvantaged populations in order to more completely address health disparities.

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**2118 Board #164 May 31 9:00 AM - 10:30 AM**  
**Engaging and Enabling Rural Communities in Chronic Disease Prevention: The HealthSteps Program**

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(No relationships reported)

Heart disease and type II diabetes are on the rise, and more than half of Canadian adults are classified as overweight or obese. Rural communities have a higher prevalence of heart disease and diabetes while they face additional barriers to performing regular exercise compared to their urban counterparts. Our previous research has demonstrated that tailored exercise prescription in the family health team setting is feasible and effective, as at-risk patients improved cardiovascular fitness, reduced waist circumference, normalized blood pressure and increased energy expenditure.

**PURPOSE:** To implement a post-research study program to enable and engage communities in sustainable lifestyle change for individuals at-risk of developing type II diabetes.

**METHODS:** The HealthSteps program is the knowledge translation phase following a 12-month randomized controlled trial to determine the efficacy of a prescriptive exercise intervention in patients with cardiovascular risk factors of type II diabetes (ARTEMIS). The HealthSteps program consists of group lifestyle prescription sessions led by healthcare professionals in the family health team (FHT) setting. Program components include a comprehensive, community-sensitive program of training and support for healthy lifestyle change delivered by the family health team.

**RESULTS:** Conceptualization and then construction of the program was informed by knowledge brokering stakeholders and users in focus group sessions. The HealthSteps pilot program was launched in September 2011 in a rural Southwestern Ontario FHT comprised of 8 physicians and 10 healthcare professionals serving a population of 59,325. Analysis revealed that participants found the program suitable to their needs to continue a healthy lifestyle and 100% would continue the program and recommend it to others. In addition, participants noted that the support of a program after the initial study was essential to their continuing motivation for a healthy lifestyle.

**CONCLUSIONS:** The HealthSteps program is the knowledge to action outcome of an evidence-based research program that has demonstrated feasibility and utility in the FHT setting. Next steps will include implementation in a range of rural and urban community family health teams to demonstrate generalizability and fidelity of the program.

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**2119 Board #165 May 31 9:00 AM - 10:30 AM**  
**Atherosclerotic Cardiovascular Risk and Aerobic Fitness in Paralympic Athletes with Locomotor Impairments**

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(No relationships reported)

Atherosclerotic cardiovascular disease (ACVD) represents a leading cause of morbidity and mortality in locomotor impaired (LI) individuals. A sedentary habit has been established as main risk factor (RF) in this population.

**PURPOSE:** We evaluated the hypotheses that (1) in LI athletes (LIA) aerobic fitness (oxygen uptake peak - VO<sub>2</sub>peak) was inversely related to ACVD RF and (2) the prevalence for each RF was higher in LIA with spinal cord injury (SCI) than in LIA with other locomotor impairments.

**METHODS:** A total of 70 male LIA, who competed in the last two summer and winter Paralympic Games (36 with SCI, 18 lower limb amputees, 3 with cerebral palsy, 5 with poliomyelitis and 8 with other locomotor disorders) were screened through anthropometric and blood pressure (BP) measurements, laboratory blood tests and graded maximal arm cranking exercise tests, to estimate both an ACVD RF score and VO<sub>2</sub>peak. The ACVD risk score was assessed summing 1 point for each of the following RF, potentially modifiable by fitness and evaluated in accordance with the ACSM recommendations: obesity, hypertension, dyslipidemia, impaired fasting glucose and subtracting 1 point when serum HDL cholesterol was higher than 60 mg-dl<sup>-1</sup>.

**RESULTS:** Prevalence of hypertension, obesity, total cholesterol, LDL cholesterol, HDL cholesterol and impaired fasting glucose were equal to 13.9% and 17.6%, 13.9% and 5.9%, 47.2% and 32.3%, 50% and 41.2%, 38.9% and 44.1%, 30.6% and 23.5%, respectively in LIA with SCI and LIA with other impairments. Based on the number of ACVD RF, 4 groups were formed: group 1 (RF=0, N=26), group 2 (RF=1, N=25), group 3 (RF=2, N=9), group 4 (RF=≥3, N=10). VO<sub>2</sub>peak values were equal to 36±8.8 ml·kg<sup>-1</sup>·min<sup>-1</sup>, 32±8.6 ml·kg<sup>-1</sup>·min<sup>-1</sup>, 27±5.5 ml·kg<sup>-1</sup>·min<sup>-1</sup>, 18±4.3 ml·kg<sup>-1</sup>·min<sup>-1</sup> in group 1, group 2, group 3 and group 4, respectively.

**CONCLUSIONS:** ACVD risk was higher in LIA with SCI than in other LIA. VO<sub>2</sub>peak is inversely associated with ACDR RF. High aerobic fitness, which has been demonstrated correlated with energy expenditure of some continuous and intermittent sports, provides a protective effect on the ACVD risk.

Funding from Italian Paralympic Committee and Sapienza, University of Rome.

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**2120 Board #166 May 31 9:00 AM - 10:30 AM**  
**Objectively Measured Physical Activity And Health-related Quality Of Life: The Hong Kong Family Project**

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(No relationships reported)

The association between physical activity (PA) and health-related quality of life / well-being has been well established. However, most previous studies used self-reported questionnaire data with uncertain validity. Accelerometers offer an objective measurement of motion, and are becoming popular in PA monitoring, but the relationship between accelerometer-measured PA and health-related quality of life is unclear.

**PURPOSE:** To examine the relationship between PA, measured objectively both by time spent and by number of steps, and health-related quality of life, measured by the physical component subscale (PCS) and mental component subscale (MCS) of the Medical Outcome Study Short Form - 12 (SF-12) in Hong Kong.

**METHODS:** In the Hong Kong Jockey Club FAMILY Project Cohort Study household survey, 2,138 adults (aged 44.5 ±SD 17.6 years, 46.3% male) wore an ActiGraph accelerometer for four days and completed the SF-12 at baseline (March - October 2009). In the follow up surveys, the SF-12 questionnaire was repeated 3, 9 and 15 months later.

**RESULTS:** The follow-up rates were 64% at 3 months, 75% at 9 months, and 68% at 15 months. Of all the participants, 40.9% had at least 150 minutes of moderate-to-vigorous physical activity (MVPA) in the four-day observation period, and 48.9% accumulated ≥8,000 steps per day. Adjusting for age, sex, income, education, marital status, smoking and drinking habits, multilevel regression for repeated measure showed that participants who had at least 150 minutes of MVPA per week over the 4-day had a higher PCS (difference = 0.71, Cohen's d effect size = 0.10, p < 0.05) than those who did not, but there was no difference in MCS (p > 0.05). Participants who walked at least 8,000 steps per day had a higher PCS (difference = 0.89, Cohen's d effect size = 0.12, p < 0.01) than those who did not, but there was no difference in MCS (p > 0.05).

**CONCLUSIONS:** Both MVPA and number of steps were associated with physical ability but not with mental aspects of health-related quality of life.

Supported by the Hong Kong Jockey Club Charities Trust.

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**2121 Board #167 May 31 9:00 AM - 10:30 AM**  
**Analysis Of Physical Activity Participation, Attitude, Barrier Factors Of Patients With Colorectal Cancer In Korea**

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(No relationships reported)

Colorectal cancer is the third most commonly diagnosed cancer in the United States and also in Korea. Although the effects of physical activity on prevention and prognosis of colorectal cancer have been reported previously, the amount of physical activity participation and barrier factors affecting physical activity in colorectal cancer patients, have not been fully elucidated.

**PURPOSE:** This study was to examine the level of physical activity participation, barrier factors affecting physical activity participating and attitude toward exercise in colorectal cancer patients in Korea.

**METHODS:** A total of 431 patients (male:271, female:160, aged:59.69 ±10.86), diagnosed with colorectal cancer, were recruited for this study. Data collection is accomplished through a structured interview.

**RESULTS:** The level of physical activity participation increased significantly after patients were diagnosed with colorectal cancer. The subjects showed higher level of physical activity participation after the completion of cancer treatment compare to the level of physical activity participation during cancer treatment ( $p < 0.05$ ). A 68.8% of patients believed that the exercise is beneficial for the prevention of cancer recurrence and 66.5% of patients were willing to participate in some kind of physical activity programs. However, only 34.9% of patients participated in more than 18 MET-hours per week of physical activity, which is known to have beneficial effects in the prevention of colorectal cancer recurrence. The major barriers in participating in physical activity experienced by colorectal cancer patients were fatigue, lack of fitness and not feeling well.

**CONCLUSIONS:** Interestingly, the colorectal cancer patients participate more physical activity after the cancer diagnosis with expectation that the exercise is helpful for them. Although most of colon cancer patients had an positive attitude toward physical activity and exercise, only one third of them participated in enough physical activity known to prevent cancer recurrence. Therefore, a strategy to increase the physical activity for colorectal cancer patients is required.

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**2122 Board #168 May 31 9:00 AM - 10:30 AM**  
**Free Choice Access to Wellness Education and Services Positively Impact Employee Wellness**

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(G.A. Sforzo: Contracted Research - Including Principle Investigator; Plus One Health Management.)

The effects of wellness and exercise programming are usually studied in subjects agreeing to a minimal level of participation. This removes a normal degree of free choice from these studies. In the present study we recruited subjects to partake in wellness programming but did not dictate a minimum level of involvement but instead simply made healthful services available to them. The most prominent services provided were wellness education, access to a fitness facility, and healthy cafeteria meals. The only obligation participants had was to complete outcome measures. **PURPOSE:** Examine effects of voluntary participation in employer-sponsored, multi-point wellness education programming on employee wellness.

**METHODS:** A randomized and controlled design was used to organize 96 participants into three groups: education+access; access-only; and control. Those receiving education were offered health promoting: email messages three times weekly; lectures once per week; and web portal entry. Those receiving access were offered use of a corporate fitness facility and discounted healthy cafeteria meals. Outcome measures included biometrics, fitness, psychological, and health knowledge variables and were made at start and end of a 12-week intervention period. ANOVA and path analysis were used to inspect these data.

**RESULTS:** Education+Access improved wellness knowledge (pre: .50+.14; post: .69+.14;  $p < .05$ ) which led to improvements in life satisfaction ( $r = .27$ ;  $p < .05$ ), employee morale ( $r = .29$ ;  $p < .05$ ), energy ( $r = .25$ ;  $p < .05$ ), and nearly in stress level ( $r = .24$ ;  $p = .06$ ). Those who received facility access without educational programming did not reap health benefits. Employees voluntarily used the fitness facility and healthy meal cards only 1.3 and 1.5 times/week, respectively.

**CONCLUSIONS:** Participants made limited and likely inadequate use of wellness opportunities when given access but free choice. As a result, physical health benefits (e.g., fitness parameters, blood pressure) were not seen. It is evident that motivation to participate, and determining obstacles that limit participation, is of great concern for employee wellness programs. However, wellness education, delivered in a multi-point fashion was effective and resulted in psychosocial health benefits in just 12 weeks.

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**2123 Board #169 May 31 9:00 AM - 10:30 AM**  
**Reaching Targeted Participants In An Urban Ciclovía: The Case Of Sunday Streets San Francisco**

Susan G. Zieff, Mi-Sook Kim. *San Francisco State University, San Francisco, CA.* (Sponsor: Marialice Kern, FACSM)  
(No relationships reported)

Community-based events that use public spaces such as city streets for physical recreation have the potential to influence population-wide health behavior. The rotating routes used for an urban, monthly "street opening" event, Sunday Streets SF (SS), purposely include neighborhoods that lack recreational resources.

**PURPOSE:** Previous studies showed that convenient access to physical activity (PA) influences participation of residents living on or near SS routes. The purpose of this study first examined the extent to which SS attracts participants who reside in neighborhoods that are underserved for PA resources but are outside of route boundaries. Second, the study explored these participants' experiences while at SS.

**METHODS:** A total of 626 participants (mean age: 39.51 years, SD=10.8) from three SS events were recruited to complete a 24-item survey in 2010. The participants reported demographic information, their residential zipcodes, reasons to attend and return to the event, and their experience while attending SS. Using residential zipcodes of participants, the target group for the present study was selected from a list of zipcodes identifying neighborhoods lacking recreational facilities using a park assessment report, city government website zipcode data, and a city Planning Department map.

**RESULTS:** A total of 17.3% of participants were classified as the targeted group (n=108). The participants traveled an average of 7.3 miles (SD=5.9 miles) to attend SS and 67% reported attending multiple SS events. Biking (20.4%) and walking (19.4%) were the most commonly reported activities and participants indicated an average of 57 minutes engaged in PA of their total average time of 168 minutes at the event. The most important reasons to attend and return were for the safe environment and the opportunity for outdoor PA. Printed advertisements (billboards and buses) (22.2%) and word of mouth (22.2%) were the most common ways that participants learned of the event.

**CONCLUSIONS:** Public streets offer a unique and effective strategy for increasing PA among underserved populations. This study suggests that community events successfully attract a substantial group of participants from distant neighborhoods with low-access to recreational opportunities thereby reducing the need for separate events in each location.

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**2124 Board #170 May 31 9:00 AM - 10:30 AM**  
**Exercise Is Medicine On Campus: Participation Rates In A University Employee Wellness Program.**

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(No relationships reported)

Exercise is Medicine on Campus (EIMC) is a national initiative aimed at improving physical activity (PA) and health on college campuses. One way to promote EIMC is through the development of a university employee wellness program, which can potentially lead to individual improvements in health and fitness. Employee wellness programs may offer a variety of structured opportunities for participants to improve health. In order to maximize participation it is important to evaluate participation within all components of the wellness program.

**PURPOSE:** Therefore, the purpose of this study was to assess participation rates of university employees in each component of a university worksite wellness program.

**METHODS:** Participants included all eligible university employees who participated in at least on component of the university wellness program. Participation was tracked for the following components of the wellness program: 1) logging of exercise, 2) strength training, 3) annual physical exams, 4) lunch and learns, and 5) fitness testing. Maximal monthly participation and mean yearly participation rates, along with percentage of each as a function of active program participants and total eligible participants, are reported for the various components of the wellness program.

**RESULTS:** Over a three year period, participation in the university wellness program have slowly increased from 40% to 49% of the eligible participants. The average number of participants using the exercise log to record physical activity has increased from 43% of active and 18% of eligible participants in year 1 to 54% and 22% in year 3, respectively. Participation in lunch and learns has remained steady over the 3 year period at 18% of active and 7% of eligible employees. Only 9% of the active participants participated in fitness testing this past year.

**CONCLUSIONS:** While university wellness program participation has increased over the past 3 years, less than half of the eligible participants are taking advantage of the opportunity. Of the various components offered through the program, tracking of exercise using the exercise log is the most often utilized (54%) by active participants. These findings highlight a need for greater EIMC promotion and increased employee participation in an already established university wellness program.

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**2125** Board #171 May 31 9:00 AM - 10:30 AM

**Health Clinic Staff do not Increase Physical Activity One Year After a Brief Intervention**

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(No relationships reported)

Staff workers in primary health care settings have potential for impacting physical activity (PA) levels in patients.

**PURPOSE:** We sought to measure PA levels of health clinic staff and to determine whether a brief intervention would result in higher PA levels after one year of follow-up.

**METHODS:** Apparently healthy clinic staff  $\geq 18$  yrs were recruited. Exclusion criteria included unmanaged chronic disease and pregnancy. Self-reported age, height and weight were assessed by medical history. PA was assessed by accelerometry (accel) and two self-report assessments designed for primary care. At least 4 valid days of accel were required for analysis. After baseline PA assessment, staff were asked to choose a goal to improve diet or PA. Guidance of 1-3 minutes on desired behavior change and a tip sheet, on which the goal was indicated, were provided. The suggested PA goal was to do 30 minutes of moderate to vigorous (MV) PA on 5 days of the week. Staff were told that follow-up would occur about 12 months later without contact from researchers in the interim. The intervention was meant to mimic the time between typical primary care visits in patients without chronic disease. Change in PA variables was assessed by repeated measures ANOVA.

**RESULTS:** 85 staff workers were recruited at baseline; 62 had valid accel data. 40 staff completed follow-up testing; 30 had valid accel data. Those with complete PA data were mostly women, were  $39.4 \pm 11.9$  yrs, and had a BMI of  $28.5 \pm 3.0$  kg/m<sup>2</sup>. Weekly minutes of MVPA by accel at baseline were not statistically different between staff who did ( $95.1 \pm 71.5$ ) or did not ( $89.5 \pm 44.4$ ) choose to improve PA. Self-reported PA was also similar between groups. At follow-up, weekly minutes of MVPA by accel was  $96.9 \pm 71.3$  in those who chose a PA goal ( $n=20$ ) and was  $77.1 \pm 44.4$  in those who chose a diet goal ( $n=10$ ). There were no group or time differences in any PA measures at follow-up. These results were not altered when body weight or age were considered as covariates.

**CONCLUSIONS:** Very few staff achieved the goal of 150 minutes per week of MVPA at baseline or at follow-up. More intensive intervention strategies and cultural change may be necessary in order to improve PA in this group. Funded in part by DHHS Office on Women's Health (Asist2010: ASTWH070006-01-00) and the University of Utah Department of Family and Preventive Medicine.

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**2126** Board #172 May 31 9:00 AM - 10:30 AM

**Body Weight And Smoking Modifications After An Exercise Program On Female Young Smokers**

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(No relationships reported)

Weight gain is a factor on smoking cessation because it has been seen as a problem that may influence the cessation attempts among smokers.

**PURPOSE:** To establish the effects of a supervised aerobic program on body weight and number of smoking cigarettes of 15 sedentary young female smokers on pre contemplative stage.

**METHODS:** Through a case control study, fifteen sedentary young smokers were placed on two groups. Nine women were part of the Control Group (COG) and had no intervention. Six women belonged to the case group (CG) and participated on an aerobic exercise program during 8 weeks. Each session lasted 35 to 40 minutes 3 days a week, at 65 to 75% HRmax, with a Borg scale intensity of 13-14 and an average caloric expenditure of 242.2 per session. Bodyweight, BMI and fat percentage were measured at the beginning and the end of training period.

**RESULTS:** At the end of the supervised aerobic program, the CG group had a lower number of cigarettes smoked by day compared to COG group ( $0.66 \pm 0.5$  vs.  $3.11 \pm 1.61$ ;  $p < 0.05$ ), BMI changed from  $23.02 \pm 3.9$  to  $23.2 \pm 4.05$  ( $p > 0.05$ ) and body fat percentage  $24.8 \pm 7.01$  to  $26.03 \pm 4.8$  ( $p > 0.05$ ). As for the CG, body weight changed from  $57.3 \text{ Kg} \pm 6.7$  to  $56.9 \text{ Kg} \pm 7.3$  ( $p > 0.05$ ), BMI changed from  $22.01 \pm 2.3$  to  $21.8 \pm 2.5$  ( $p > 0.05$ ) and body fat percentage  $25.4 \pm 7.1$  to  $24.3 \pm 6.1$  ( $p > 0.05$ ).

**CONCLUSIONS:** After eight weeks of training there were no differences on body composition (weight, BMI or body fat percentage) between the groups but a supervised aerobic program decrease the number of cigarettes smoked by day on a group of habitual female cigarette smokers on pre contemplative stage. According to these data, a supervised aerobic program might prevent the increased in body weight after smoking cessation.

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**2127** Board #173 May 31 9:00 AM - 10:30 AM

**Behavioural Outcomes Using Smartphone Technology Versus Paper-based Logs In The Prevention Of Cardiovascular Risk**

Brittany Intzandt<sup>1</sup>, Kristin J. Sabourin<sup>1</sup>, Sheree Shapiro<sup>1</sup>, Melanie I. Stuckey<sup>1</sup>, Lyndsay Foisey<sup>1</sup>, Claudio Munoz<sup>2</sup>, Robert J. Petrella, FACSM<sup>1</sup>. <sup>1</sup>Lawson Health Research Institute, London, ON, Canada. <sup>2</sup>Gateway Rural Health Research Institute, Seaforth, ON, Canada.

(No relationships reported)

**PURPOSE:** This study investigated the potential behavioural influence of a physical activity (PA) intervention for participants in rural Southwestern Ontario who are at risk for type II diabetes and cardiovascular disease.

**METHODS:** Participants were  $57.8 \pm 9.2$  y and had at least two of the following criteria: abdominal obesity, high blood pressure (BP), low high density lipoproteins (HDL), elevated triglycerides, and increased blood glucose (BG) levels. Intervention participants ( $N=63$ ) received a Step Test and Exercise Prescription (STEP), home monitoring BG and BP systems, a Smartphone, and a pedometer. Participants documented BG and BP three times per week, as well as daily PA through an online health monitoring system. Control participants ( $N=45$ ) also received STEP but used only paper-based logs to record daily PA and did not have BG or BP home monitoring. At baseline (V0), 12 (V1)- and 24-week (V2) visits, participants completed two behavioural questionnaires: Decisional Balance (DB), and Health-related Quality of Life (SF-36).

**RESULTS:** Analysis of variance revealed no changes in the perceived pros or cons of PA ( $p > 0.05$ ) as determined by DB for either group. The intervention group's general ( $71.4 \pm 15.6$  at V0 to  $75.2 \pm 14.4$  at V1 and  $76.6 \pm 13.9$  at V2;  $p < 0.05$ ) and mental health improved ( $78 \pm 14.7$  at V0 to  $82.3 \pm 12.6$  for V1 and to  $82.8 \pm 11.3$  for V2;  $p < 0.05$ ). The intervention group also demonstrated changes in vitality from  $58.7 \pm 19$  V0 to  $63.7 \pm 17.5$  at V1 and  $65.9 \pm 17.1$  at V2 ( $p < 0.05$ ). The control group showed improvements in general ( $71.1 \pm 18.1$  at V0 to  $76.4 \pm 16.5$  at V2;  $p < 0.05$ ) and mental health ( $78.4 \pm 14.2$  at V0 to  $81.6 \pm 13.7$  at V2;  $p < 0.05$ ). Vitality also improved for controls from  $59.2 \pm 18.8$  at V0 to  $65.2 \pm 16$  at V1 to  $65 \pm 17$  at V2 ( $p < 0.05$ ).

**CONCLUSIONS:** Based on these findings, exercise prescription, along with tracking PA may have a positive effect on the quality of life amongst at-risk individuals residing in rural areas. Aspects of quality of life increased at a greater for the intervention group than the controls.

2128 Board #174 May 31 9:00 AM - 10:30 AM

**Lifestyle Intervention For The Management Of Type 2 Diabetes Mellitus In African-americans**

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(No relationships reported)

The prevalence of Diabetes Mellitus (DM) in African-Americans

(AA) is higher than Caucasians. The Lifestyle Intervention for Veterans (LIVE) Program was developed to provide intensive diabetes management through lifestyle interventions as an adjunct to traditional medication therapy.

**PURPOSE:** To assess metabolic and cardiovascular changes following a 12-week supervised exercise and dietary intervention in AA diabetic veterans.

**METHODS:** Individuals from our Primary Care and Diabetes clinics were referred to the program. Baseline exercise capacity was assessed by a peak exercise test. Blood chemistries, blood pressure and exercise parameters were recorded at baseline and after 12 weeks of individualized dietary counseling provided by a registered dietician and a supervised cardiovascular and resistance exercise training. Exercise intensity was maintained at 50% to 80% of heart rate reserve. In addition to the supervised, participants were instructed to supplement their exercise by daily brisk walks aiming to accumulate at least 150 minutes of exercise per week.

**RESULTS:** The average weekly time spent in supervised exercise sessions was 72 minutes. There were significant improvements noted in exercise capacity (8.5±1.8 to 10.1±2.1 METs), body weight, and waist circumference, cardiovascular and metabolic parameters (Table).

**CONCLUSIONS:** Supervised exercise program and dietary interventions were effective in improving cardiovascular and metabolic parameters in AA with Type 2 DM.

| VARIABLES           | BASELINE | POST-EXERCISE | P-values |
|---------------------|----------|---------------|----------|
| Wt (lbs)            | 230±42   | 224±39        | 0.001    |
| Waist (inches)      | 45.2±5   | 44.2±5        | 0.009    |
| Rest SBP (mm Hg)    | 125±17   | 120±14        | 0.07     |
| Rest DBP (mm Hg)    | 71±9     | 68±8          | 0.08     |
| HR @ 3 min (bpm)    | 107±13   | 104±14        | 0.02     |
| SBP @ 3 min (mm Hg) | 158±20   | 147±20        | <0.001   |
| DBP @ 3 min (mm Hg) | 79±17    | 73±10         | 0.02     |
| Peak HR (bpm)       | 137±19   | 139±21        | 0.8      |
| Peak SBP (mm Hg)    | 187±25   | 181±26        | 0.9      |
| Peak DBP (mm Hg)    | 84±14    | 77±11         | 0.003    |

2129 Board #175 May 31 9:00 AM - 10:30 AM

**Long-Term Physical Activity Vs. Inactivity And Health: A Co-twin Control Study**

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(No relationships reported)

When studying the associations between physical (in)activity and health outcomes we are faced with two specific issues: genetic selection may explain some of the associations in observational follow-up studies, and RCTs that investigate the effects of exercise on health outcomes are usually of a too short duration to document the long-term effects on health.

**PURPOSE:** To tackle these limitations, we have investigated 7 monozygotic (MZ) and 9 dizygotic (DZ) twin pairs (50-74 yrs), discordant for leisure-time physical activity habits during their adult life, to document the specific effects of long-term physical activity on fitness and obesity status while controlling for genes and childhood family environment.

**METHODS:** Twin pairs were comprehensively identified from the Finnish Twin Cohort. Discordance was initially defined in 1975 and the same co-twin remained more active during the 32-year-long follow-up. Symptom-limited maximal clinical exercise test with cycle ergometer was performed for the assessment of cardiorespiratory fitness. Maximal isometric left knee extensor force was measured in a sitting position using an adjustable dynamometer chair. Body composition was measured using bioimpedance technique (InBody 720) after a 10-h fast. T1-weighted MRI axial scans were acquired from the abdomen and mid thigh with 1.5T GE-Signa Excite HD CVI.

**RESULTS:** Estimated peak oxygen uptake was 6.1 ml/kg/min lower (p<0.001) in inactive compared to the active co-twins, the difference being 4.8 ml/kg/min between inactive and active MZ co-twins. Compared to their inactive co-twins, maximal knee extension force was 20% higher among the active twins (p=0.006) and 26% higher among the active MZ twins. The fat percent was lower among all active (21.5 vs 27.0 kg/m<sup>2</sup>, p=0.004) and active MZ twins (22.9 vs 27.9 kg/m<sup>2</sup>, p=0.10). The area of visceral fat at the level of L4-L5+5cm was 1.5 times greater among the inactive twins (p=0.01) and 1.3 times greater among the inactive MZ twins (p=0.18). Mid thigh intramuscular fat area was 1.5 times greater among the inactive twins (p=0.002), being also 1.5 times greater among the inactive MZ twins (p=0.028).

**CONCLUSIONS:** Physically active lifestyle maintains fitness and lowers the rate of in particular ectopic fat accumulation even after taken into account the genetic background.

2130 Board #176 May 31 9:00 AM - 10:30 AM

**Prescribed Exercise Dose and Associated Physiological Outcome Changes in the TIGER Study**

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(No relationships reported)

Accumulating recommended levels of moderate and vigorous physical activity is associated with health benefits including reduced all-cause mortality and risk of chronic illness. Exercise dose is a complex stimulus involving intensity and duration of exercise accumulated across multiple sessions, and there is continued interest in examining health benefits associated with cumulative exercise dose.

**PURPOSE:** To examine the association of total aerobic exercise dose, quantified by a heart rate physical activity score (HRPAS), and changes in physiological outcomes across a 15-week intervention.

**METHODS:** Data from 1,285 ethnically-diverse participants (507 men, 778 women), age 17-35 y, from the Training Interventions and Genetics of Exercise Response (TIGER) Study were included in the present analyses. Exercise training was comprised of three 30-min sessions of aerobic exercise at 65%-85% maximum heart rate reserve (HRR) weekly for 15 weeks. Exercise intensity and duration were recorded using computerized HR monitors during each session. HRPAS was calculated by summing the product of relative exercise intensity (%HRR) and duration (min) across all sessions. Regression models adjusted for age, gender, race and baseline values were used to regress each outcome on HRPAS score. Partial t-test and p values are provided for each model.

**RESULTS:** Exercise dose, as defined by HRPAS, was significantly associated with improvements in BMI (t(1062) = -5.19, p< 0.001), waist (t(1048) = -4.16, p< 0.001) and hip (t(1047) = -3.57, p< 0.001) circumferences, %BF (t(998) = -2.66, p = 0.008), resting HR (t(1049) = -3.46, p = 0.001), estimated aerobic capacity (t(980) = 4.10, p< 0.001), DXA fat mass (t(636) = -3.84, p< 0.001), and DXA percent fat (t(636) = -4.16, p< 0.001). Systolic and diastolic blood pressure and DXA total lean mass were not associated with HRPAS. In TIGER, the minimum

cumulative dose needed to meet ACSM vigorous activity guidelines (i.e., 75 min/wk,  $\geq 60\%$ HRR, HRPAS = 675) was associated with a 1.3% decrease in percent body fat, a 4.0 b-min<sup>-1</sup> decrease in resting HR, and a 2 cm decrease in waist and hip circumferences independent of age, gender and race.

**CONCLUSIONS:** Cumulative aerobic exercise dose is associated with improved physiological outcomes including measures of body composition, resting HR, and estimated fitness.

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**2131** Board #177 May 31 9:00 AM - 10:30 AM

**Aerobic Exercise Training Improves Heart Rate Recovery Activity In Sedentary African Americans With Abnormal Diastolic Function**

Jan Kretzschmar<sup>1</sup>, Deborah Crabbe<sup>1</sup>, Deborah Fearheller<sup>2</sup>, Kathleen Sturgeon<sup>1</sup>, Keith Diaz<sup>1</sup>, Sheara Williamson<sup>1</sup>, Praveen Veerabhadrapa<sup>1</sup>, Chenyi Ling<sup>1</sup>, Amanda Perkins<sup>1</sup>, Kassandra McGlenn<sup>1</sup>, Olivia Menardy<sup>1</sup>, Michael Brown, FACSM<sup>1</sup>. <sup>1</sup>Temple University, Philadelphia, PA. <sup>2</sup>University of California Los Angeles, Los Angeles, CA.

(No relationships reported)

**PURPOSE:** African Americans are an at risk population for diastolic heart failure (DHF). Increased Sympathetic Nervous System Activity (SNSa) is strongly associated with DHF. Abnormal diastolic function (ADF) is a precursor to DHF and manifests itself early in the disease process without any other apparent signs or symptoms. Like DHF, ADF is often accompanied by increased SNSa. Heart Rate Recovery (HRR) obtained from a graded exercise test is thought to be an indicator of SNSa. Aerobic exercise training has been shown to decrease SNSa and improve HRR, therefore presenting a potential tool for early intervention for people with ADF. Thus, the purpose of this preliminary study was to investigate the effects of aerobic exercise training on HRR in African Americans with abnormal diastolic function.

**METHODS:** AA subjects (n=9) ages 45-62, who were sedentary, non-diabetic, non-smoking, and had abnormal diastolic function, but were free of cardiovascular disease, underwent 6 months of aerobic exercise training (3days/week, 65% of VO<sub>2</sub>max, 40 minutes/day). E' was measured by Doppler ultrasound during an echocardiographic stress test, and abnormal diastolic function was defined as having an E' value less than 10 cm/sec. HRR (maximum heart rate obtained during the test minus 4 min heart rate of passive recovery) determined from a sub-maximal graded exercise stress test was used as a surrogate measure for SNS activity.

**RESULTS:** HRR significantly ( $p<0.029$ ) increased ( $60.22\pm 3.58$  bpm vs.  $70.22\pm 2.55$  bpm) with 6 months of aerobic exercise training. However, aerobic fitness measured via VO<sub>2</sub>max did not ( $p<0.176$ ) change ( $28.07\pm 2.76$  ml/kg/min vs.  $30.57\pm 2.94$  ml/kg/min).

**CONCLUSIONS:** Although no improvements in aerobic fitness were observed, likely due to the small sample size, a significant improvement in HRR was seen, which might indicate an improvement in SNSa. Therefore, among individuals at risk for the development of DHF, aerobic training may be a useful tool at altering one associated abnormality associated with its progression, increased SNS activity.

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**2132** Board #178 May 31 9:00 AM - 10:30 AM

**Aerobic Gait Training in Older Adults With Mild Cognitive Impairment and Hypertension: Preliminary Results.**

Noah Koblinsky<sup>1</sup>, Joseph DeCaria<sup>2</sup>, Manuel Montero-Odasso<sup>3</sup>, Robert Petrella, FACSM<sup>1</sup>. <sup>1</sup>University of Western Ontario, London, ON, Canada. <sup>2</sup>Lawson Health Research Institute, London, ON, Canada. <sup>3</sup>Parkwood Hospital, London, ON, Canada.

(No relationships reported)

Executive dysfunction and gait disability are commonly associated with aging and have shown to be accentuated by hypertension. There is sufficient evidence that warrants the treatment of hypertension in order to slow cognitive and functional decline in at risk older adults.

**PURPOSE:** To determine the effect of aerobic exercise combined with step length feedback on blood pressure (BP), executive function (EF), and gait in hypertensive older adults with signs of mild cognitive impairment (MCI) and hypertension.

**METHODS:** Eleven community dwelling older adults (72.5 $\pm$ 6.3 years) with hypertension and objective signs of MCI completed 12 weeks of an aerobic gait-training intervention. The participants exercised at a moderate to vigorous intensity for 30 minutes, 3 times a week on a treadmill that provided real time visual feedback about their step length. BP was measured over 24 hours by ambulatory monitoring and EF was measured using the Trail Making Test (TMT) and the Digit Symbol Substitution Test (DSST). An electronic walkway measured gait under single and dual task conditions. Paired samples t-tests were used to detect changes between baseline and 12 weeks.

**RESULTS:** Baseline 24-hour mean systolic and diastolic BP was 125.73 $\pm$ 12.31 and 74.27 $\pm$ 8.63 mmHg respectively. Mean baseline TMTa time was 39.57 $\pm$ 18.92 seconds and mean DSST score was 52.91 $\pm$ 11.20 items. Baseline single and dual task (naming animals) step length was 65.04 $\pm$ 8.21 cm, and 61.30 $\pm$ 11.32 cm respectively, while baseline single and dual task (serial 7's) gait velocity averaged 121.22 $\pm$ 17.25 cm and 85.05 $\pm$ 34.98 cm respectively. Following the intervention, 24-hour mean systolic and diastolic BP decreased by [mean difference (95%CI)] 1.09 (1.95; -4.13) mmHg ( $p=0.443$ ) and 2.18 (-0.43; -3.93) mmHg ( $p=0.019$ ). Mean TMTa scores improved by 4.55 (1.04; 8.06) seconds ( $p=0.016$ ) while improvements in DSST scores were not significant ( $p=0.120$ ). Dual task step length increased by 3.74 (1.47; 6.01) cm ( $p=0.004$ ) and dual task velocity increased by 9.85 (0.12; 19.59) cm/s ( $p=0.048$ ).

**CONCLUSIONS:** Our 12-week aerobic gait training intervention was feasible in our sample and the significant improvements observed warrant a larger trial to evaluate the impact of this intervention in at risk older adults. Supported by the St. Joseph's healthcare foundation

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**2133** Board #179 May 31 9:00 AM - 10:30 AM

**The POTS Registry: Treatment of Patients with the Postural Orthostatic Tachycardia Syndrome with Exercise Training**

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(No relationships reported)

The Postural Orthostatic Tachycardia Syndrome (POTS) is characterized by chronic orthostatic intolerance resulting in upright tachycardia ( $\geq 120$  bpm or  $>30$  bpm over supine heart rate (HR) at 10-min standing), with lightheadedness, fatigue, and reduced quality of life. Our prior research has shown that "cardiovascular deconditioning" (i.e., cardiac atrophy and hypovolemia) is a significant underlying mechanism, and that an "optimized" 3 month exercise training program improved or even cured POTS (53% "cure" rate, i.e. they no longer meet heart rate criteria) as well as improved patient quality of life.

**PURPOSE:** To determine the effectiveness of this program in the community setting in POTS patients.

**METHODS:** We established a World-wide POTS registry and enrolled 111 patients from five countries [12 M, 99 F, 26  $\pm$  11 (mean  $\pm$  SD) years old]. Before and after use of the program, a 10-min stand test was performed to obtain heart rate (HR) and blood pressure (BP), and patient quality of life was assessed using the Short-Form 36 Health Survey. The program begins with semi-recumbent exercise and progresses to upright modes while encouraging adherence in the face of likely increased fatigue in the first 4-6 weeks. Weight training focused on leg and core muscles. In addition, water and salt intake were increased.

**RESULTS:** Forty patients completed the program to date. Fourteen patients dropped out (12.6% drop out rate). Thirty-six are still pending due to lack of follow up data, and twenty-one are still training. The HR response to 10-min standing was significantly reduced after training ( $\Delta$ HR 40.9  $\pm$  14.8 bpm pre vs. 21  $\pm$  9.3 post,  $p<0.001$ ). Mean BP was not different before and after training (Supine: 85.8  $\pm$  9.3 mm Hg pre vs. 85.1  $\pm$  16.3 post; at 10-min standing: 84.3  $\pm$  8.8 vs. 89.1  $\pm$  12.2,  $p=0.129$  for interaction). Patients' physical (27.3  $\pm$  7.3 pre vs. 35.2  $\pm$  6.5 post,  $p<0.001$ ), mental (42.5  $\pm$  9.6 vs. 46.5  $\pm$  6.4,  $p=0.026$ ), and social function (36.6  $\pm$  5.9 vs. 44.7  $\pm$  6.5,  $p<0.001$ ) scores were significantly improved. Twenty-five out of forty patients were "cured" (63% "cure" rate).

**CONCLUSIONS:** These results suggest this unique training program is effective in the community setting, and thus, can be used as a non-drug treatment for POTS patients. However, it remains to be determined if maintaining exercise is an effective life-long treatment strategy.

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2134 Board #180 May 31 9:00 AM - 10:30 AM

**Hemodynamic, Cardiorespiratory, and Perceived Exertion Responses To Low-impact Exercise In Coronary Patients**

Roger L. Sacks, Barry Franklin, FACSM, Adam deJong, FACSM, Jenna Brinks, Brad Gliha, Kirk Hendrickson, Lindsey Krajewski, Amy Fowler, Lisa Schornak, Judy Boura. *William Beaumont Hospital, Royal Oak, MI.*

(No relationships reported)

**PURPOSE:** Cardiac exercise programs use varied forms of exercise equipment. For patients with orthopedic limitations, low or non-impact equipment, including the elliptical trainer (ET), is commonly recommended to minimize musculoskeletal discomfort. We compared hemodynamic cardiorespiratory and perceived exertion (RPE) responses to the ET and the Cybex Arc Trainer (AT) in clinically stable patients with coronary disease.

**METHODS:** Ten low risk cardiac men (mean  $\pm$  SD age = 58  $\pm$  11 years) satisfying inclusion criteria (functional capacity  $\geq$  7 metabolic equivalents [METs] without evidence of impaired left ventricular function, signs/symptoms of myocardial ischemia or significant dysrhythmias) were monitored for heart rate (HR), blood pressure (BP), and oxygen consumption ( $\text{VO}_2$ ) responses at rest and during submaximal exercise bouts on the AT and traditional ET using legs-only at 50 and 70% heart rate reserve (HRR). Data were obtained for each piece of equipment on 2 non-consecutive days at the same time of day. Metabolic data were directly obtained using breath-by-breath measurements of  $\text{VO}_2$ , adjusted for body weight (kg). RPE was assessed using the category Borg Scale (6-20), as was pain/discomfort using the 0-4 Scale.

**RESULTS:** Mean  $\pm$  SD aerobic requirements at 50% HRR on the AT and ET were 17.8  $\pm$  4.8 and 18.5  $\pm$  5.1 ml/kg/min (NSD), respectively. Exercise BP responses at 50% HRR during AT and ET were 158  $\pm$  26 and 151  $\pm$  27 mmHg (NSD), respectively. RPE responses at 50% HRR on the AT and ET were 11  $\pm$  1 and 12  $\pm$  2 (NSD), respectively. At 50% HRR subjects reported no pain/discomfort on either device. Aerobic requirements at 70% HRR using the AT and ET were 21.8  $\pm$  6.5 and 21.8  $\pm$  6.9 ml/kg/min (NSD), respectively. Exercise BP responses at 70% HRR on AT and ET were 178  $\pm$  22 and 173  $\pm$  26 mmHg (NSD), respectively. RPE responses at 70% HRR on the AT and ET were 13  $\pm$  1 and 13  $\pm$  1 (NSD), respectively. At 70% HRR, 3 subjects reported 1/4 (mild) leg pain on the AT whereas 2 subjects reported comparable discomfort on the ET.

**CONCLUSIONS:** Our findings suggest the AT is a viable alternative to the ET, with comparable hemodynamic, cardiorespiratory and perceived exertion responses at either 50 or 70% HRR.

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2135 Board #181 May 31 9:00 AM - 10:30 AM

**Exercise Training Increased SOD Activity in Liver of NASH Rats**

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(No relationships reported)

**PURPOSE:** To investigate the interaction of exercise training and MCD diet on steatosis and oxidative stress in liver.

**METHODS:** In this study, 8-week-old male Sprague Dawley rats were randomly divided into 5 groups: control (fed normal diet, W0), MCD diet fed for 9 weeks or 14 weeks combined without (W9, W14) or with exercise training (W9+Ex, W14+Ex). The exercise training was treated for 4 weeks on a motorized treadmill before sacrifice. The blood were collected and analyzed for AST. The liver tissues were collected, extracted and assayed for the production of glutathione (GSH) and lipid peroxidation and the activities of superoxide dismutase (SOD), catalase, glutathione peroxidase (GPx), and glutathione reductase (GR) by using commercial kits. The hematoxylin-eosin staining was used to determine the degree of lobular inflammation and fibrosis in liver. The degree of fibrosis and inflammation were evaluated by METAVIR score. The statistical analysis was done using the one-way ANOVA for independent samples, with significance level of 5%.

**RESULTS:** Rat fed with the MCD diet showed a rapid induction of AST and hepatic steatosis, loss of body weight and liver weight, but increased the ratio of liver and body weight. Compared with W14, the W14+Ex significantly decreased steatosis ( $p < 0.05$ ) and fibrosis ( $p < 0.05$ ). The production of lipid peroxidation in liver increased significantly in W14 (24.0  $\pm$  6.9 vs 0.40  $\pm$  0.05 nmole/min/ $\mu$ g protein,  $p < 0.05$ ) but not in W14+Ex compared with W0 group. The activity of SOD in W14 and W14 +Ex were increased compared with W0. Feeding with MCD diet for 14 weeks significantly decreased the activities of catalase ( $p < 0.01$ ), GPx ( $p < 0.05$ ), and GR ( $p < 0.05$ ). Exercise training did not alter MCD diet abolished activities of antioxidant enzymes.

**CONCLUSIONS:** Exercise training improves NAFLD through increased activity of SOD in liver.

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2136 Board #182 May 31 9:00 AM - 10:30 AM

**Lead, Exercise Training and Herbal Supplementation: Concomitant Neuroprotective Effects of Endurance Exercise Training and Curcumin**

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(No relationships reported)

**BACKGROUND:** Lead as an air pollutant is a life-threatening metal that has been associated with several conditions including degenerative disease of the nervous system.

**PURPOSE:** To investigate neuroprotective effects of treadmill running (TR) and/or Curcuma Longa (CCML) on lead -induced neurotoxicity in the hippocampus and cortex of rats.

**METHODS:** 40 male rats were randomly divided into 5 groups: (1) lead acetate; (2) CCML; (3) TR; (4) TR+CCML; and (5) a sham-treated group. The rats in groups 1 to 4 received lead acetate (20 mg/kg). In addition, groups 3 and 4 underwent TR, 15 to 22 m/min for 25 to 64 minutes, 5 times a week for 8 weeks, while groups 2 and 4 received CCML (30 mg/kg) intraperitoneally. Rats in group 5 received CCML solvent (ethyl oleat), only.

**RESULTS:** Chronic administration of lead increased lipid peroxidation as measured by malondialdehyde (MDA) in the plasma (72%), hippocampus (59%), and cortex (96%) in comparison to the sham group. In addition, lead decreased brain-derived neurotrophic factor (BDNF) in the hippocampus and cortex (17% and 10% respectively), nerve growth factor (NGF) levels in the cortex (39%), and total antioxidant capacity (TAC) levels in the hippocampus (27%), and the cortex (38%), as compared to the sham-treated group ( $P \leq 0.05$ ). Both training and supplementation treatment alone ameliorated the adverse effects of lead; however, the combination of them was more effective. Treadmill+CCML treatment resulted in a significant decrease in MDA levels in plasma and hippocampus (60% and 22%, respectively). However, it increased BDNF in the plasma, hippocampus, and cortex (45%, 76% and 113%, respectively), NGF in the cortex (149%), and TAC levels in plasma (62%) in comparison to the lead only group.

**CONCLUSIONS:** These results provide a rationale for an inhibitory role of CCML and regular exercise in the attenuation of lead-induced neurotoxicity.

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2137 Board #183 May 31 9:00 AM - 10:30 AM

**Estimating Fitness Improvements After Phase II Cardiac Rehabilitation: Comparison of Three Methodologies**

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(No relationships reported)

A recent review of modulators of coronary patient outcomes suggests that each 1-metabolic equivalent (MET) increase in functional capacity (FC) appears to confer an 8% to 35% reduction in mortality. The Duke Activity Status Index (DASI) is a self-administered questionnaire that has been shown to accurately estimate FC, expressed as METs. Other widely used methods for estimating fitness improvements in phase II cardiac rehabilitation (PII CR) include the increase in training workload (Train WL) and the decrease in heart rate (HR) at a fixed workload, where a 10 bpm decrease  $\sim$  1 MET.

**PURPOSE:** The present study compared the change ( $\Delta$ ) in METs following PII CR using the DASI questionnaire with the  $\Delta$  in METs via the Train WL and HR at a fixed WL.

**METHODS:** Patients (157 men, 41 women) who completed  $>18$  PII CR sessions were evaluated. A comparison of the improvement in METs ( $\Delta$  METs) according to the 3 methodologies is shown in the table, with specific reference to gender and to patients on versus off beta-blocker (BB) therapy.

|              | DASI |      |      | Train WL |      |      | HR-Fixed WL |      |      |
|--------------|------|------|------|----------|------|------|-------------|------|------|
|              | N    | Mean | SD   | N        | Mean | SD   | N           | Mean | SD   |
| All Patients | 194  | 0.89 | 1.49 | 193      | 1.28 | 1.03 | 184         | 0.80 | 1.23 |
| Women        | 41   | 0.89 | 1.23 | 40       | 0.73 | 0.64 | 37          | 0.61 | 1.03 |
| Men          | 153  | 0.90 | 1.55 | 153      | 1.43 | 1.06 | 147         | 0.85 | 1.27 |
| BB -Yes      | 154  | 0.89 | 1.51 | 151      | 1.29 | 1.01 | 144         | 0.70 | 1.00 |
| BB -No       | 38   | 0.97 | 1.37 | 39       | 1.27 | 1.10 | 38          | 1.19 | 1.84 |

**RESULTS:** Correlation coefficients comparing the 3 methodologies for all patients (n = 194), and for the varied population subsets, were nonsignificant (P = 0.12 - 0.58). Nevertheless, on average, FC increased by ~ 1 MET, regardless of the methodology employed. Women tended to demonstrate slightly lower absolute improvements in  $\Delta$  METs, using the Train WL or HR-fixed WL estimates. The HR at a fixed WL methodology appeared to underestimate fitness improvements in patients taking  $\beta$ B.

**CONCLUSIONS:** The present findings suggest that a brief PII CR program results in ~ 1 MET improvement in FC, and may help to explain the reduced mortality associated with exercise-based CR programs.

**2138** Board #184 May 31 9:00 AM - 10:30 AM

**Quality Coding Of Meta-analyses Of The Blood Pressure Response To Exercise: A Systematic Review**

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(No relationships reported)

**PURPOSE:** Many meta-analyses have been conducted to summarize the growing numbers of controlled trials addressing the blood pressure (BP) response to exercise. The methods involved in meta-analysis have improved across science, but it is not known to what extent meta-analyses on exercise and BP exhibit high quality among all of the steps required in conducting meta-analyses. This study addressed this gap.

**METHODS:** Meta-analyses were retrieved from electronic databases (PubMed, Biosis, Scopus, and Web of Science) with pre-established inclusion criteria: 1) applied meta-analytic procedures; 2) to controlled exercise trials; and 3) that had systolic BP (SBP) or diastolic (DBP) as endpoints. The AMSTAR questionnaire (Shea et al., 2007) and several customized items quantified the quality of the procedures in the meta-analyses. Across the 17 dimensions, two trained coders exhibited high reliability (mean agreement=87%; mean kappa=0.80).

**RESULTS:** The 22 meta-analyses that qualified for this review were published between 1993 and 2011 and reviewed widely varying exercise modalities and populations. Total methodological quality ranged from 13.33% to 76.47% of the total points possible (Mean 46.72±20.22%), with more recent meta-analyses scoring significantly higher, r(21)=0.59, p<.01, and with higher quality meta-analyses being more cited per year in the Web of Knowledge, in a non-significant trend, r(21)=0.30, p=.17. Nearly all meta-analyses (95%) satisfactorily followed a priori design, but they tended not to satisfy quality criteria related to literature search and duplicate effort (46%); coding of studies (44%); analysis and interpretation (36%); and 5) reporting potential conflicts of interest (41%). Criteria that were the least likely to be met satisfactorily were with regard to documenting the quality of studies included in the meta-analytic sample (0%) and interpretation of results relative to the quality of studies (5%).

**CONCLUSIONS:** Meta-analyses may provide insights into the BP response to exercise but to date none have achieved contemporary quality standards. Our results offer some guidance as to whether new meta-analyses are needed to address particular problems and help readers of these meta-analyses to realize what constitutes a high-quality review.

**2139** Board #185 May 31 9:00 AM - 10:30 AM

**Single Session of Exercise Ameliorates Differences in Insulin Resistance Between Active and Inactive Overweight Adults**

Rachael K. Nelson, Jeffrey F. Horowitz, FACSM. University of Michigan, Ann Arbor, MI.

(No relationships reported)

Regular physical activity (PA) is an essential component of lifestyle programs targeting the prevention and/or treatment of obesity-related metabolic complications, such as insulin resistance. However, the contribution of adaptations resulting from a habitually active lifestyle compared with the effects of the most recent session of exercise on improvements in insulin resistance remains unclear.

**PURPOSE:** To determine the influence of habitual PA level and a single session of exercise on insulin resistance in overweight-to-mildly obese adults.

**METHODS:** A total of 22 overweight-to-mildly obese men and women (BMI: 27-34 kg/m<sup>2</sup>) were divided into 2 cohorts based on their self-reported PA. Five men and 7 women were classified as ACTIVE (>2.5h moderate-to-vigorous PA/week), while 5 men and 5 women were INACTIVE (<30min PA/week). Participants reported to the laboratory after an overnight fast for an oral glucose tolerance test (OGTT), and insulin resistance was assessed using the Matsuda Insulin Sensitivity Index (ISI). ACTIVE participants refrained from exercising for exactly 3 days before the OGTT. After completing the OGTT, participants performed a single session of exercise for 1h at an intensity of ~70% of their age-predicted HRmax, and they returned to the laboratory the next morning for a second OGTT.

**RESULTS:** Despite similar body weight (89±3 vs. 91±3 kg) and %body fat (34±2 vs. 36±2%) in ACTIVE vs. INACTIVE, ISI tended to be greater in ACTIVE (measured 3 days after their last exercise session) compared with INACTIVE (4.0±0.6 vs. 2.5±0.3), but this difference did not reach statistical significance (P=0.09). A single session of exercise increased ISI the next morning in INACTIVE (P=0.03), but interestingly the exercise session did not increase ISI the next day in our ACTIVE subjects (P=0.89). As a result, ISI was similar between ACTIVE and INACTIVE subjects in the morning after a single session of exercise (3.9±0.7 vs. 3.2±0.4; P=0.49).

**CONCLUSIONS:** A single session of moderate exercise was sufficient to increase ISI the next day in our INACTIVE participants, which ameliorated the difference in insulin resistance between habitually active and habitually inactive overweight adults.

**2140** Board #186 May 31 9:00 AM - 10:30 AM

**Effects of Accumulated Short and Very Short Bouts of Exercise on Cardiovascular Fitness: A Meta-Analysis**

Joel D. Reece, Youngdeok Kim, Minsoo Kang, FACSM. Middle Tennessee State University, Murfreesboro, TN.

(No relationships reported)

The American College of Sports Medicine recommends 30 minutes of moderate exercise most days of the week, which can be accumulated in short bouts of as little as 10 minutes. A number of studies have also examined the effect of very short bouts of exercise (< 10 minutes), yet this effect is uncertain.

**PURPOSE:** To determine the effect of accumulated short and very short bouts of exercise on cardiovascular fitness and to examine the difference in effect size (ES) between accumulated short (10-15 minutes) and very short bouts (< 10 minutes).

**METHODS:** Multiple online databases (i.e. Medline, Web of Science, EBSCO Host, Science Direct, Pubmed, Google Scholar, and Oregon PDF in Health and Performance) were used to identify applicable articles. Search terms included the following words: accumulate, exercise, physical activity, short bouts, intermittent, and health benefits. In addition, extensive cross-referencing from review and original articles was conducted. Only articles that were randomized, trained for at least 4 weeks (not sport specific), measured cardiovascular fitness, and included an experimental group with well-defined or well-estimated accumulated short or very short bouts of exercise (2-15 minutes) were included. Comprehensive Meta-Analysis software was used for the analysis.

**RESULTS:** A total of 51 articles were collected in the initial searches. After further review, 14 ES values from 12 articles and 5 ES values from 5 articles were calculated using a random effect model for accumulated short and very short bouts, respectively. Overall, all accumulated bouts of exercise yielded a moderate ES of 0.43 (95% CI = 0.30, 0.57). No significant difference

was identified between accumulating short and very short bouts of exercise ( $Q = 0.41$ ,  $df = 1$ ,  $p = 0.52$ ). Accumulating short (10-15 minutes) and very short bouts (< 10 minutes) of exercise yielded moderate effects of 0.41 (0.25, 0.56) and 0.51 (0.24, 0.78), respectively.

**CONCLUSIONS:** The accumulation of short and very short bouts of moderate-to-vigorous exercise has a moderate and positive effect on cardiorespiratory fitness. In addition, evidence from this study suggests the effects of exercise accumulated in as short as 2-minute bouts are homogeneous to those accumulated in 10- to 15-minute bouts of exercise.

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**2141 Board #187 May 31 9:00 AM - 10:30 AM**

**Effect Of A 14-week Group Exercise Class On Various Health Measures Among College-age Women.**

Stephanie M. Otto, Shanda Kirkeidi, Kelly Maloney, Dain Clausen, Sandie Walker, Rochelle L. Quam. *Gustavus Adolphus College, St. Peter, MN.*

(No relationships reported)

Group exercise is a popular form of activity and is often taught using a combination of weight bearing exercise and resistance training, resulting in positive health outcomes. However, there is still much to learn about the impact of group exercise participation on specific health measures.

**PURPOSE:** The purpose of this study was to monitor changes in body mass index (BMI), body fat percentage (BF%), mean arterial blood pressure (MAP), calcium intake, and bone stiffness index (BSI) among college age females for the duration of a 14-week group exercise course.

**METHODS:** Pre-menopausal, non-athlete women ( $n = 16$ , age  $20.44 \pm 0.89$ ) elected to participate in a 14-week group exercise class that met three days per week for 50 minutes each day. Activity included step, kickboxing, floor aerobics, and some resistance training. Height, weight, BMI, BF%, MAP, and BSI were measured during week two, week 8, and week 14.

**RESULTS:** Repeated measures analysis of variance ( $p < .05$ ) was used to evaluate change over the three measurement periods. Results indicated no significant change in any of the variables of interest except BF% ( $F = 11.33$ ,  $p = .00$ ) and calcium intake ( $F = 6.55$ ,  $p = .01$ ). Multiple paired sample t-tests ( $p < .016$ ) were used to identify where significant differences appeared. Results indicated an increase in BF% between week 2 and week 8 ( $t = -4.65$ ,  $p = .00$ ). Significantly higher calcium intake was identified at week 8 compared to week 14 ( $t = 3.07$ ,  $p = .01$ ).

**CONCLUSIONS:** Participants in this study exhibited significant increases in BF% at week 8 compared to week 2. In addition, a significant increase in calcium intake was seen at week 8 compared to week 14. There is some evidence suggesting that novice exercisers report decreases in additional leisure time activity and increases in dietary intake upon the initiation of an exercise program (Church, Martin, Thompson, Earnest, Mikus, & Blair, 2009), which may have contributed to the results seen in this study. It appears that among this group of non-athlete, college age women, group exercise participation was associated with dietary adjustments that may have contributed to changes in body composition throughout this 14-week period.

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**2142 Board #188 May 31 9:00 AM - 10:30 AM**

**Effects of Neck Muscle Training On Body Weight Shifting Ability In Patients With Chronic Neck Pain**

Yi-Jia Lin<sup>1</sup>, Shih-Wei Chou<sup>2</sup>, Cheng-Hsiu Lai<sup>1</sup>, Chia-Hua Kuo<sup>1</sup>, Alice May-kuen Wong<sup>2</sup>. <sup>1</sup>Taipei Physical Education College, Taipei, Taiwan. <sup>2</sup>Chang Gung Memorial Hospital, Taipei, Taiwan.

(No relationships reported)

Through cervical mechanoreceptors and their central and reflexive connections to the vestibular and visual systems, the neck plays an important role in providing various inputs which are responsible to body weight shifting. Although patients with chronic neck pain demonstrate impaired balance performance and also degraded neck fitness, the effectiveness of the neck strengthening program on body weight shifting ability remained unclear.

**PURPOSE:** To evaluate the effects of neck muscle training on body weight shifting.

**METHODS:** We recruited thirty patients (Age:  $55.3 \pm 6.4$  year-old) with chronic neck pain and 19 healthy adults (Age:  $53.7 \pm 3.9$  year-old). We gave neck exercise of which each training session includes warm-up, stretching, strengthening and neuromuscular control exercise. Seventeen patients completed 18 training sessions. Before and after the whole course, we assessed visual analogue scale (VAS), active range of motion (ROM), maximal isometric strength of the neck and dynamic balance by target reaching test using SMART Balance Master System. The parameters of Rhythmic Weight Shifting (RWS) including on-axis velocity and directional control were recorded. Changes in all parameters pre- and post-training were compared by the paired t-test (SPSS 15.0).

**RESULTS:** For the between group comparison before training, in the balance test of RWS, significant differences were detected at the on-axis velocity (deg/sec) in Front/Back -slow Speed (healthy subjects:  $2.6 \pm 0.2$  vs. patients:  $2.4 \pm 0.3$ ,  $p = 0.046$ ); and at the directional control 1 (%) in Left/Right -Medium Speed (healthy subjects:  $86.8 \pm 3.6$  vs. patients:  $83.0 \pm 6.6$ ,  $p = 0.038$ ). After training, significant differences were detected at the on-axis velocity (deg/sec) in Front/Back -fast Speed (Pre-Training:  $5.3 \pm 1.0$  vs. post-training:  $6.1 \pm 0.8$ ,  $p = 0.012$ ); and at the directional control (%) in Left/Right -Medium Speed (Pre-Training:  $83.0 \pm 6.6$  vs. post-training:  $86.7 \pm 3.8$ ,  $p = 0.022$ ).

**CONCLUSIONS:** The patient with chronic neck pain showed worse body weight shifting than healthy subjects in terms of body weight shifting ability. Neck muscle training seems have significant influence in neck fitness and body weight shifting ability. Our study shows the importance of the neck training in weight shifting ability which plays essential role in ADL activities.

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**2143 Board #189 May 31 9:00 AM - 10:30 AM**

**Resistance Training Effect's on Anthropometric, Aerobic Capacity and Muscle Strength in Women Who Underwent Bariatric Surgery**

Ricardo A. Simões<sup>1</sup>, Marcelo C. Cesar<sup>1</sup>, Adalberto V. Oliveira Jr.<sup>1</sup>, Fernanda Torques<sup>1</sup>, Silvia C.C. Alves<sup>1</sup>, Maria I.L. Montebello<sup>1</sup>, Irineu Rasera Jr.<sup>2</sup>. <sup>1</sup>Universidade Metodista de Piracicaba, Piracicaba, Brazil. <sup>2</sup>Bariatric Clinic of Piracicaba - Center Gastroenterology and Obesity Surgery, Piracicaba, Brazil.

(No relationships reported)

Bariatric surgery (BS) has proven an effective method for weight loss and reduction of comorbidities in individuals with morbid obesity. To avoid weight regain is necessary to modify sedentary lifestyle. Resistance training (RT) is part of the ACSM recommendations for promoting health.

**PURPOSE:** To evaluate the effects of a RT program on anthropometric, aerobic capacity and muscle strength in women who underwent BS.

**METHODS:** Subjects were 15 women with 30 to 180 days after BS separated into two groups: Control (CG;  $n = 6$ ;  $35.3 \pm 3.3$  yrs;  $80.4 \pm 4.9$  kg;  $157.0 \pm 3.0$  cm;  $32.6 \pm 1.3$  kg/m<sup>2</sup>), who did not perform any type of exercise and Training (TG;  $n = 9$ ;  $30.7 \pm 1.5$  yrs;  $92.4 \pm 6.7$  kg;  $162.0 \pm 1.0$  cm;  $35.3 \pm 2.6$  kg/m<sup>2</sup>) who performed a 8 weeks of RT program. The subjects followed the following protocol evaluations: 1) Anthropometric measures (AM) - weight, height, BMI and waist circumference. 2) Six minute walk test (W6M) - aerobic capacity and 3) 10RM test in bench press machine (BPM), leg-press 45° (Leg) and lat pull down (LPd) - muscle strength tests. The RT sessions lasted about 60 minutes with 3 sets of 15RM, 60s rest between sets following ACSM guidelines with one exercise for the major muscle groups for a total of 13 exercises. Normal distribution of the data was checked by Kolmogorov-Smirnov test. Student's t-test and Mann Whitney was used for the comparison between the variables

**RESULTS:** There were no significant differences between CG and TG at baseline (W0) for all measured variables. After 8 weeks (W8) AM decreased significantly ( $p < 0.05$ ) in all collected variables for CG and TG, not showing difference between groups ( $\Delta CG$  vs  $\Delta TG = -8.2 \pm 0.5$  vs  $-8.4 \pm 1.4$  kg;  $-3.3 \pm 0.2$  vs  $-3.2 \pm 0.5$  kg/m<sup>2</sup>;  $-4.9 \pm 1.0$  vs  $-7.1 \pm 1.0$  cm;  $p > 0.05$ ). The same was observed in the W6M, both groups increased the distance traveled at W8 compared to W0 with no significant difference between then ( $\Delta GC = +37.5 \pm 2.0$  vs  $\Delta TG = +63.4 \pm 25.7$  m;  $p > 0.05$ ). 10RM increased significantly the load lifted only on the BPM for the GC. GT increase 10RM for all exercises compared both to WO and GC ( $\Delta CG$  vs  $\Delta TG$ : BPM:  $+3.0 \pm 0.8$  vs  $+7.7 \pm 1.4$ ; LPd:  $+1.5 \pm 1.0$  vs  $+5.7 \pm 2.0$ ; Leg:  $+4.0 \pm 3.6$  vs  $+17.6 \pm 2.9$  kg;  $p < 0.05$ ).

**CONCLUSIONS:** RT program may contribute to increase the muscular strength, without affect the decrease of AS and improve of aerobic capacity, in women after BS.

Supported by CAPES and FAE-UNIMEP

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2144 Board #190 May 31 9:00 AM - 10:30 AM

**Training Using Single Versus Multiple Intermittent Bouts Of High-intensity Exercise Training Are Equally Effective For Increasing Maximal Oxygen Uptake**

Amt E. Tjønnå<sup>1</sup>, Ingeborg M. Leinan<sup>1</sup>, Anette T. Bartnes<sup>1</sup>, Bjørn M. Jenssen<sup>1</sup>, Richard A. Winett<sup>2</sup>, Martin Gibala<sup>3</sup>, Ulrik Wisløff<sup>1</sup>. <sup>1</sup>Norwegian University of Science and Technology, Trondheim, Norway. <sup>2</sup>Virginia Tech, Blacksburg, VA. <sup>3</sup>McMaster University, Hamilton, ON, Canada.  
(No relationships reported)

**PURPOSE:** Regular exercise training improves maximal aerobic capacity (VO<sub>2</sub>max) and reduces all-cause mortality risk, but the influence of intensity and volume remains to be clearly established. Public health guidelines generally advocate a relatively high-volume of moderate-intensity exercise, but a growing body of evidence suggests that low-volume, high-intensity training may be a time-efficient means to achieve health benefits. In the present study, we measured changes in health status markers after 10 wk of training using an established, efficacious high-intensity interval training protocol [4 x 4 min at 90% of maximal heart rate (HRmax) interspersed with 3 min active recovery at 70% HRmax; 4-BOUT], or a novel single bout protocol that requires a markedly lower time commitment (1 x 4 min at 90% HRmax; 1 BOUT)

**METHODS:** Twenty six healthy, sedentary overweight men (BMI: 25-30, age: 35-45 y) were randomized to either 1-BOUT (n=13) or 4-BOUT (n=13).

**RESULTS:** After 10 wk of training, VO<sub>2</sub>max increased by 10% (~5.0 mL\*kg<sup>-1</sup>\*min<sup>-1</sup>) and 13% (~6.5 mL\*kg<sup>-1</sup>\*min<sup>-1</sup>) in 1-BOUT and 4-BOUT, respectively, with no group difference (P=0.22). Work economy also improved in both groups after training, as evidenced by lower oxygen cost during running at a sub-maximal work load (14% and 13%, respectively, in 1-BOUT and 4-BOUT; with no group difference P=0.40). Systolic blood pressure decreased 7.1 and 2.6 mmHg in 1-BOUT and 4-BOUT respectively, no group difference (P=0.3), and diastolic pressure decreased 7.7 and 6.1 mmHg in 1-BOUT and 4-BOUT respectively (no group difference P=0.74). Both groups had a decrease in fasting glucose (-6% and -5% in 1 and 4-BOUT respectively, no group difference (P=0.30). 4-BOUT improved blood-profile to a larger extent than 1-BOUT, although without any group difference.

**CONCLUSIONS:** These preliminary data suggest that training using a relatively brief, single bout of vigorous exercise three times per week may be a time-efficient strategy to improve health in previously sedentary but otherwise healthy middle-aged individuals. Such brief bouts of exercise could be translated into public health policies and programs.

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**C-32 Free Communication/Poster - High Altitude/Hypoxia I**

MAY 31, 2012 7:30 AM - 12:30 PM

ROOM: Exhibit Hall

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2145 Board #191 MAY 31 8:00 AM - 9:30 AM

**Climbing Mount Rainier: Water Turnover and Core Temperature**

Walter Hailes<sup>1</sup>, John S. Cuddy<sup>1</sup>, Dustin S. Slivka<sup>2</sup>, Brent R. Ruby, FACSM<sup>1</sup>. <sup>1</sup>University of Montana, Missoula, MT. <sup>2</sup>University of Nebraska at Omaha, Omaha, NE.  
(No relationships reported)

**PURPOSE:** Hydration is an important logistical consideration for individuals performing in austere environments because water demands must be balanced with the burden of carrying the water. Therefore investigation into the water turnover of individuals climbing Mount Rainier can provide insight into the hydration demands of high altitude activity in cool to cold environments.

**METHODS:** Seven novice climbers participated in a study to determine the hydration kinetics and core temperatures associated with a successful summit of Mt Rainier. Ingestible, radio equipped thermometers were ingested to monitor core temperature and a dose of deuterium was administered to determine hydration kinetics via stable isotope dilution.

**RESULTS:** Mean core temperature was 37.6 ± 0.3°C, water turnover was 95.0 ± 17.5 mL\*kg<sup>-1</sup>\*24H<sup>-1</sup>, body mass was not different from pre (75.9 ± 13.0 kg) to post (74.8 ± 12.5 kg) climb (p=0.06), but urine specific gravity increased from pre (1.013 ± 0.002) to post (1.022 ± 0.006) climb (p=0.004).

**CONCLUSIONS:** Hydration demands of climbing Mt Rainier are highly elevated despite modest fluctuations in core temperature. Participants were able to maintain sufficient hydration with limited access to water over the course of the approximately 30 hour climb.

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2146 Board #192 MAY 31 8:00 AM - 9:30 AM

**OUES And VE/VCO<sub>2</sub> Slope, At Sea Level And 3600 Meters, In Professional Soccer Player**

Galo E. Narvaez<sup>1</sup>, Enrique Vargas<sup>2</sup>, Galo E. Narvaez Alban<sup>1</sup>. <sup>1</sup>Comite Olimpico Ecuatoriano, Guayaquil, Ecuador. <sup>2</sup>Instituto Boliviano De Biologia De Altura, La Paz, Bolivia, Plurinational State of. (Sponsor: George Brooks, FACSM)  
(No relationships reported)

**PURPOSE:** In previous works [1, 2], we analyzed VE/VCO<sub>2</sub> Slope and Oxygen Uptake Efficiency Slope OUES, during a soccer-specific test. In this paper we are comparing VE/VCO<sub>2</sub> Slope and OUES vs. traditional parameters (tp): VE, VO<sub>2</sub>, VE/VO<sub>2</sub>, VE/VCO<sub>2</sub>, VO<sub>2</sub>/HR, under laborator conditions.

**METHODS:** 53 professional soccer players, not native high; 43 at sea level in Guayaquil (GYE) and 10 from La Paz Bolivia (LPB) at 3600 m. All underwent maximum treadmill ramp (MXRT). Expired gas samples were taken with an automatic analyzer K4b2. All variables are representative of the total test time.

**RESULTS:** (X±DS) VO<sub>2</sub> 3.044±82.5 vs 3232±66.2 L.min<sup>-1</sup>; OUES 21.8±4.3 vs 21.5±3.3; VO<sub>2</sub>/HR 21.1 ± 2.1 vs 20.5 ± 2.8 ml.beat<sup>-1</sup> NS. VE 109.4±2.7 vs 84.8±1.8 L.min<sup>-1</sup> t=6.2 p<0.0001; VE/VCO<sub>2</sub> Slope 40.9±3.3 vs 25.4±4.4 t=10.1 p<0.0001; VE/VO<sub>2</sub> 34.2±0.5 vs 25.1±0.4 t=9.5 p<0.0001; VE/VCO<sub>2</sub> 35.8±0.5 vs 25.1±0.6 t=8.8 p<0.0001 for LPB vs GYE respectively.

**CONCLUSIONS:** Hyperventilation at altitude is a good argument. However, this study shows its influence on VE/VCO<sub>2</sub> Slope and other tp. The OUES and VO<sub>2</sub>/HR are remaining stable, independent of altitude, due in part to reduce variability in VO<sub>2</sub> at sea level and LPB. The stability of the oxygen uptake efficiency and O<sub>2</sub> Pulse could be good indicators of adaptation to altitude, during physical exercise in trained subjects.

1- Narvaez P.GE. et al. Oxygen Uptake Efficiency Slope (OUES), during Training and Competition at Moderate Altitude. Medicine and Science in Sports and Exercise, Volume 43:5 Supplement pp 195 2011. 2- Narvaez P.GE. et al. Functional Outcome at Sea Level vs. Moderate Altitude (2500 m) in Race Walk. Medicine & Science in Sports & Exercise Volume 42 - Issue 5 - pp 467 2010

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2147 Board #193 MAY 31 8:00 AM - 9:30 AM

**Effects of Garlic Consumption on Exercise in Hypoxia**

David Morris, Reid Beloni, Hannah Wheeler, Collier Scott. *Appalachian State University, Boone, NC.*  
(No relationships reported)

Effects of Garlic Consumption on Exercise in Hypoxia

David M. Morris, Reid K. Beloni, Hannah Wheeler, & Scott R. Collier, FACSM

Appalachian State University, Boone, NC 28608

Hypoxia can induce pulmonary vasoconstriction (HPV) and ventilatory shunt. The reduced interface between alveoli and vasculature contributes to reductions in blood oxygenation and aerobic

exercise performance. Reduction in HPV via pharmacological vasodilators reduces pulmonary hypertension and improves blood oxygenation and exercise performance. Garlic administration to rats has also been shown to reduce HPV.

**PURPOSE:** To investigate the effects of garlic supplementation on blood oxygen saturation and aerobic exercise performance during exercise in acute hypoxia.

**METHODS:** Ten male subjects ( $21 \pm 3$  yr,  $70.7 \pm 5.0$  kg) completed an initial graded exercise test to exhaustion (GXTE) on an electronically braked cycle ergometer under normoxia (N) ( $P_{iO_2} = 144$  Torr) to assess time to exhaustion (TTE),  $VO_{2max}$ , and  $SaO_2$  at exhaustion. Subjects then consumed  $4650 \text{ mg} \cdot \text{d}^{-1}$  garlic (H+G) or equal volume of placebo (H-G) for 1 wk. Following supplementation, subjects performed an identical GXTE under hypoxic conditions ( $P_{iO_2} = 90$  Torr). After a 1-week washout period the remaining supplement was consumed followed by a second hypoxic GXTE. Dependent variables were compared across the 3 treatments using repeated measures ANOVA and Bonferroni post-hoc analyses.

**RESULTS:**  $VO_{2max}$  in N ( $4.24 \pm 0.27 \text{ l} \cdot \text{min}^{-1}$ ) was significantly higher ( $P < 0.01$ ) compared to H+G ( $2.94 \pm 0.32 \text{ l} \cdot \text{min}^{-1}$ ) and H-G ( $2.99 \pm 0.24 \text{ l} \cdot \text{min}^{-1}$ ), but did not differ between H+G and H-G ( $P = 0.67$ ).  $SaO_2$  was significantly higher ( $P < 0.01$ ) in N ( $91 \pm 4\%$ ) than H+G ( $71 \pm 2\%$ ) and H-G ( $71 \pm 6\%$ ), but did not differ between H+G and H-G ( $P = 0.80$ ). TTE in N ( $570 \pm 84$  s), was significantly greater ( $P < 0.01$ ) than H+G ( $330 \pm 60$  s) and H-G ( $334 \pm 82$  s), but did not differ between H+G and H-G ( $P = 0.91$ ).

**CONCLUSION:** Garlic supplementation for one week does not improve blood oxygen saturation, maximal oxygen consumption, or time to exhaustion in a progressive exercise test to exhaustion performed in acute hypoxia.

Supported by a Grant from the Gatorade Sport Science Institute.

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2148 Board #194 MAY 31 8:00 AM - 9:30 AM

**Effect Of Post-exercise Oxygen Supply On Heart Rate Variability And Hemodynamic Change**

Wen-Chih Lee<sup>1</sup>, Hung-Ling Wang<sup>2</sup>, Sun-Chin Yang<sup>1</sup>, Cheng-Feng Ho<sup>1</sup>. <sup>1</sup>Shih Hsin University, Taipei, Taiwan. <sup>2</sup>Buddhist Tzu Chi General Hospital, Taipei, Taiwan. (Sponsor: Chia-Hua Kuo, FACSM)

(No relationships reported)

**PURPOSE:** Glucose and insulin are delivered by blood to peripheral tissues via blood vessel, which is largely controlled by autonomic nervous system (can be reflected by heart rate variability or HRV). Under this condition, the role of autonomic nervous activity in blood flow regulation has not yet been elucidated previously.

**METHODS:** In the proposed study, 8 youth swimmers (N=10,  $14.8 \pm 0.5$  years) will be recruited for a counterbalanced design. In particular, 2 different concentrations of oxygen will be delivered (21%, 16% O<sub>2</sub>) following a training protocol with 1 week separation period among trials. Muscle tissue oxygenation will be monitored by Near Infrared Spectroscopy (NIRS) on arm and leg. Oxygen saturation, oxyhemoglobin, deoxyhemoglobin, total hemoglobin, sympathetic power and vagal power will be measured under each experimental condition for all subjects.

**RESULTS:** After training, hypoxia exposure significantly increased total hemoglobin and oxygen saturation on triceps and quadriceps muscles above normoxic level. This increase was paralleled with oxy-hemoglobin elevation. Furthermore, hypoxia did not cause differences in deoxy-hemoglobin levels. Hypoxia did not affect vagal activity but significantly increased sympathetic power.

**CONCLUSION:** This study demonstrated that hypoxia can increase total hemoglobin and oxygen saturation on triceps and quadriceps muscles. This effect may be due to increased sympathetic power during recovery.

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2149 Board #195 MAY 31 8:00 AM - 9:30 AM

**The Effect Of Exercise On Cerebral Oxygenation And Cognitive Performance During Normobaric Hypoxia.**

Chul-Ho Kim, Edward J. Ryan, Corey A. Peacock, Yongsuk Seo, John Gunstad, Ellen L. Glickman, FACSM. Kent State University, Kent, OH.

(No relationships reported)

Exposure to the reduced oxygen (i.e. hypoxia) is associated with cognitive impairment, largely mediated by reduced cerebral oxygenation. Physical activity during hypoxia is common, though its effects on cerebral oxygenation and cognitive function are poorly understood.

**PURPOSE:** The purpose of present investigation was to determine the effect of normobaric hypoxia and low intensity exercise on cerebral oxygenation and cognitive function in middle-aged males.

**METHODS:** Eight apparently healthy ( $35.9 \pm 5.7 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ ), middle-aged ( $40.5 \pm 2$  yr) males participated in the present investigation. Prior to experimental trials, participants completed a graded exercise test (Excalibur 1300W cycle ergometer) to estimate  $VO_{2max}$ . Following pre-experimental testing, participants underwent two experimental trials, hypoxia (H) and hypoxia with exercise (HE), including 2-h resting, 1-h exercise (cycling with 50% of hypoxic  $VO_{2max}$ ) and 2-h recovery. Both trials were accomplished in a normobaric hypoxia (12.5% O<sub>2</sub>) chamber (Colorado Altitude Training, Louisville, CO). Arterial oxygen saturation ( $SaO_2$ ) was measured by Pulse-oximeter (Oxi-Go, Roslyn, NY), and cerebral oxygenation ( $rSO_2$ ) were measured by Near-Infrared Spectroscopy (Somanetics, Troy, MI) every 30-min. Computerized versions of the Trail Making Test (TMT) A and B were administered at baseline, 30-min, pre-exercise, post-exercise, 4-h and 5-h during all experimental trials. The ratio of TMTA to TMTB was used as the dependent variable.

**RESULT:** Repeated measures ANOVA revealed a trial (H and HE) by time interaction in both  $SaO_2$  and  $rSO_2$  ( $p < 0.01$ );  $SaO_2$  and  $rSO_2$  were lower during exercise in hypoxia. In terms of cognitive function, there were no significant main effect of time ( $p > 0.05$ ) and time by trial interaction ( $p > 0.05$ ) for TMTA. For TMTB, there was a significant main effect of time ( $p < 0.01$ ), but no time by trial interaction emerged ( $p > 0.05$ ). Follow-up, a test (of the ratio) revealed a main effect of time ( $p < 0.01$ ), but no time by trial interaction emerged ( $p > 0.05$ ).

**CONCLUSION:** There was a differential response following exercise with respect to oxygen saturation and cerebral oxygenation. In addition, cognitive performance was declined over time during hypoxia, but low intensity exercise did not impact cognitive performance in middle-aged males.

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2150 Board #196 MAY 31 8:00 AM - 9:30 AM

**Weight and Body Composition Changes in Mountaineers Following an Ascent of Denali**

Dale R. Wagner. Utah State University, Logan, UT. (Sponsor: Gerald Smith & Edward Heath, FACSM)

(No relationships reported)

Sojourns to both hypobaric and cold environments have been associated with weight loss. Denali (Mt. McKinley) in Alaska, at a height of 6194 m and latitude of 63°N, combines these environmental stressors.

**PURPOSE:** To determine the weight and body composition changes that occur in mountaineers during a commercial climbing expedition on Denali.

**METHODS:** Eleven mountaineers began the expedition, and 8 (5 clients, 3 guides; 7 males, 1 female; age:  $39.2 \pm 9.6$  yr) completed the study; all 8 reached the summit. Pre- and post-data, spanning 21 days, was collected in Talkeetna, AK (105 m). Height was self-reported; weight and body fat percentage (%BF) were obtained with a full-body bioelectrical impedance (BIA) scale. Urine specific gravity was assessed with a digital refractometer to ensure that participants were euhydrated at the time of the BIA measurements. Only 10 of the 21 days involved ascending or descending. Typical loads carried were approximately 40 kg, distributed between packs and sleds. Calorie intake was unrestricted, and food was available ad libitum throughout the expedition.

**RESULTS:** Every participant lost weight ( $0.8$  to  $5.2$  kg;  $2.9 \pm 1.4$  kg,  $p = .001$ ), and on average there was a significant drop in %BF ( $3.0 \pm 3.1\%$  BF,  $p = .029$ ). There was a tendency for the clients to lose more weight ( $3.5 \pm 1.1$  kg vs  $2.0 \pm 1.5$  kg,  $p = .149$ ) and %BF ( $4.8 \pm 1.4\%$  BF vs  $0.1 \pm 3.1\%$  BF,  $p = .024$ ) than the guides. Neither the pre-expedition weight nor the pre-expedition %BF were significantly correlated with the losses.

**CONCLUSIONS:** Despite sleeping only 3 nights above 5000 m and having no food restrictions, mountaineers lost a significant amount of weight and %BF during a 3-wk expedition on Denali. Additional research is needed with a larger sample to make more definitive comparisons among groups of mountaineers (e.g., commercial vs non-commercial expeditions, clients vs guides, males vs females).

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2151 Board #197 MAY 31 8:00 AM - 9:30 AM

**N-acetyl-cysteine Does Not Improve Cerebral Blood Flow Or Cerebral Oxygenation At An Altitude Of 3500m.**

Marie R. Grunbeck, Beth A. Beidleman, Stephen R. Muza, FACSM, Sean P. Andrew, Janet E. Staab, Charles S. Fulco. *U. S. Army Research Institute of Environmental Medicine, Natick, MA.*  
(No relationships reported)

Altitude exposure increases the concentration of reactive oxygen species (ROS) in the brain, which may impair cerebral vascular auto-regulation and result in reduced cerebral oxygenation. Whether minimizing ROS accumulation would benefit vascular function to improve oxygenation has not been determined.

**HYPOTHESIS:** N-acetyl-cysteine (NAC), a product that minimizes ROS accumulation, will increase cerebral blood flow (CBF) and cerebral oxygenation during exposure to 3500 m.

**METHODS:** Seventeen unacclimatized men and two women (mean  $\pm$  SD; 22  $\pm$  3 yr; 77  $\pm$  12 kg; 176  $\pm$  9 cm) were divided into two groups who were treated *t.i.d.* with either 800 mg of NAC (n=10, FDA-approved oral suspension) in 240 ml of diet soda or placebo (PLA, n=9, 240 ml of diet soda only) for 2 days prior to and during a 24 hr exposure to 3500 m. Near infrared spectroscopy estimated cerebral oxygenation and CBF via relative concentration changes in oxy- ( $\Delta$ [O<sub>2</sub>Hb]) and total ( $\Delta$ [Hb<sub>tot</sub>]) hemoglobin, respectively, in the mornings at sea level (SL) and following 2 hr (ALT2) and 24 hr (ALT24) of altitude exposure. Delta values were calculated as the difference between breathing 100% O<sub>2</sub> and 20.9% O<sub>2</sub> (room air).

**RESULTS:** For both groups at ALT compared to SL,  $\Delta$ [O<sub>2</sub>Hb] was higher (P<0.05), indicating decreased cerebral oxygenation at ALT2 and ALT24 while  $\Delta$ [Hb<sub>tot</sub>] did not change at ALT2 but was lower (P<0.05) at ALT24, indicating an increase in cerebral blood flow. There were no differences (P>0.05) between PLA and NAC groups at ALT for either  $\Delta$ [O<sub>2</sub>Hb] at ALT2 (2.96  $\pm$  0.6 vs 3.64  $\pm$  0.5) and ALT24 (2.71  $\pm$  0.4 vs 2.04  $\pm$  0.4) or for  $\Delta$ [Hb<sub>tot</sub>] at ALT2 (-0.64  $\pm$  0.4 vs 0.02  $\pm$  0.4) and ALT24 (-0.84  $\pm$  0.5 vs -1.46  $\pm$  0.5).

**CONCLUSION:** Results suggest that administering NAC to reduce ROS accumulation does not alter CBF and cerebral oxygenation at 3500 m.

This does not reflect the views of the U.S. Army. Funding provided by the Defense Medical Research and Development Program (D10\_I\_AR\_J5\_419).

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2152 Board #198 MAY 31 8:00 AM - 9:30 AM

**Prediction of Susceptibility to Acute Mountain Sickness by Baseline Physiological Measurements Obtained at Sea Level**

Justin P. Waxman, Erin N. Harper, Rose M. Ward, Mark S. Walsh. *Miami University, Oxford, OH.* (Sponsor: Helaine Alessio, FACSM)  
(No relationships reported)

High altitude illness describes several syndromes, ranging from mild to life threatening, which can occur in unacclimatized individuals shortly after ascending to altitudes of greater than 2500 meters. Acute Mountain Sickness (AMS) includes a constellation of symptoms and is the most common (and most mild) altitude related illness, affecting approximately 40-50% of individuals ascending from sea level to high altitude each year. While the cause of AMS is well established, just what causes some people to suffer from AMS but not others is still undetermined. The only treatment for individuals suffering with symptoms of AMS is to let the individual spend more time acclimatizing or descend to lower elevation, however sometimes these options are not feasible. If susceptible individuals could be identified prior to ascending to high altitude, precautionary measures could be taken to reduce or eliminate the risk of developing AMS.

**PURPOSE:** The purpose of this study was to determine if one or more physiological variables measured at sea level could predict the occurrence of AMS at high altitude (5140 m).

**METHODS:** Twenty college students participating in a study abroad trip to the Himalayas volunteered for this study. Before leaving for Nepal, 15 sea level measurements were obtained for each participant (e.g., blood parameters, body composition, VO<sub>2</sub>max). On the trek, evaluation of AMS symptoms was obtained through the administration of the Lake Louise Questionnaire. Multiple regression analysis was used to determine whether any of the baseline values obtained predicted AMS.

**RESULTS:** A series of multiple linear regression analyses evaluated how well baseline physiological measurements predicted AMS scores at the highest elevation of the trek. Of the 15 physiological measurements, only Red Blood Cell (RBC;  $\beta$  = .47) count was found to be significantly related to the AMS score, F (1, 19) = 4.975, p < .05. The sample multiple correlation coefficient of .47, indicated approximately 17% of the variance of the AMS score in the sample was accounted for by RBC.

**CONCLUSIONS:** Results of this study suggest that a pre-trek evaluation of RBC count can help to identify a subpopulation at risk of developing AMS at high altitude. This laboratory measurement may prove to be a useful screening tool for a trek leader when creating a high-altitude protocol.

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2153 Board #199 MAY 31 8:00 AM - 9:30 AM

**Male Gendered and Lower Arterial Oxygen Saturation are Associated with Acute Mountain Sickness**

Janet E. Staab<sup>1</sup>, Beth A. Beidleman<sup>1</sup>, Charles S. Fulco<sup>1</sup>, Allen Cymerman<sup>1</sup>, Paul B. Rock<sup>2</sup>, Stephen R. Muza, FACSM<sup>1</sup>. <sup>1</sup>*U.S. Army Research Institute of Environmental Medicine, Natick, MA.* <sup>2</sup>*Oklahoma State University, Tulsa, OK.*  
(No relationships reported)

Although the ultimate cause of acute mountain sickness (AMS) is thought to be hypoxia, arterial oxygen saturation (SaO<sub>2</sub>) has not been consistently related to AMS. The lack of a clear association may be due to measurements having been made under diverse altitudes, time points and experimental conditions (i.e., field environment with no control for hydration, medication usage, or acclimatization status).

**PURPOSE:** Assess the relationship of AMS to SaO<sub>2</sub> and demographic data in a large sample collected under well-controlled experimental conditions at 4300 m.

**METHODS:** Seven prior USARIEM studies on the summit of Pikes Peak, CO (4300 m, P<sub>B</sub> 460 $\pm$ 2mmHg) were retrospectively analyzed for AMS prevalence, resting SaO<sub>2</sub> and heart rate (HR) in 60 men (mean $\pm$ SD: 26 $\pm$ 5 yr, 79 $\pm$ 10 kg, 54 $\pm$ 7ml/kg/min) and 25 women (23 $\pm$ 4 yr, 65 $\pm$ 11 kg, 42 $\pm$ 8ml/kg/min) in the morning after rapid passive ascent the previous day. The AMS cerebral factor score (AMS-C) was calculated from the Environmental Symptoms Questionnaire and an AMS-C  $\geq$  0.7 indicated the presence of AMS. Resting SaO<sub>2</sub> and HR were measured at the same time as AMS. Independent t-tests were utilized to analyze differences in SaO<sub>2</sub> and HR between AMS sick and AMS non-sick groups while multiple logistic regression was utilized to examine the relationship between SaO<sub>2</sub>, HR, and demographic data with the presence of AMS.

**RESULTS:** Fifty-two subjects (62%) had AMS and SaO<sub>2</sub> (%) was lower (p=0.05) in sick compared to non-sick subjects (81 $\pm$ 6 vs. 83 $\pm$ 6) but HR (bpm) did not differ between groups (80 $\pm$ 15 vs. 80 $\pm$ 14). A lower SaO<sub>2</sub> was associated with AMS (OR: 1.15, 95% CI: 1.03 to 1.29; p=0.02) and men demonstrated increased odds of experiencing AMS (OR: 3.37, 95% CI: 1.05 to 10.82; p=0.02). Heart rate was not associated with AMS.

**CONCLUSION:** Under well-controlled experimental conditions male gender and a lower resting SaO<sub>2</sub> was associated with the presence of AMS.

Funding provided by US Army MRMC ATO. Authors' views not official US Army or DoD policy.

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2154 Board #200 MAY 31 8:00 AM - 9:30 AM

**Acid-base Balance During Moderate Altitude Exposure Under Acid Or Alkaline Forming Nutrition**

Petra Platen, FACSM, Mirjam Limmer. *Ruhr-University Bochum, Bochum, Germany.*  
(No relationships reported)

**PURPOSE:** The present pilot study was conducted to examine the effects of moderate altitude exposure in combination with acid or alkaline forming nutrition on blood and urinary acid-base parameters.

**METHODS:** 12 healthy physical education students (n=10 males; n=2 females) were randomized into 2 groups according to the acid/alkaline load of their nutrition: the alkaline forming (ALK; n=6) and acid forming (ACID; n=6) group. 7 days of moderate hypobaric altitude exposure were obtained in the European Alps while living and hiking at an altitude level of 2434 m to 3772 m. During altitude exposure, ALK mainly consumed alkaline forming nutrients while ACID mainly consumed acid forming nutrients. Blood acid-base parameters (pH, oxygen saturation, bicarbonate, oxygen and carbon dioxide partial pressure, active/standard base excess and standard bicarbonate) were determined in capillary blood samples taken daily or every other day from the earlobe in the morning prior to breakfast. Furthermore, urinary pH values were determined daily in spontaneous early morning urine samples. All parameters were analyzed directly after sampling (blood acid-base-status: Radiometer system, urinary pH-values: pH-paper-sticks). Data were analyzed with repeated measures ANOVA.

**RESULTS:** We could not find any significant differences of the blood parameters in ALK and ACID. Urinary pH values, however, significantly declined over time in ACID (from 6.18 to 5.57) while it remained nearly constant in ALK (from 6.18 to 6.08).

**CONCLUSIONS:** The results indicate that nutritional acid/alkaline load influenced urinary acid excretion during moderate altitude exposure, while blood acid-base-balance remained more stable under these conditions. Further studies with longer or higher altitude exposure are needed to demonstrate chronic effects of nutritional manipulation on acid-base balance.

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**2155** Board #201 MAY 31 8:00 AM - 9:30 AM

**Time-trial Performance Is Impaired To A Greater Degree In Hypobaric Versus Normobaric Hypoxia At The Same Ambient PO<sub>2</sub>**

Beth A. Beidleman, Janet E. Staab, Charles S. Fulco, Allen Cymerman, Stephen R. Muza, FACSM. *USARIEM, Natick, MA.*

(No relationships reported)

Previous research has suggested differences in pulmonary ventilation, arterial oxygen saturation (SaO<sub>2</sub>) and heart rate (HR) in hypobaric hypoxia (HH) versus normobaric hypoxia (NH) at the same ambient PO<sub>2</sub>.

**PURPOSE:** To determine whether time-trial (TT) performance also differs between HH and NH at the same ambient PO<sub>2</sub> (92 mmHg, 4300 m equivalent).

**METHODS:** Seventeen volunteers (21±3 yr, 79.0±11.7 kg, 48.7±4.2 ml/kg/min) exposed to HH and six volunteers (21±3 yr; 77.4±8.8 kg, 49.9±5.1 ml/kg/min) exposed to NH completed a 720-kJ TT on a cycle ergometer both at sea level (SL) and following ~1 h of exposure to the same ambient PO<sub>2</sub> (92 mmHg, 4300 m equivalent) in either HH or NH. Volunteers were free to manually increase or decrease the work rate on the cycle ergometer by 5 watt increments. Heart rate, SaO<sub>2</sub> and rating of perceived exertion (RPE) were collected every 5 min during the TT and mean values were calculated.

**RESULTS:** Five volunteers (29%) were unable to complete the 720-kJ TT in HH so only the remaining 12 volunteers were utilized for data analysis. Both groups exhibited nearly identical TT performance (min) at SL (73.3±12.2 vs. 73.2±8.2) but TT performance was longer (p=0.05) in HH (120.4±20.6) compared to NH (99.5±18.1). Similarly, the % decrement in TT performance from SL to HH (65.4±23.5) was greater (p=0.01) than the % decrement from SL to NH (35.5±13.7). In HH, the HR (bpm) and SaO<sub>2</sub> (%) (148±9; 74±4) tended (p=0.09) to be lower than in NH (157±13; 77±3). There were no differences in RPE during the TT in HH or NH.

**CONCLUSION:** Time-trial performance is impaired to a greater degree in hypobaric compared to normobaric hypoxia at the same ambient PO<sub>2</sub> equivalent to 4300 m despite similar cardiorespiratory responses. Funding provided by US Army MRCM ATO. Authors' views not official US Army or DoD policy.

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**2156** Board #202 MAY 31 8:00 AM - 9:30 AM

**The Ergogenic Effect Of Oxygenation At Exhaustion In Severe Acute Hypoxia: A Placebo Effect?**

José Losa-Reyna, Jesús Gustavo Ponce-González, Rafael S. de Torres-Peralta, Ismael Pérez-Suárez, David Feijóo, Pedro J. Martínez-Muñoz, Lorena Rodríguez-García, Jaime Calle-Herrero, José A. L. Calbet. *Universidad de Las Palmas de Gran Canaria, Las Palmas de Gran Canaria, Spain.*

(No relationships reported)

At exhaustion in hypoxia (FIO<sub>2</sub>≤0.115) administration of an O<sub>2</sub>-enriched gas mixture relieves fatigue swiftly. It is unknown what minimal level of oxygenation improvement is required for this ergogenic effect. This question requires an experimental design ruling out a potential placebo effect avoiding experimental bias due to lack of concealment and deception.

**PURPOSE:** To determine what is the minimal level of oxygenation required to swiftly relieve fatigue in hypoxic exercised humans.

**METHODS:** Ten men (21.7±2.2 years; VO<sub>2</sub> max 53.0±4.4 ml·kg<sup>-1</sup>·min<sup>-1</sup>, mean±SD) performed five randomized incremental exercise tests (cycle ergometer, 80 rpm) to exhaustion on different days. One test was carried out in normoxia (Δ30w/2 min) (Nx). The other four tests started in severe hypoxia (P<sub>i</sub>O<sub>2</sub>=74 mmHg; Δ20w/2min) (HYP1). At exhaustion (inability to maintain a pedalling rate above 50 rpm despite strong verbal encouragement for 5 seconds) the breathing gas mixture was swiftly changed and subjects requested to try overcome fatigue. After two minutes the intensity was increased (Δ20w/2min) until exhaustion (HYP2). Four different gas mixtures were randomly administered in HYP2 (P<sub>i</sub>O<sub>2</sub>= 74 (placebo), 83, 91, 99 mmHg). At exhaustion, subjects were again requested to overcome fatigue when swiftly switched to breathe normoxia (NX3, P<sub>i</sub>O<sub>2</sub> 143 mmHg) and after 2 min the exercise intensity was increased (Δ20w/2min) until termination.

**RESULTS:** Similar VO<sub>2</sub>max were achieved in NX3 and in the control incremental test in Nx (3.54±0.17; 3.63±0.17, 3.66±0.16, 3.68±0.13, and 3.63±0.12). The transition to HYP2 resulted in significantly increased work (P<0.05) only for the 99 mmHg P<sub>i</sub>O<sub>2</sub>. A placebo effect accounted for 25% of the extra work performed with oxygenation in HYP2. The transition to NX3 allowed continuing the incremental exercise in all conditions. The work performed in NX3 was significantly lower when the preceding P<sub>i</sub>O<sub>2</sub> was 99 mmHg compared to the other conditions.

**CONCLUSION:** Fatigue during incremental exercise to exhaustion in severe acute hypoxia is swiftly relieved by even small increases in oxygenation. The latter combined with the existence of a placebo effect is compatible with central fatigue as the main mechanism causing exhaustion during exercise in either moderate or severe acute hypoxia.

Supported by MEC, Spain (DEP2009-11638).

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**2157** Board #203 MAY 31 8:00 AM - 9:30 AM

**Ischemic Preconditioning Does Not Improve Cycling Capacity at Sea Level or During Acute Normobaric Hypoxia**

Elizabeth A. Hittinger, Amanda A. Price, Jochen Kressler, Kevin A. Jacobs. *University of Miami, Coral Gables, FL.*

(No relationships reported)

Ischemic preconditioning (IPC), a technique involving brief episodes of occlusion-derived ischemia followed by reperfusion, has been shown to improve outcomes from surgical procedures that necessitate prolonged ischemia. IPC may also benefit exercise performance that is limited by arterial hypoxemia, but little is known of this effect to date.

**PURPOSE:** To examine the effect of IPC of the arm on pulmonary function and peak cycling capacity at sea level (SL) and acute normobaric hypoxia (NH).

**METHODS:** Nine highly, male, trained cyclists and triathletes (32.1 ± 5.8 yr, 56.1 ± 7.0 ml/kg/min VO<sub>2peak</sub>, mean ± SD) performed four experimental exercise trials at least 48 h apart at SL and NH (12.8% F<sub>i</sub>O<sub>2</sub>, ~3900 m) with or without IPC before exercise in randomized and counterbalanced fashion. Each trial consisted of pulmonary function measurements at rest, IPC or no IPC, and a continuous progressive cycling capacity test. Pulmonary function (FVC, FEV<sub>1</sub>, FEV<sub>1</sub>/FVC, FEF<sub>25-75%</sub>, PEF) was measured using an online open-circuit metabolic cart. The IPC protocol was 4 cycles of 5 min of occlusion of one arm to 200-220 mm Hg followed by 5 min of reperfusion. The cycling capacity test started 10-15 minutes after the end of the IPC cycles and consisted of 2 min at 50 W and increases in workload by 50 W every 2 min until 150 W, and then by 20 W every 2 minutes until volitional exhaustion on an electromagnetically braked cycle ergometer. Heart rate measured by telemetry and RPE were assessed at the end of every stage and arterial oxygen saturation was measured continuously by pulse oximetry.

**RESULTS:** IPC of one arm did not significantly change peak cycling capacity at either SL (316 ± 20 vs. 323 ± 43 W, control vs. IPC) or NH (253 ± 24 vs. 251 ± 21 W). IPC also did not significantly change arterial oxygen saturation at either SL (91 ± 4 vs. 90 ± 4%, control vs. IPC) or NH (70 ± 5 vs. 68 ± 5%) or any other variable measured.

**CONCLUSION:** IPC of the arm does not positively affect pulmonary function or peak cycling capacity at SL or NH, but these results may be limited by the small amount of musculature made ischemic by the IPC procedure.

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**2158** Board #204 MAY 31 8:00 AM - 9:30 AM

**Time-course Of Changes In Cardiorespiratory Measures Post-altitude Training: Implications For Competitive Endurance Performance**

Abigail S. Laymon, Daniel P. Wilhite, Joseph W. Duke, Jonathon L. Stickford, Joel M. Stager, Timothy D. Mickleborough, FACSM, Robert F. Chapman, FACSM. *Indiana University, Bloomington, IN.*

(No relationships reported)

Coaches have anecdotally noted that best performances following altitude training occur either: a) very early after return from an altitude training camp, or b) after a period of 10-25 days of post-altitude sea level training. However, there is little scientific evidence to support these "ideal" times for post-altitude competition.

**PURPOSE:** To describe serial changes in cardiorespiratory measures related to performance in elite distance runners over three weeks at sea-level (SL), immediately following return from a "live high - train low" (LHTL) altitude camp.

**METHODS:** Six elite male distance runners completed a 28d altitude training intervention at 2150m, following a LHTL training model. Isocapnic hypoxic ventilatory response (HVR), submaximal and maximal exercise ventilation (VE), oxygen uptake (VO<sub>2</sub>), heart rate (HR), and respiratory muscle VO<sub>2</sub> (VO<sub>2</sub>RM) were measured in the one week prior to and within 24h upon return (D1) from altitude. Additional SL measures of HVR and submaximal VE, VO<sub>2</sub>, HR, and VO<sub>2</sub>RM were taken on days 5-6 (D5), 12-13 (D12), and 20-21 (D20) post-alt. Competitive performance was assessed via race times at SL over 26d post-alt.

**RESULTS:** HVR was significantly elevated above pre-alt levels on D1 post-alt and declined back to pre-alt levels over the ensuing three weeks. There were no significant differences between any cardiorespiratory measures during maximal exercise pre- to D1 post-alt. During submaximal exercise, VO<sub>2</sub> tended to be lower at all speeds and all days post-alt as compared to pre-alt. HR was significantly lower D1, D5, and D20 at all speeds compared to pre-alt, but not at D12. Following a similar pattern, the VO<sub>2</sub>RM was less than pre-alt measures at D1 post-alt and rose to a peak at D12 before declining again at D20. Average race time in competition on days 9-10 post-alt was 0.4% slower than the athlete's pre-alt personal best; results from competition on day 26 showed an average time of 0.6% faster than pre-alt best.

**CONCLUSION:** The time course of changes in cardiorespiratory measures post-altitude training appears to follow a pattern that matches the anecdotally noted timing of best competitive performances. Whether post-altitude variations in competitive performance are explained by physiological de-acclimatization effects or post-altitude training effects has yet to be determined.

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**2159** Board #205 MAY 31 8:00 AM - 9:30 AM

**Effects of Normobaric Hypoxia Training with Different Durations on Metabolic Risk Markers in Sedentary Men**

Takuma Morishima, Yuta Hasegawa, Hiroto Sasaki, Toshiyuki Kurihara, Takafumi Hamaoka, FACSM, Kazushige Goto. *Ritsumeikan University, Kusatsu, Japan.*

(Sponsor: Takafumi Hamaoka, FACSM)

(No relationships reported)

**PURPOSE:** To investigate the effects of normobaric hypoxia training with different durations (2wk or 4wk) on metabolic risk markers in sedentary men.

**METHODS:** Twenty one healthy men (25 ± 6 yrs, BMI: 25 ± 0.6) were divided into either 2-wk training group (2wk group; n = 11) or 4-wk training group (4wk group; n = 10). Each group conducted 12 training sessions at 65% of maximal oxygen uptake (VO<sub>2max</sub>) under normobaric hypoxia condition (FiO<sub>2</sub> = 0.15) during either 2wk (6 days per week) or 4wk (3days per week). Before and after each training period, body composition (measured by DXA), VO<sub>2max</sub>, glucose tolerance (measured by OGTT) were determined. Arterial stiffness was evaluated by brachial-ankle pulse wave velocity (baPWV).

**RESULTS:** After each training period, body fat mass and percent body fat did not change significantly in both groups. In the 2wk group, a significant increase in VO<sub>2max</sub> was observed after the training period ( $P < 0.05$ ). Although 4wk group showed increase in VO<sub>2max</sub> with training, it did not reach statistical difference ( $P = 0.056$ ). Both groups revealed significant increase in time to exhaustion during VO<sub>2max</sub> test ( $P < 0.05$ ). The 2wk and 4wk groups did not show significant change in fasting blood glucose and serum insulin concentrations. In the OGTT test, no change was observed in area under the curve (AUC) of blood glucose concentration in both groups. However, the AUC of serum insulin concentration was significantly reduced only in the 4wk group ( $P < 0.05$ ). Arterial stiffness did not change significantly in both groups.

**CONCLUSIONS:** These results indicate that hypoxia training with longer duration (4wk) causes greater improvement of insulin sensitivity compared with equivalent training with shorter duration (2wk). Although we did not find significant improvement of glucose tolerance in 2wk group, a possible reason may be marked inter-individual variation for adaptation of insulin sensitivity.

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**C-33** Free Communication/Poster - Muscle

MAY 31, 2012 7:30 AM - 12:30 PM

ROOM: Exhibit Hall

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**2160** Board #206 MAY 31 9:00 AM - 10:30 AM

**The Association Of C-reactive Protein Level With Muscle Strength In Japanese Adult**

Lei Guan, Kaijun Niu, Yoritoshi Kobayashi, Haruki Momma, Hui Guo, Masahiko Chujo, Atsushi Otomo, Yufei Cui, Cong Huang, Ryoichi Nagatomi. *Graduate School of Medicine, Tohoku University, Sendai, Japan.*

(No relationships reported)

**BACKGROUND:** Chronic inflammation impairs muscle function. Serum C-reactive protein (CRP) level is considered to represent the grade of chronic inflammation. Even at a very low range, a cross-sectional study showed that serum CRP concentration showed an inverse relationship with muscle strength in an elderly population. We hypothesized that such association should be present at younger population group who have lower levels of CRP within the normal range (1mg/L).

**PURPOSE:** To determine the association between serum CRP level and muscle strength in Japanese middle-age male and female.

**METHODS:** We designed a cross-sectional study for 1405 (mean age and standard deviation: 45.2 ± 11.0 years) Japanese adults employees. Subjects participated in annual health check-up examination in Sendai Oroshisho Center, and the examination results for serum high-sensitivity CRP concentration (hs-CRP) and muscle strength such as grip strength and leg extension power from 2008 to 2010 were used for current study.

**RESULTS:** After adjustment for potential confounders, the adjusted mean values of grip strength (kg; mean, 95% confidence interval [CI]) across the tertile of serum CRP concentration 1.0mg/l in 1,073 male subjects were 42.9 (42.1, 43.6), 42.1 (41.4, 42.7), 41.9 (41.2, 42.6), and 41.2 (40.4, 42.1), respectively and in 332 female subjects were 26.5 (25.6, 27.4), 24.9 (24.0, 25.7), 24.5 (23.6, 25.4), and 24.0 (22.4, 25.7), respectively. (P for trend = 0.03 and 0.01, respectively). In the subgroup of 825 males subjects, leg extension power (W/kg BW) were 18.7 (18.1, 19.4), 18.2 (17.6, 18.8), 17.9 (17.3, 18.5), and 17.4 (16.7, 18.2), respectively, and in the 332 female subjects for leg extension power (W/kg; mean, 95% confidence interval [CI]) were 9.9 (9.1, 10.7), 9.8 (9.0, 10.6), 8.6 (7.7, 9.4), and 8.5 (6.7, 10.3) respectively. (P for trend <0.01 and 0.04, respectively).

**CONCLUSION:** Serum CRP concentration was found to be inversely associated with muscle strength, even within a very low range (<1.0mg/l). This finding may together with further follow up study may rationalize earlier risk stratification and subsequent exercise recommendation. This work is supported by a Grant-in-Aid under the "Knowledge Cluster Initiative" from the Ministry of Education, Culture, Sports, Science and Technology of Japan.

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**2161** Board #207 MAY 31 9:00 AM - 10:30 AM

**The Association Of C reactive Protein Level With Muscle Strength In Japanese Adult**

Lei Guan. *Tohoku University, Sendai, Japan.*

(No relationships reported)

**BACKGROUND:** Chronic inflammation impairs muscle function. Serum C-reactive protein (CRP) level is considered to represent the grade of chronic inflammation and generally, one cross-sectional study show that serum CRP concentration is favorably related to muscle strength, even within a very low range in the elderly population. However, this association is also unclear in the Japanese adult. In this paper, we investigated the associations of muscle strength with the levels of CRP of Japanese adults who have lower levels of CRP within the normal range (1mg/L).

**PURPOSE:** To determine the association relationships between serum CRP level and muscle strength and its gain or loss in Japanese adult male and female.

**METHODS:** We designed a cross-sectional study for Japanese employees 1405 (45.2 ± 11.0 years) in their annual health check-up examination for hsCRP concentration (± mg/L) and muscle strength measured that grip strength and leg extension power measured in 2008 to 2010.

**RESULTS:** Our result show that after adjustment for potential confounders, the adjusted mean values (95% confidence interval [CI]) for the tertile of serum CRP concentration <1.0mg/l or >1.0mg/l in subjects of grip strength were In the 1,073 males subjects for grip strength measurement (kg) were 42.9 (42.1, 43.6), 42.1 (41.4, 42.7), 41.9 (41.2, 42.6), and 41.2 (40.4, 42.1),



respectively and in the 332 female subjects were 26.5 (25.6, 27.4), 24.9 (24.0, 25.7), 24.5 (23.6, 25.4), and 24.0 (22.4, 25.7), respectively. (P for trend 0.03 and 0.01). In the 825 males subjects for leg extension power measurement (age 45.0 ± 11.0) were 18.7 (18.1, 19.4), 18.2 (17.6, 18.8), 17.9 (17.3, 18.5), and 17.4 (16.7, 18.2), respectively, and in the 332 female subjects for grip strength measurement (age 42.9 ± 10.7) were 26.5 (25.6, 27.4), 24.9 (24.0, 25.7), 24.5 (23.6, 25.4), and 24.0 (22.4, 25.7), respectively (p for trend <0.01 and 0.04).

**CONCLUSION:** A lower serum CRP concentration is found to be favorably related to muscle strength, even within a very low range (<1.0mg/l). The findings suggest that maintaining CRP levels as low as possible may potentially maintain a better muscle strength.

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2162 Board #208 MAY 31 9:00 AM - 10:30 AM

**Clinically Significant Side-to-Side Lower Extremity Strength Asymmetries in US Army 101st Airborne Soldiers**

Nicholas C. Clark<sup>1</sup>, Karen A. Keenan<sup>1</sup>, John P. Abt<sup>1</sup>, Timothy C. Sell<sup>1</sup>, Takashi Nagai<sup>1</sup>, Jennifer B. Deluzio<sup>1</sup>, Mita T. Lovalekar<sup>1</sup>, Larry J. McCord<sup>2</sup>, Michael D. Wirt<sup>2</sup>, Scott M. Lephart<sup>1</sup>. <sup>1</sup>University of Pittsburgh, Pittsburgh, PA. <sup>2</sup>101st Airborne Division (Air Assault), Fort Campbell, KY.

(No relationships reported)

Side-to-side (S-S) symmetry of lower extremity (LE) muscle strength is important for preventing between-limb compensations that overload one side and increase injury risk. As such, S-S comparisons in LE strength are frequently made in injury prevention and rehabilitation contexts. Past work consistently shows S-S LE strength differences <10% are normal in athletes. However, S-S LE strength differences in large military samples have not been previously reported. Considering the healthcare burden of unintentional musculoskeletal injuries, characterizing the S-S LE strength differences in Soldiers will give data of the frequency of potentially dangerous S-S muscle imbalance. This data can then be used to screen for future risk of new LE injury or re-injury.

**PURPOSE:** To describe the prevalence of clinically significant S-S asymmetry (S-S difference >10%) in LE strength of Soldiers.

**METHODS:** Fully operational male US Army 101st Airborne Soldiers (n=402; age 28.1 ± 6.6yr; height 177.7 ± 7.1cm; mass 84.1 ± 12.5kg) were tested. An isokinetic dynamometer measured concentric quadriceps (QUAD) and hamstring (HAM) mean peak torque (Nm/kg, 5 reciprocal repetitions, 60°/sec), and isometric hip abductor (ABD) mean peak force (N/kg, 3 reciprocal repetitions, 5 sec/effort). A handheld dynamometer measured isometric ankle eversion (EV) and inversion (INV) mean peak force (kg, 3 repetitions, 5 secs/effort). Counts were made of Soldiers with S-S differences >10% (designated 'suprathreshold' (ST)) and proportions calculated.

**RESULTS:** For QUAD and HAM strength, 41% had S-S differences >10% (ST range=11-50%). For ABD strength, 38% had S-S differences >10% (ST range=11-53%). For EV strength, 34% had S-S differences >10% (ST range=11-37.5%). For INV strength, 37% had S-S differences >10% (ST range=11-40%).

**CONCLUSION:** A large proportion of Soldiers (>33%) had S-S leg strength differences >10% (maximum S-S difference=53%). Consideration should be given to correction of S-S imbalances via targeted training programs. Such intervention may contribute to reducing the risk of sustaining new unintentional LE injury or re-injury, and enhance Soldiers' ability to safely and effectively execute mission essential tasks.

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W81XWH-06-2-0070/09-2-0095

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2163 Board #209 MAY 31 9:00 AM - 10:30 AM

**Concurrent Inspiratory-Expiratory And Aerobic Training Effects On Respiratory Muscle Strength In Asthmatics**

Brandon S. Shaw<sup>1</sup>, Ina Shaw<sup>2</sup>, Gregory A. Brown, FACSM<sup>3</sup>. <sup>1</sup>Tshwane University of Technology, Johannesburg, South Africa. <sup>2</sup>Monash South Africa, Johannesburg, South Africa. <sup>3</sup>University of Nebraska at Kearney, Kearney, NE.

(No relationships reported)

The evaluation of respiratory muscle strength can prove useful to determine the severity and progress of asthma and is an appropriate indicator of an increased use of health care resources and survival in hospitalized patients with respiratory disease.

**PURPOSE:** The purpose was to evaluate and compare the effects of eight weeks of aerobic, inspiratory-expiratory training and concurrent inspiratory-expiratory and aerobic training on respiratory muscle strength.

**METHODS:** Previously sedentary, moderate-persistent asthmatics (n = 88) were divided into a non-exercising control (NOEX), aerobic trained (AERT), inspiratory-expiratory trained (IET) or endurance trained combined with inspiratory and expiratory trained (CONC) group. AERT, IET and CONC subjects exercised three times weekly over eight weeks with the AERT program (n = 22) consisting of walking/jogging at 60% of individual age-predicted maximum heart rate, the IET program (n = 22) of inspiratory and expiratory training in a semi-recumbent position at varying inspiration, expiration ratios while the CONC program (n = 22) utilized a combination of the AERT and IET programs. NOEX subjects (n = 22) were instructed to continue their usual activities and received no prescribed exercise.

**RESULTS:** While there were no significant changes in any of the measured variables in the NOEX group. AERT, IET and CONC resulted in significant (p ≤ 0.05) strength improvements in eleven of the thirteen measured inspiratory muscles. AERT and CONC resulted in significant strength improvements in all seven of the measured expiratory muscles, while IET improved the strength of five of the seven measured expiratory muscles, excluding left latissimus dorsi and left quadratus lumborum.

**CONCLUSIONS:** Programs utilizing aerobic and inspiratory-expiratory training can improve respiratory muscle strength in moderate-persistent asthmatics and are essential to the asthmatic to ensure ventilation by adapting to the increasing workloads of the disease.

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2164 Board #210 MAY 31 9:00 AM - 10:30 AM

**Effects Of Muscle Strengthening Activities And Protein Intake On Fat-free Mass Percentage In Us Adults**

Jonathan Kurka<sup>1</sup>, Kelly Laurson<sup>2</sup>, Robert Cullen<sup>2</sup>, Dale Brown, FACSM<sup>2</sup>, Julie Schumacher<sup>2</sup>. <sup>1</sup>Arizona State University, Phoenix, AZ. <sup>2</sup>Illinois State University, Normal, IL.

(No relationships reported)

**PURPOSE:** The study examined the independent and dependent effects of grams of protein intake per kilogram body weight per day (PI) and frequency of participation in muscle strengthening activities per week (MSF) on fat-free mass percentage (FFM%) estimated by bioelectrical impedance analysis.

**METHODS:** The sample consisted of males (n=2,499) and females (n=2,373) aged 20-49 years from the National Health and Nutrition Examination Survey (NHANES, 2001-2004). PI and MSF were divided into three groups based on American College of Sports Medicine (ACSM) guidelines and prior research. Multiple regression was used to determine the association between varying levels of PI, MSF and FFM%, while stratifying by sex and controlling for age, race, socio-economic status, standing height, and total caloric intake.

**RESULTS:** There was a significant association between FFM% and MSF in males (0.6±0.1% per unit MSF) and females (0.4±0.1 FFM% per unit MSF). The same was true for the association between FFM% and PI in males (3.5±0.4% per unit PI) and females (5.9±0.4% per unit PI). Using MSF=0 and PI 1.4 categories respectively, compared to referent groups. It was significantly observed that the MSF=0 and PI 1.4 group interaction.

**CONCLUSIONS:** Results of the study showed that MSF and PI significantly predict FFM% increases in males and females, even when controlling for covariates. From a nationally representative sample, results indicated that higher PI was a stronger predictor of FFM% in females, while MSF was more predictive in males. Meeting ACSM guidelines of ≥2 MSF per week and the PI recommended dietary allowance (RDA) of >0.8 showed significant increases in FFM% in males and females.

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## C-34 Free Communication/Poster - Neuro-Motor Control

MAY 31, 2012 7:30 AM - 12:30 PM  
ROOM: Exhibit Hall

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2165 Board #211 MAY 31 8:00 AM - 9:30 AM

### Asymmetry In Parkinson's Disease Is Reflected In The Timed Up And Go Test

Kyle M. Rose, Arend W. A. Van Gemmert, Jan M. Hondzinski, Li Li, FACSM. *Louisiana State University, Baton Rouge, LA.*  
(No relationships reported)

The cardinal symptoms of Parkinson's disease (PD) are movement related. The severity and effects of the disease, along with the effectiveness of rehabilitation within this population, can be measured using the Timed Up and Go (TUG). Since PD manifests itself typically with asymmetrical symptoms, we reasoned that asymmetry might influence performance of the TUG test in this population. We investigated whether TUG scores were influenced by turning direction congruent with the most affected side of PD patients.

**PURPOSE:** To determine if asymmetry observed in PD influences TUG scores when turning toward or away from the most affected side.

**METHODS:** Performance of the TUG test by people with PD was measured electronically in three segments: approaching the turn (approach), turning (turn), and returning back to the chair (return). Each patient completed the course a total of six times, turning different directions three times each. The segments collected in each trial were analyzed relative to the total time in seconds. Mean and standard deviations of the relative approach, turn, and return segments, in addition to total time for the most vs. least affected sides were analyzed using one-tailed, paired T-Tests. The most affected side was determined by leg rigidity on the United Parkinson's Disease Rating Scale (UPDRS).

**RESULTS:** The relative approach, turn, and return percentages and the total mean times (seconds) and standard deviations on turns toward the most affected side were  $2.26\% \pm 0.52$  ( $P < .05$ ),  $2.17\% \pm 0.61$  ( $P < .05$ ), and  $5.35(s) \pm 1.98$  ( $P < .05$ ), respectively. P-values less than .05 indicated that approach and turn segments as well as total times differed between most and least affected sides.

**CONCLUSIONS:** Our results indicate directional turning to the most affected side vs. the least affected side can produce different TUG scores in PD patients. This difference can be primarily attributed to the relative timing of the turn segment. This outcome offers greater insight into asymmetrical movement patterns for people with PD that should be considered when designing training interventions for this population.

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2166 Board #212 MAY 31 8:00 AM - 9:30 AM

### Emergency Brake Response Time after Stroke

Hui Yu Shih<sup>1</sup>, Chih Chung Wang<sup>2</sup>, Jing Min Liang<sup>1</sup>, Wei Tso Hung<sup>1</sup>, Ying Yi Chen<sup>1</sup>, Jia Hroung Wu<sup>3</sup>, Wen Lan Wu<sup>1</sup>. <sup>1</sup>*Kaohsiung Medical University, kaohsiung, Taiwan.* <sup>2</sup>*Kaohsiung Medical University Hospital, kaohsiung, Taiwan.* <sup>3</sup>*Hsiuping Institute of Technology, Taichung, Taiwan.*  
(No relationships reported)

**INTRODUCTION:** Previous research has shown that most of stroke patients didn't obtain enough information about resuming driving during their hospital stay and nearly half of them would like to have driving training to help them drive safely.

**PURPOSE:** For assessing the driving capabilities, 3 stroke patients (mean age=48.33±4.04) with right hemiplegia and 10 healthy controls (mean age=22.80±2.39) were included in this study to investigate whether their ability was sufficient for the emergency braking function.

**METHODS:** The driving simulator was used in this study. This simulator consisting of actual brake and accelerator pedal assemblies attached to an automobile steering column was constructed. A 17-in color monitor that displayed a driving simulation was placed in front of the steering wheel. The monitor was positioned at the subject's eye level, and the steering wheel was placed at a height to represent his or her normal driving position. An automobile seat is adjustable for the patient's height. Subjects were instructed to drive in the city condition, the average speeds ranged from 45 to 55 km/hr. The machine recorded the time taken from the appearance of the walker to brake until the moment the patient began to lift the foot from the accelerator pedal; this was recorded as the reaction time. The machine also calculated the time taken from the moment the patient began to release the accelerator pedal to the moment the patient depressed the brake pedal; this was recorded as the brake time. Totally, each subject was required to apply the brake pedal five times during a 100-second trial.

**RESULTS:** On the braking task, normal controls and 1 of 3 patients (brunnstrom stage 6) were able to completely avoid a collision with the walker. However, the collision occurred once during their 5 trials for the other 2 patients (brunnstrom stage 5 and 6), respectively. The mean reaction time of the patients was 983.67±322.41 ms, which was significantly longer than that of healthy volunteers (643.00±78.72 ms). The mean brake time of patients and controls was 374.33±157.51 ms and 206.90±37.17 ms, respectively.

**CONCLUSION:** The braking time of the patients remained higher than the controls. The results suggested that not only "reaction time" but also the "brake time" were the important factors determining the ability to drive again.

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2167 Board #213 MAY 31 8:00 AM - 9:30 AM

### Interval Active Assisted Cycling Improves Balance in Individuals with Parkinson's disease

Angela L. Ridgel, Emily J. Fickes, Corey A. Peacock, Kayla A. Wilson, Megan L. Williamson. *Kent State University, Kent, OH.* (Sponsor: Ellen L. Glickman, FACSM)  
(No relationships reported)

Parkinson's disease (PD) is a progressive neurodegenerative disorder that results in tremor, rigidity, bradykinesia and postural instability. As PD progresses, balance impairment can lead to increases in falling and decreases in quality of life. With the progressive nature of PD and the short term effect of medication on balance it is critical to identify rehabilitative interventions that minimize disease-related impairments.

**PURPOSE:** To determine the effects of a four week interval active-assisted cycling program on balance in individuals with Parkinson's disease.

**METHODS:** Individuals were counterbalanced into two groups: a non-exercise control group and an exercise group. Participants in the exercise group completed 30 minutes of interval active-assisted high-rate cycling with 5 minutes of warm-up and cool-down, three times a week for four weeks. Balance was assessed by testing postural stability, Clinical Test of Sensory Integration of Balance/Clinical Test of Sensory Integration of Balance/fall risk and sensory integration of balance (m-CTSIB) using the Biodex Balance System SD. The Biodex Balance System quantifies the ability to maintain postural stability on an unstable surface and the ability to move the centre of mass within the limits of stability utilizing a circular platform that moves in the anterior-posterior and medial-lateral axes. Balance was also assessed using the Berg balance scale. All participants (exercise and control groups) were tested at baseline, 2 weeks and 4 weeks.

**RESULTS:** Repeated-measures ANOVA analysis demonstrated a significant ( $p = 0.025$ ) improvement in postural stability in the exercise group ( $1.66 \pm 1.7$  pre,  $1.30 \pm 1.0$  post). Although there was no significant change in fall risk ( $p = 0.371$ ;  $2.0 \pm 1.1$  pre,  $1.74 \pm 0.76$  post) and m-CTSIB ( $p \leq 0.088$ ;  $1.11 \pm 0.51$  pre,  $0.86 \pm 0.41$  post), there was improvement in both scores. Furthermore, slight, but non-significant, improvements were also present in the Berg balance scale scores after 4 weeks ( $p = 0.239$ ;  $38.8 \pm 11.1$  pre,  $42.6 \pm 13.9$  post). However, this slight difference moves this group from the medium fall risk to the low fall risk category.

**CONCLUSION:** A four week interval active-assisted cycling intervention leads to improvements in some measures of balance in individuals with PD.

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2168 Board #214 MAY 31 8:00 AM - 9:30 AM

### Electromyographic Responses Across Repeated Maximal Isometric And Concentric Muscle Actions

Clayton L. Camic<sup>1</sup>, Marcia L. Taddy<sup>1</sup>, Jorge M. Zuniga<sup>2</sup>, Terry J. Housh, FACSM<sup>3</sup>, Daniel A. Traylor<sup>3</sup>, Haley C. Bergstrom<sup>3</sup>, Richard J. Schmidt<sup>3</sup>, Glen O. Johnson<sup>3</sup>.  
<sup>1</sup>University of Wisconsin-Platteville, Platteville, WI. <sup>2</sup>Western New Mexico University, Silver City, NM. <sup>3</sup>University of Nebraska-Lincoln, Lincoln, NE.  
(No relationships reported)

**PURPOSE:** To examine the pattern of electromyographic (EMG) responses associated with fatigue across repeated maximal isometric (ISO) and concentric (CON) muscle actions.

**METHODS:** Twelve female subjects (mean age  $\pm$  SD = 21.1  $\pm$  1.4 yrs; BW = 63.3  $\pm$  7.4 kg) volunteered to perform ISO and CON muscle actions of the leg extensors on a Cybex 6000 isokinetic dynamometer on three separate days. The first visit was structured as an orientation session to familiarize the subjects with the testing protocols. During the second and third visits, the subjects performed randomly ordered ISO and CON fatigue protocols separated by 72 hours. The intermittent ISO fatigue protocol involved 30 maximal ISO muscle actions that were sustained for 3 seconds followed by 3 seconds of rest. The CON fatigue protocol involved 30 consecutive maximal CON muscle actions at 30°·s<sup>-1</sup>. In addition, EMG signals were recorded from the vastus lateralis during the ISO and CON fatigue protocols. The relationships for torque, EMG amplitude, and EMG mean power frequency (MPF) versus repetition number were examined using polynomial regression analysis.

**RESULTS:** There were significant ( $p < 0.05$ ) decreases across the 30 repeated maximal ISO muscle actions for torque (linear,  $r^2 = 0.95$ ), EMG amplitude (quadratic,  $R^2 = 0.44$ ), and EMG MPF (linear,  $r^2 = 0.62$ ). In addition, there were significant decreases across the 30 repeated maximal CON muscle actions for torque (quadratic,  $R^2 = 0.97$ ), EMG amplitude (quadratic,  $R^2 = 0.46$ ), and EMG MPF (quadratic,  $R^2 = 0.86$ ).

**CONCLUSIONS:** The pattern of responses for EMG amplitude indicated that both the ISO (quadratic,  $R^2 = 0.44$ ) and CON (quadratic,  $R^2 = 0.46$ ) muscle actions led to a fatigue-induced de-recruitment of activated motor units and/or a reduction in the global firing rate that occurred after 10 - 15 maximal repetitions. These findings also suggested that complete muscle activation during the maximal ISO and CON muscle actions required multiple repetitions. Furthermore, the decreases in EMG MPF during both the ISO (linear,  $r^2 = 0.62$ ) and CON (quadratic,  $R^2 = 0.86$ ) muscle actions were parallel to the linear ( $r^2 = 0.95$ ) and quadratic ( $R^2 = 0.97$ ) decreases in torque, respectively. Thus, the present findings suggested that the mechanisms of fatigue responsible for decreases in torque were consistent between the ISO and CON muscle actions.

2169 Board #215 MAY 31 8:00 AM - 9:30 AM

### Trunk Kinematics Analysis during Acute Loading Before and After Prolonged Loading of the Paraspinal Tissues

Michael W. Olson. Southern Illinois University Carbondale, Carbondale, IL. (Sponsor: M. Daniel Becque, FACSM)  
(No relationships reported)

Continuous loading of the low back tissues results in modified neuromuscular output to external perturbations, and influences temporal and spatial movement variables. It is believed that these movement outcomes provide evidence to support hypotheses related to movement disorders.

**PURPOSE:** To observe trunk kinematics parameters after introduction of an acute load before and after passive cyclic trunk flexion-extension exercise.

**METHODS:** Fifteen healthy volunteers (7 males, 8 females; 21.3  $\pm$  2.1 yrs, 1.74  $\pm$  0.08 m, 70.8  $\pm$  11.8 kg) participated. Reflective markers were adhered to the skin over bony landmarks at C7, L1, L3, and S1 for kinematics analysis. An isokinetic dynamometer was used in performing two, five min sets of cyclic trunk flexion-extension conditions at a preset velocity of 10°/s through the subjects' range of trunk motion from seated upright position at a: 1) passive and 2) active. Blocks of three trials were performed before and after (3 blocks, B) each trunk cyclic loading period as subjects stood on a platform while holding a crate affixed to a pulley system with a 9 kg mass attached. A triaxial accelerometer affixed to the crate was used to determine the onset time of trunk perturbation. Kinematics dependent variables included trunk displacement (Dis\_T), peak trunk velocity (PV\_T), rate of trunk displacement (SLOPE), and SLOPE to PV\_T ratio (VR). A 2 x 3 x 2 (condition x block x gender) repeated measures ANOVA was performed on the kinematics data. Alpha was set at 0.05.

**RESULTS:** A significant difference for Dis\_T between blocks was present (B1: 10.13  $\pm$  5.0°, B2: 8.24  $\pm$  4.8°, B3: 8.11  $\pm$  5.0°,  $p < 0.01$ ). Gender difference were present for PV\_T (males: 49.47  $\pm$  22.0°·s<sup>-1</sup> vs. females: 60.85  $\pm$  38.1°·s<sup>-1</sup>,  $p < 0.01$ ) and SLOPE (males: 26.4  $\pm$  13.1°·s<sup>-1</sup> vs. females: 30.1  $\pm$  16.7°·s<sup>-1</sup>,  $p < 0.032$ ). A non-significant trend ( $p = 0.0518$ ) was present for VR between B (B1: 0.501  $\pm$  0.16, B2: 0.539  $\pm$  0.13, B3: 0.539  $\pm$  0.10). All other variables were not significantly different.

**CONCLUSIONS:** Kinematic differences were not apparent between conditions, which may or may not agree with neuromuscular response of the system to these protocols. However, there is evidence present to indicate a time-dependent modified kinematics response to these protocols.

2170 Board #216 MAY 31 8:00 AM - 9:30 AM

### Effect Of Coffee On Dual-task Performance

Mojdeh Baniasadi, Nassim Nadji, Jeremy A. Patterson, FACSM, Douglas F. Parham. Wichita State University, Wichita, KS.  
(No relationships reported)

**PURPOSE:** To assess the effects of coffee on dual-task performance (DtP).

**METHODS:** 23 college-aged individuals (15/8 m/f; 25 $\pm$ 3.4 yrs) participated in this study. Each participant attended 3 sessions (Familiarization, Baseline, and Experimental). Before each session, participants were asked to abstain from consuming caffeinated beverages the night before testing. The DtP assessment was completed during all three visits, this consisted of testing cognition (Stroop color-word test/ N-back test) while measuring balance (modified CTSIB) at the same time. The modified CTSIB test consist of four, 30-second tests; Condition 1; eyes open on a firm surface, Condition 2; eyes closed on a firm surface, Condition 3; eyes open on a foam surface, Condition 4; eyes closed on a foam surface reporting the Stability Index as the average position of the participant's body from center. In Conditions 1 and 3, subjects were asked to stand on the balance machine with eyes open and respond to the Stroop color-word test by naming the color of a word that appears on the screen in front of them in a color different from its name. In Conditions 2 and 4 of balance test, the N-back test was completed with eyes closed and participants responded by saying 'yes' when a word read had already been read aloud two words previously. Additionally, on the Experimental visit participants were asked to consume one cup of brewed coffee (12 oz) that contain 240 mg caffeine, and after 30 minutes the DtP assessment was repeated. Statistical analysis was performed using paired sample t-test, with significance set at  $p \leq 0.05$ .

**RESULTS:** Outcomes suggest that the DtP assessment showed significant differences between Condition 1 ( $p = 0.018$ ) and Condition 3 ( $p = 0.013$ ) at Baseline compared to Familiarization. Moreover, after receiving coffee the results of all DtP assessments indicated no significant difference between Baseline and Experimental ( $p = 0.063$ ;  $p = 0.390$ ;  $p = 0.992$ ;  $p = 0.204$ ).

**CONCLUSION:** The data of this study suggests that the DtP assessment requires a Familiarization visit. In addition, significant improvement appears on DtP in Condition 1 and 3, but it does not report any significant effect on DtP after consuming coffee.

2171 Board #217 MAY 31 8:00 AM - 9:30 AM

### Gaze Behavior In Response To A Dynamic Obstacle With Time Delays In Young Adults

Fabricio Saucedo<sup>1</sup>, Emily McIntosh<sup>2</sup>, Lori Vallis<sup>2</sup>, Rebecca Reed-Jones<sup>1</sup>. <sup>1</sup>The Univ. Of Texas at El Paso, El Paso, TX. <sup>2</sup>University of Guelph, Guelph, ON, Canada.  
(No relationships reported)

Dynamic obstacles pose a unique challenge to the motor control system. On-going locomotor patterns must be quickly adapted to changes in obstacle height and position in order to successfully avoid collision. Adaptations of motor patterns are based on available visual information regarding the obstacle and body position in space. Thus how vision is being directed (gaze behavior) may be critical to successful obstacle avoidance and have important implications for falls in older adults.

**PURPOSE:** To examine the gaze behavior of healthy young adults as they negotiate a dynamic obstacle with varying time delays.

**METHODS:** Six young adults performed 36 walking trials over an obstacle that, following trigger of a laser beam, moved (with a zero, short or long delay) and ended in either a high (45% of leg length) or low (10 cm lower) position. Gaze behavior was measured using a head mounted eye tracking system (ISCAN, MA, USA; 60 Hz). Six possible points of interest (POI) within the movement environment were identified (wall ahead, travel path pre obstacle, foot position pre obstacle, obstacle, foot position post obstacle, and travel path post obstacle). Movement trials were windowed three steps before obstacle crossing and two steps afterwards. Fixation of gaze with respect to each of the POIs was coded for the windowed trials and converted to a % of trial

time. Repeated measures ANOVA was conducted on the fixation data with obstacle height and time delay as independent factors.

**RESULTS:** A significant interaction between obstacle height\*POI was found ( $p = .024$ ). Participants directed gaze to the obstacle itself when the obstacle moved from a low position to a high position. In contrast, gaze was directed to the post foot position when the obstacle moved from a high position to a low position. Overall, young adults directed their gaze to either the obstacle or the post foot position on all trials with little fixation spent pre obstacle. No significant effect of time delay was found for gaze behavior.

**CONCLUSION:** The results indicate that obstacle height rather than time-delays change where young adults direct their gaze. Future research will examine the gaze behavior of older adults to assess whether there are differences in gaze behavior and whether this contributes fall risk.

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2172 Board #218 MAY 31 8:00 AM - 9:30 AM

**Assessment Of Oculomotor Control And Balance In Concussed And Non-concussed Individuals**

Nicholas Murray, Pradeep V.N Ambati, Fabricio Saucedo, Monica Contreras, Anthony Salvatore, Rebecca Reed-Jones. *The Univ. Of Texas at El Paso, El Paso, TX.*  
(No relationships reported)

Damage sustained from a concussion can result in lingering balance disturbances and vertigo. Rehabilitation focused on the vestibular system has shown to improve balance performance post concussion. However the role of the vestibular system in oculomotor control (stabilization and tracking) has been generally overlooked. Investigating oculomotor control post concussion could provide valuable scientific information regarding vestibular function post concussion.

**PURPOSE:** The purpose of this research is to study oculomotor function during concussion recovery. The goal is to provide evidence for the use of oculomotor assessment in addition to balance assessment post concussion.

**METHODS:** Nine post concussion athletes and nine non-concussed athletes performed 3 balance trials while wearing a head mounted eye tracking system (Applied Science Laboratories, MA, USA). Balance performance was measured using the Nintendo WiiFit® soccer heading game. This test assesses combined oculomotor control and balance as it incorporates directing center of pressure in response to visual stimuli. Gaze stabilization was used as the measure of oculomotor control and coded as the percent of time fixed on the center of the game screen. Between subjects ANOVA and Pearson Product correlations were performed for gaze time on center and soccer game score.

**RESULTS:** A significant correlation between gaze time on center and soccer game score was found, however; these were different between the concussed and non-concussed groups. Non-concussed individuals had a positive correlation ( $r = .792$ ,  $p = .011$ ) between gaze and soccer variables. In contrast, concussion subjects showed a significant negative correlation ( $r = -.846$ ,  $p = .004$ ). No significant between group differences in Wii score or time on center were found. However, soccer score was lower in the concussed ( $94.90 \pm 21.80$ ) versus non-concussed group ( $132.2 \pm 25.57$ ), while time on center was similar between the groups (63.5% non-concussed versus 64.2% concussed).

**CONCLUSION:** Results indicate deficits in visually driven balance responses in concussed athletes. Concussed athletes directed gaze to the center however balance responses were reduced. Further research will examine the association of these measures with the vestibular system.

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2173 Board #219 MAY 31 8:00 AM - 9:30 AM

**Changes in Kinematic Sequence with Fatigue: A Comparison of Female Dancers and Female Athletes**

Karl F. Orishimo<sup>1</sup>, Ian J. Kremenic<sup>1</sup>, Evangelos Pappas<sup>2</sup>, Marshall Hagins<sup>2</sup>, Marijeanne Liederbach<sup>3</sup>. <sup>1</sup>Lenox Hill Hospital, New York, NY. <sup>2</sup>Long Island University, Brooklyn, NY. <sup>3</sup>NYU Langone Medical Center Hospital for Joint Diseases, New York, NY. (Sponsor: Malachy McHugh, FACSM)  
(No relationships reported)

The propulsive phase of a stretch-shortening cycle movement is characterized by a proximal to distal transfer of joint velocities, with peak hip velocity preceding peak knee velocity, which in turn precedes peak ankle velocity. Due to their extensive training in jumping activities, dancers are considered experts in these tasks. While fatigue affects jump biomechanics, it is not known how it alters the kinematic sequence or if fatigue-induced changes are different between dancers and athletes.

**PURPOSE:** To compare the effects of fatigue on kinematic sequence of female dancers and female athletes during the propulsive phase of a single-leg countermovement jump.

**METHODS:** Twenty female dancers and twenty female athletes performed single-leg countermovement jumps to 50% of their maximum jump height before and after a lower extremity fatigue protocol. Joint kinematics were measured with eight infrared cameras and 22 markers. For each subject, the velocity profile of each joint was normalized to the maximum velocity achieved by that joint. Repeated-measures ANOVA (Group x Joint x Fatigue) were used to compare the timing of peak joint velocities as well as the percentage of peak velocity of each joint when the other two were maximal.

**RESULTS:** As documented elsewhere, dancers achieved peak joint velocities later in the propulsive phase compared to the athletes (Group:  $P = 0.044$ ). With fatigue, peak hip and knee velocities were delayed while ankle timing was unchanged.

**CONCLUSIONS:** Fatigue affected the kinematic sequence in both groups similarly by shifting the timing of peak hip and knee velocities closer to that of peak ankle velocity. This could be to compensate for the changes in muscle mechanics following fatigue in order to maintain jump height.

Percent of propulsive phase at which peak joint velocities occurred; \* = Effect of Fatigue  $P < 0.05$

|              | Hip          | Knee         | Ankle      |
|--------------|--------------|--------------|------------|
| Pre-Fatigue  | 69.0 ± 7.1   | 74.8 ± 6.0   | 84.1 ± 3.9 |
| Post-Fatigue | 71.8 ± 7.1 * | 77.1 ± 6.0 * | 84.6 ± 3.9 |

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2174 Board #220 MAY 31 8:00 AM - 9:30 AM

**Assessment Of Prediction And Learning Effect On Dynamic Postural Stability In Single Leg Landing Task**

Issei Ogasawara<sup>1</sup>, Yoshio Koyanagi<sup>1</sup>, Ken Nakata<sup>2</sup>. <sup>1</sup>Mukogawa Women's University, Nishinomiya, Japan. <sup>2</sup>Osaka University, Suita, Japan.  
(No relationships reported)

**PURPOSE:** The purpose of this study is to investigate the effect of prediction for the postural demands after single legged landing and to elucidate whether human can learn how to stabilize their posture even in the unpredictable condition.

**METHODS:** 12 subjects with no histories of lower limb surgery or neurological disorder participated in this study. The subjects were asked to land on the target with their dominant leg from the 30 cm high box. The length of the center of pressure (CoP) trajectory from 0 to 100 ms after foot impact was compared between following two conditions. In the normal condition (NC), the target was displayed before the trial to allow the subjects to predict the postural demands after the foot impact. In perturbation condition (PC), the target was displayed beforehand, however, when the subject started their landing, it was moved to another position (10 cm apart from the initial position) in order to interfere with the subjects' prediction for postural adjustment.

**RESULTS:** Figure compares the trial-by-trial change for the CoP trajectory length between NC and PC from a representative subject. The white circle denotes NC and the gray dose PC. In NC, the length gradually decreased as the subject adopted to stabilize the post landing posture, however, in PC, the length was entirely longer than that of NC ( $NC 0.25 \pm 0.69$  cm vs  $PC 0.32 \pm 0.56$  cm,  $p < 0.05$ ) and the obvious adaptation was not observed. Similar results were also obtained in CoP velocity.

**CONCLUSIONS:** Our findings suggest that it is difficult to learn the postural stabilization skill in unpredictable condition. Difficulty in predictive postural adjustment may contribute to develop the sports injury, such as knee ligament injury, which occurs in unpredictable situation.

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2175 Board #221 MAY 31 8:00 AM - 9:30 AM

**Assessment Of Muscle Use With Surface Electromyography And Positron Emission Tomography**

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(No relationships reported)

Surface EMG (SEMG) has certain inherent limitations when applied during dynamic human movements. By quantifying exercise induced glucose uptake, positron emission tomography (PET) presents an alternative method to acquire detailed 3D information about muscle use during complex human movement. PET and SEMG have not previously been combined.

**PURPOSE:** To compare PET and SEMG obtained during different contractile tasks.

**METHODS:** In total 12 subjects participated: 6 subjects performed concentric vs. eccentric plantarflexor (PFLX) contractions on separate days with similar load (30%MVC) and duration (6 contractions/min for 30 min). 6 other subjects performed aerobic whole body exercise in a skiing ergometer (20 min bouts, intensity: 55-75% of VO<sub>2</sub>max). Prior to exercise, a tracer ([18F]FDG) was injected, during exercise EMG was sampled, and after exercise the subjects underwent a PET scanning. An MRI scan was performed for anatomical reference. Muscle activation/use during exercise was quantified by 1) peakEMG (%MVC) and 2) by a glucose uptake index (GUI) for each muscle based on PET scans. To determine associations between the two methods, linear regression analyses was performed, and Pearson product-moment correlations were computed.

**RESULTS:** Two PFLX muscles were examined in eccentric/concentric conditions and 10 muscles for the aerobic exercise trial. For the PFLX exercise average GUI of all muscles (related to passive muscle) was 161±59%, while EMG was 32±18% MVC. A positive, weak but significant (r=0.45, P<0.05) correlation was seen for this condition. For the aerobic exercise, average GUI of all muscles (related to bone tissue) was 1641±1184%, while EMG was 37±18 %MVC with a positive moderate correlation (r=0.85, P<0.01).

**CONCLUSIONS:** The two methods are highly different with respect to time/spatial resolution, to actual measurement (electrical voltage vs. glucose uptake) and to normalization method (EMG is related to maximal contraction, PET is normalized to passive tissue uptake). Nonetheless, a reasonable relation exists between the outcomes suggesting certain compatibility. Depending on the research question, PET may be an alternative or supplementary method when high spatial resolution is required and further when muscles that can not be accessed by EMG (surface or indwelling) are examined.

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2176 Board #222 MAY 31 8:00 AM - 9:30 AM

**Heterogenic Effect of Exercise Induced Quadriceps Muscle Damage on Ankle Kinematics and Step Cycle Timing During Slope Walking**

Manning Sabatier<sup>1</sup>, Chris Black<sup>2</sup>, Megan Luallen<sup>1</sup>, Kourtney Aylor<sup>1</sup>, Samantha Drew<sup>1</sup>. <sup>1</sup>Clayton State University, Morrow, GA. <sup>2</sup>University of Mississippi, University, MS. (Sponsor: Melanie Poudevigne, FACSM)  
(No relationships reported)

It is currently not clear how exercise induced muscle damage (EIMD) affects heterogenic proprioception in the lower extremities.

**PURPOSE:** To determine whether EIMD in one muscle could affect lower limb function. It was hypothesized that quadriceps EIMD would affect ankle angle trajectories and step cycle timing during walking.

**METHODS:** Eight subjects (age: 24+/-2, height: 64+/-5 in, mass: 60+/-5 kg) were tested. Electrogoniometers were used to monitor ankle angle during slope walking (-10, 0 and 10 degrees) at 2.5 mph. Maximal isometric (IM) strength was measured with the knee at 75 degrees of flexion. EIMD was induced with 60 repetitions of eccentric-only quadriceps muscle contractions with 110% of 1RM, then walking and IM strength were evaluated again.

**RESULTS:** EIMD resulted in a 22% loss of IM strength (p<0.01). Ankle angle kinematics vary greatly with slope before EIMD. The most significant differences are much larger stance phase 1) passive ankle flexion during downslope (Ds) walking (30 degrees vs 20 and 13 degrees for Lv and Us, p<=0.01) and 2) active ankle extension associated with thrust during upslope (Us) walking (35 degrees vs 28 and 18 degrees for Us and Lv, respectively, p<=0.05). There was a loss of the slope effect on excursion during the thrust period of stance after injury and more time was allocated to the swing phase during downslope walking after the EIMD protocol (p=0.04).

**CONCLUSION:** Quadriceps EIMD alters slope-related ankle kinematics and step cycle timing, especially during Ds walking. Since the quadriceps undergoes large excursions of loaded muscle lengthening during the stance phase of Ds walking, these results support the idea that the distribution of proprioceptive feedback related to stretch emanating from the quadriceps is important for normal control of downslope walking.

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2177 Board #223 MAY 31 8:00 AM - 9:30 AM

**Head and Trunk Coordination in Turning between Young and Old Adults**

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(No relationships reported)

Turning is a task critical to everyday life. Without the ability to turn people cannot navigate in a crowded market or safely turn down a hallway in their home. Unfortunately, turning is a movement that is significantly interrupted by aging and by neurological deficits such as Parkinson's disease. Currently, there is limited research regarding this important movement and the motor control associated with it.

**PURPOSE:** In previous work using virtual reality, it was found that the initial eye movement made prior to redirecting the body may be a critical trigger for releasing a coordinated turning response (head leads the trunk). The purpose of the current study was to translate these previous findings to real world walking. Therefore, the current study examined segment coordination during a 90° turn in healthy young and older adults under two visual conditions: Free Gaze and Fixed Gaze.

**METHODS:** Whole body kinematics were recorded using a Vicon motion capture system. Participants performed walking trials (straight, right turn, and left turn) randomly presented in two experimental conditions (Free Gaze and Fixed Gaze). In addition, eye movement was recorded using a head mounted eye tracking system (Applied Science Laboratories). Repeated measures ANOVAs for each group (young and older adults) were performed on the time between segment reorientation.

**RESULTS:** Young adults showed a significant (p < .05) difference in the relative head and trunk reorientation time between Free Gaze (255 ± 72 ms) and Fixed Gaze (54 ± 81 ms) conditions. In contrast, older adults showed similar relative head and trunk orientation between Free Gaze (68 ± 31 ms) and Fixed Gaze (86 ± 93 ms).

**CONCLUSION:** Results in young adults support previous findings that when visual redirection is constrained segment reorientation is altered and segments move together in an 'en bloc' movement strategy. More interestingly, older adults did not show a head leading strategy during the turn in either visual condition; the relative time between head and trunk was similar between Free and Fixed Gaze conditions. These findings indicate that older adults may have compromised turning coordination. Further investigation of the eye movement data will determine whether this is a result of lack of eye movement in the Free Gaze condition.

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2178 Board #224 MAY 31 8:00 AM - 9:30 AM

**The Effects Of Additional Load On The Occurrence Of Bilateral-Deficit: Mechanical Or Neural Factors?**

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(No relationships reported)

Bilateral deficit (BD) is the reduction in the maximal voluntary force output from a synchronous bilateral contraction, when compared to the combined force outputs in biomechanically similar unilateral contractions (Bobbert et al., 2006). A number of theories for the occurrence of BD have been suggested; (1) an inhibition in neural drive or (2) differences in the mechanics between bilateral and unilateral jumping. If BD is principally a neural phenomenon, then a change in load should not affect the relative magnitude of BD observed. However, if there is a mechanical basis for BD then a difference will present in the observed BD between unloaded and loaded conditions.

**PURPOSE:** Examine the effects of an additional load of 10% body-weight (BW) on the occurrence of bilateral deficit.

**METHODS:** A group of 26 physically active students (22.3±4yrs, 22 male, 4 female) performed a series of counter-movement jumps under both unloaded (BW) and loaded (BW+10%) conditions: 3 x unilateral left leg jumps (UL), 3 x unilateral right leg jumps (UR) and 3 x bilateral jumps (BL). A period of 30-s rest was taken between jumps, with 5-min between sets of jumps. Participants were randomly assigned to 1 of 2 groups. Group 1 performed unloaded followed by loaded condition. Group 2 performed loaded followed by unloaded condition. Vertical jump height was determined using a jump mat with the percentage difference (%diff) in jump height between the combined unilateral jumps (UL + UR) and BL for the unloaded and loaded conditions being analyzed.

**RESULTS:** No effect for jump order was observed ( $p > 0.05$ ). A significant reduction in BD was observed in the jump heights recorded during the unloaded and loaded conditions (unloaded %diff:  $81.1 \pm 6.7\%$ ; loaded %diff:  $82.8 \pm 7.9\%$ ;  $p < 0.05$ )

**CONCLUSION:** A significant reduction in the difference between unilateral and bilateral vertical jumps resulting from the addition of extra load suggests that mechanical factors may predominate in BD, with the additional load causing a shift in the force-speed continuum of the active musculature.

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**2179** Board #225 MAY 31 8:00 AM - 9:30 AM

**Neural Drive during Explosive Force Production exceeds that at Maximum Force**

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(No relationships reported)

Anecdotal observations suggest that the neural drive during explosive force production may exceed that achieved at maximum voluntary force (MVF) i.e. the rising vs plateau phase of contraction, and these high levels of neural drive may be followed by an immediate decline. However, these phenomena have not been documented.

**PURPOSE:** To compare the magnitude and pattern of neural drive during explosive force production to neural drive at MVF.

**METHODS:** Following familiarisation, 27 healthy, untrained, young men performed two identical trials of isometric contractions of the knee extensors at a knee joint angle of 120°, 7 days apart, with data averaged across both trials. Force was measured by a strain gauge perpendicular to the tibia and double differential surface EMG recorded from two sites over each of the three superficial quadriceps muscles (RF, VM, VL). Participants performed: two series of four maximum voluntary contractions of 3-s duration in order to measure MVF and EMG amplitude (RMS of a 500-ms epoch around MVF,  $EMG_{@MVF}$ ); and 10 explosive contractions of ~1-s duration. For the explosive contractions, force was assessed for 200-ms after force onset, and EMG RMS amplitude measured in four successive 50-ms time periods after signal onset and the highest value from these time periods ( $EMG_{EXP-MAX}$ ).

**RESULTS:** Whole quadriceps  $EMG_{EXP-MAX}$  exceeded  $EMG_{@MVF}$  ( $206 \pm 119$  vs  $181 \pm 0.084 \mu V$ ;  $P < 0.01$ ), reaching  $112 \pm 16 \%EMG_{@MVF}$ , and this was also the case for all three individual muscles (All,  $P < 0.02$ ; VM  $115$ , VL  $112$  and RF  $113 \%EMG_{@MVF}$ ). Participants were divided into two groups according to relative explosive force after 100 ms (HIGH,  $59 \pm 6 \%MVF$ ,  $n=14$ ; LOW,  $45 \pm 5 \%MVF$ ,  $n=13$ ;  $P=0.02$ ) with HIGH recording greater quadriceps  $EMG_{50-100}$  ( $115 \pm 17$  vs  $99.4 \pm 14 \%EMG_{@MVF}$ ;  $P=0.01$ ) and this elevated neural drive was followed by a decline in EMG that was not the case for LOW ( $-20 \pm 19$  vs  $-3 \pm 20 \%$ ,  $P=0.03$ ). Furthermore, for individuals with high quadriceps  $EMG_{50-100}$  ( $>100 \%EMG_{@MVF}$ ,  $n=19$ ) this value was correlated with the subsequent decline in neural drive ( $R=-0.51$ ;  $P=0.03$ ).

**CONCLUSIONS:** In these untrained individuals neural drive during explosive force production was greater than at MVF, indicating that activation at MVF may be sub-maximal, and very high values of neural drive were associated with a subsequent decline indicating an inhibitory response.

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**2180** Board #226 MAY 31 8:00 AM - 9:30 AM

**Effect of Cycling Training with Foot External Rotation on Electromyographic Activity of the Vasti**

Wei-Gang Chang, Li-Lan Fu. *National Taiwan Sport University, Taoyuan, Taiwan.*

(No relationships reported)

Previous researches demonstrate that neuromuscular training can decrease the risk of knee injuries. Cycling exercise is one of the neuromuscular training strategies for knee joints. Recently, it was found that cycling exercise with foot external rotation (ER) could induce more vastus medialis oblique (VMO) activation than neutral position. Although neuromuscular function of the knee could be improved by the continuous training, the effect of cycling is still remained unknown.

**PURPOSE:** To determine the effect of the continuous cycling training with foot ER on electromyographic activity of the vasti.

**METHODS:** Twenty-seven healthy young male ( $21 \pm 1$  yrs) were randomly allocated into one of 3 groups, namely, neutral (N), ER 45°, and the control group (C). All subjects were trained 3 times per week for 8 weeks. Each session lasted 20 min on cycling. The foot position in the C was decided by themselves. The difference of electromyographic onset time and activities of the VMO and vastus lateralis (VL) were collected during step up (concentric contraction) and step down (eccentric contraction) that were performed before and after training. Statistical analysis using a 2-way ANOVA based on group and training was performed.

**RESULTS:** Between pre- and post-test, only subjects in the ER 45° group was significantly decreased in the difference of VMO-VL onset time ( $29 \pm 46$  vs.  $-92 \pm 54$  ms,  $p < 0.05$ ) during the descend stepping, and was significantly different compared to N and C ( $-92 \pm 54$  vs.  $-8 \pm 38$  vs.  $-7 \pm 32$  ms,  $p < 0.05$ ) after training. No significant differences in the VMO/VL ratio were found among 3 groups or between pre- and post-test.

**CONCLUSION:** The knee neuromuscular function during eccentric contraction might be enhanced after cycling training with foot ER in healthy young male.

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**2181** Board #227 MAY 31 8:00 AM - 9:30 AM

**DtP Score Method for Assessing Dual-task Performance Using Stability and Cognition Measures**

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(No relationships reported)

**PURPOSE:** To design a method assessing dual-task performance (DtP) using balance and cognition measures.

**METHODS:** 23 (15/8 m/f;  $25 \pm 3.4$  yrs) college-aged individuals participated in this study. Each participant attended two sessions which consisted of testing cognition by combining the Stroop color-word and N-back test, while measuring balance at the same time. The balance test consisted of two 30-second tests. Test 1 was completed with eyes open on a firm surface and Test 2 with eyes closed on a firm surface, values were recorded as Stability Index. During Test 1, participants were asked to stand on the balance machine and respond to the Stroop color-word test by naming the color of a word that appears on the screen in front of them in a color different from its name. During Test 2, participants completed the N-back test with eyes closed by saying 'yes' when a word read aloud had already been read aloud two words previously. The scores of the cognitive tests were divided by the results of the Stability Index to create a single score (DtP Score = Cognition Score / Stability Index).

**RESULTS:** Study results suggest that individuals who achieved a higher DtP Score had a greater capacity to complete the dual-task assessment and likewise, a low DtP Score suggested a poor ability to perform dual-tasks.

**Mean of DtP Score Test 1 and 2**

|           |        | Cognition Score  | Stability Index | DtP Score        |
|-----------|--------|------------------|-----------------|------------------|
| Session 1 | Test 1 | $16.83 \pm 2.83$ | $2.7 \pm 2.35$  | $9.79 \pm 5.76$  |
|           | Test 2 | $4.4 \pm 0.88$   | $2.7 \pm 2.35$  | $3.41 \pm 3.74$  |
| Session 2 | Test 1 | $18.25 \pm 2.32$ | $1.99 \pm 1.95$ | $13.82 \pm 7.51$ |
|           | Test 2 | $4.83 \pm 0.38$  | $2.42 \pm 2.29$ | $3.86 \pm 3.22$  |

**CONCLUSION:** The DtP Score presented here, provides a single score assessment value to measuring two tests completed at the same time. Preliminary results suggest that the DtP Scoring has consistent reproducibility and represents a unique scoring scale for evaluating DtP. Further studies with larger sample sizes and including populations with balance and/or cognitive deficits need to be completed to assess the effectiveness of the DtP Score.

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**2182 Board #228 MAY 31 8:00 AM - 9:30 AM**

**Fatigue-Induced Median Frequency Shifts in Healthy Aging and Parkinson's Disease**

Julia Falkenklaus<sup>1</sup>, Amanda Morgan<sup>1</sup>, Nicholas J. Hanson<sup>2</sup>, Michael J. Ryan<sup>1</sup>, Paul D. Reneau<sup>1</sup>, Douglas W. Powell<sup>1</sup>. <sup>1</sup>Fairmont State University, Fairmont, WV. <sup>2</sup>The Ohio State University, Columbus, OH.

(No relationships reported)

Parkinson's disease (PD) is a neurodegenerative disease of the basal ganglia that is associated with the perception of fatigue. Muscular fatigue is associated with a reduction in the number, average size and firing rate of activated motor units resulting in a shift in median frequency (Mdf).

**PURPOSE:** The nature of PD-related fatigue is not well understood; therefore, the purpose of this study was to compare changes in Mdf in people with PD to healthy young (YA) and healthy old adults (OA). We hypothesized that people with PD would exhibit less muscular fatigue than YA and OA.

**METHODS:** 16 people participated in the current study (6PD, 5YA, 5OA). Surface EMG was recorded from the vastus lateralis. An isokinetic dynamometer (Biodex System 3) was used to record isometric knee extension torques (MVIC) at 60° of knee flexion before (pre-) and after (post-) an isokinetic fatiguing knee extension protocol. The fatiguing protocol consisted of repetitions of maximal knee extension contractions at 60°/sec until peak torque was reduced by 50% for three consecutive contractions. After fatigue was reached, the MVIC was repeated (post-). Torque and surface EMG data were recorded using Datapac 2K2 software (1000 Hz, RunTech). EMG signals were smoothed using the root mean squared with a 20 ms window. Mean EMG data were calculated during a 200 ms window (100 ms pre- and post-) surrounding the peak knee extension torque. EMG amplitude was normalized to peak mean EMG of the MVIC contraction. EMG median frequency (Mdf) from the pre- and post-fatigue MVICs was calculated using customized software (MatLab 2010a). A repeated measures analysis of variance was used to determine the effect of fatigue on Mdf. Alpha level was set at  $p < 0.05$ .

**RESULTS:** YA produced significantly less torque after the fatiguing protocol (Pre-:  $118.9 \pm 15.7$ ; Post-:  $96.9 \pm 13.5$ ;  $p = 0.040$ ) while reductions in torque were not significant in OA (Pre-:  $83.9 \pm 9.0$ ; Post-:  $80.2 \pm 9.1$ ;  $p = 0.16$ ) or PD (Pre-:  $69.2 \pm 14.9$ ; Post-:  $70.5 \pm 17.6$ ;  $p = 0.726$ ). YA had a significantly greater decrease in median frequency (39 Hz) than OA (25 Hz;  $p = 0.027$ ) or PD (26Hz;  $p = 0.028$ ) groups with fatigue.

**CONCLUSIONS:** These data suggest that PD and OA do not deplete the muscle substrate and experience greater levels of central fatigue, while younger adults experience peripheral muscular fatigue due to substrate depletion.

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**2183 Board #229 MAY 31 8:00 AM - 9:30 AM**

**Analysis Of Eeg In Movement Sciences: An Example On Treadmill Walking**

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(No relationships reported)

Recent advances in technology offer the possibility to record electroencephalograms (EEG) not only during rest, but also during exercise. The use of active EEG electrodes combined with new decomposition and source localization techniques should allow for the assessment of brain activity during complex movements and moderate exercise.

**PURPOSE:** This study will give an overview of 2 new analysis techniques for EEG data, i.e., independent component analysis (ICA) and standardized low resolution electromagnetic tomography (sLORETA), recorded during exercise, in this case treadmill walking.

**METHODS:** Ten volunteers ( $28.2 \pm 4.1$  years) participated in this study. Thirty-two channel EEG data were recorded with active electrodes during 20 minutes of treadmill walking. EEG data were segmented into epochs of 1 gait cycle based on left heelstrike. ICA was used to unmix the EEG signal in its constituent components and remove artifacts. Next, data were averaged to 1 movement-related cortical potential (MRCP) for each subject. The component and channel cross spectra of the MRCPs were also calculated. The averaged MRCPs and cross spectra for each subject were imported into sLORETA software in order to compute intracerebral sources of activity.

**RESULTS:** Artifactual components due to movement can successfully be removed through ICA. It also reveals the different components that constitute the MRCP. When comparing with seated rest, sLORETA shows the visual, prefrontal and premotor cortex, the supplementary motor area, the cingulate cortex, the primary somatosensory, somatosensory association and primary motor cortex to be significant sources ( $p < 0.05$ ) that contribute to the MRCP. Gait ERSPs (event-related spectral perturbations) revealed significant modulations of spectral power in the alpha, beta and gamma frequency bands ( $p < 0.05$ ) which seem to correspond to the phases of a gait cycle.

**CONCLUSION:** Techniques such as ICA and sLORETA offer the opportunity to study brain activity during moderate exercise. In this study, these techniques revealed a specific pattern of brain activity inherent to treadmill walking (i.e., MRCP), the sources underlying this MRCP (through sLORETA), the different components (through ICA) and the corresponding perturbations in spectral power.

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**2184 Board #230 MAY 31 8:00 AM - 9:30 AM**

**Acute Muscle Damage Induced by Eccentric Contractions Increases Corticospinal Excitability**

Takashi Endoh<sup>1</sup>, Tsuyoshi Nakajima<sup>2</sup>, Azusa Uematsu<sup>3</sup>, Tetsuya Ogawa<sup>2</sup>, Kimitaka Nakazawa<sup>4</sup>. <sup>1</sup>Uekusa Gakuen University, Chiba, Japan. <sup>2</sup>Research institute, National Rehabilitation Center for Persons with Disabilities, Saitama, Japan. <sup>3</sup>Osaka University of Health and Sport sciences, Osaka, Japan. <sup>4</sup>University of Tokyo, Tokyo, Japan.

(No relationships reported)

Acute muscle damage induced by intense eccentric exercise affects not only muscle structure but also the central nervous system. For example, electromyographic (EMG) activity and force fluctuation increase immediately after eccentric exercise. However, the mechanisms that underlie this increased EMG activity and force fluctuation after eccentric exercise are unclear.

**PURPOSE:** The purpose of this study was to clarify the effects of muscle damage induced by eccentric contractions on corticospinal tract excitability.

**METHODS:** Eight healthy male volunteers (age range, 21-33 yrs) performed submaximal voluntary pincer grip contractions (5, 10, and 20% of maximal voluntary contraction [MVC]) before and 3 hours after eccentric exercise (ECC). ECC was performed using hand grip and continued until MVC decreased to 50%. Force fluctuation and background EMG activities in the first dorsal interosseous muscle (FDI) were measured during these voluntary contractions. To obtain a recruitment curve for the motor evoked potentials (MEP) in the left FDI, transcranial magnetic stimulation at a wide range of intensities (0.8-2.0 x threshold) was applied to the contralateral motor cortex innervating the left FDI during 10% maximal EMG before and 3 hours after ECC. The maximum MEP value, slope, and calculated threshold were assessed using the Boltzmann sigmoid function. Indirect markers of muscle damage, such as MVC and pressure-pain threshold, were measured before and after ECC.

**RESULTS:** Following ECC, MVC decreased to 75% of the pre-exercise value without muscle soreness. During submaximal voluntary contractions, EMG activity and force fluctuation were significantly higher after ECC than before ECC ( $p < 0.05$ ). Maximum MEP and slope values increased significantly after ECC compared with those before ECC ( $p < 0.05$ ). The calculated MEP threshold did not change before or after ECC. Discussion: These results suggest that muscle damage induced by ECC increased corticospinal excitability, which was seen at high stimulator output levels. This could be attributed to increased EMG activities and force fluctuation during voluntary contractions of damaged muscle.

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**2185** Board #231 MAY 31 8:00 AM - 9:30 AM  
**A Dynamic Systems Analysis of Phase Shift Identification in Long Jump Performance: A Longitudinal Study**  
David A. Kinnunen, Dawn K. Lewis. *CSU Fresno, Fresno, CA.* (Sponsor: Catherine G. R. Jackson, FACSM)  
(No relationships reported)

Dynamic systems theory predicts shifts in skill performance when one or more control parameters is altered. Kinnunen & Lewis (2006) identified structural-maturational variables (SM) that predict standing long jump (SLJ) performance in children age 7, at peak height velocity (PHV) (12 f, 14 m), and two years post PHV (14 f, 16 m). Shifts in SLJ performance have not yet been described along with associated rate attractors and limiters.

**PURPOSE:** To identify phase shifts in SLJ performance at age 7, age at peak height velocity and 2 years post PHV and to identify rate attractors and limiters associated with peaks and deep wells in performance.

**METHODS:** Participants (N = 487; 234 males, 258 females) were recruited at 40 months of age and were assessed until 6 months post-peak height. Thirteen SM measures and SLJ distance were collected semi-annually until participants reached adult height. Graph analyses, ANOVA and Pearson correlations identified phase shifts and associated control parameters.

**RESULTS:** Significant phase shifts in SLJ performance were identified over time. SM control factors include: Radio-styloid length, various skinfolds, standing and sitting height and biacromial width. SM included in the analyses explained between 9.5% and 25.9% of the performance variance. SM identified as driving or limiting SLJ performance varied by age and sex.

**CONCLUSION:** Improvement in motor skill performance from toddler to early adulthood occurs in progressive phases consisting of observable peaks and deep wells. Identifying SM associated with shifts in motor skill performance may modify motor development theory and pedagogy beyond identifying age-related characteristics of motor skill stages in the design of instructional plans for skill improvement across the lifespan.

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**2186** Board #232 MAY 31 8:00 AM - 9:30 AM  
**Effect of Body Position and Isometric Quadriceps Activation on Q-Angle**  
Rumit S. Kakar<sup>1</sup>, Kathy J. Simpson<sup>1</sup>, Sumit Kalra<sup>2</sup>. <sup>1</sup>University of Georgia, Athens, Athens, GA. <sup>2</sup>Banarsidas Chandiwala Institute of Physiotherapy, GGSIPU, New Delhi, India.  
(No relationships reported)

An abnormal Q angle is associated with an increased risk for developing patellar problems, e.g., patellar subluxation and chondromalacia patella. Moreover, females involved in activities that create high quadriceps force are more prone to lateral patellar dislocation than their male counterparts. Therefore, using the most valid and standardized measurement protocol is crucial to clinicians. However, factors that influence Q-angle outcomes are not well understood, potentially affecting values among differing protocols used.

**PURPOSE:** To determine if isometric quadriceps activation (QA) and body position (BP) affect Q angle.

**METHODS:** 60 subjects (30 females, 30 males), 23 ± 3 yr participated. Q angle was measured in standing and supine during quadriceps relaxed and isometric quadriceps contraction (100% maximum effort) conditions. 2 QA x 2 BP RM ANOVA for each gender were used to test Q-angle ( $p < .05$ ).

**RESULTS:** Q angle decreased when standing and during maximum effort QA. Posthoc analyses of the QA X BP interaction for Q-angle of both genders revealed that the greatest difference among mean Q angles (females and males, respectively: 7.62°, 4.79°) occurred between standing-relaxed (17.8 ± 3.5°, 11.38 ± 1.6°) and supine-maximum QA (10.2 ± 2.5°, 6.59 ± 0.9°).

**CONCLUSION:** Regardless of gender, Q angle is affected by an interactive effect of BP with QA. Females were comparatively more sensitive to the interaction than males. Therefore, it is recommended that a standardized protocol for measuring Q-angle should take into account the QA and BP. Separate Q-angle norms may be needed for standing and supine testing protocols.

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**2187** Board #233 MAY 31 8:00 AM - 9:30 AM  
**The Effects of Visual-perception on Evasive Sidestepping: Implications for Anterior Cruciate Ligament Injury Prevention**  
Marcus Lee, Brendan Lay, David Lloyd, Paul Bourke, Jacqueline Alderson. *The University of Western Australia, Perth, Australia.* (Sponsor: Sports Medicine Australia, FACSM)  
(No relationships reported)

**PURPOSE:** Sidestepping (SS) to evade opponents in sports can result in non-contact anterior cruciate ligament (ACL) injuries. Although SS in response to different simple visual stimuli has been studied previously, it has never been investigated using "game-realistic" visual conditions. This study compared the biomechanics of high-level (HL) and low-level (LL) soccer players when SS to evade projected, three-dimensional (3D) defender(s). Further comparisons were made with sidesteps performed in response to traditionally employed planned and unplanned arrow stimuli.

**METHODS:** A 3D motion analysis system captured the trunk and lower limb kinematics, ground reaction forces and activation of 8 knee muscles, of 15 HL and 15 LL soccer players performing the SS tasks. Participants sidestepped in response to an arrow-planned condition (AP), arrow-unplanned condition (AUNP), one-defender scenario (1DS) and two-defender scenario (2DS). Temporal constraints imposed by the stimuli conditions increased in difficulty from the AP, 1DS, 2DS to the AUNP. A biomechanical model was used to investigate peak lateral trunk flexion and knee valgus loading during stance phase of the sidestep. Knee muscle activation measured during pre-contact and weight-acceptance phase was used to create flexor-extensor co-contraction ratios. Dependent variables were submitted to a 4 x 2 (stimulus x skill) mixed design ANOVA.

**RESULTS:** Stimuli significantly affected all measurements ( $p < 0.05$ ). The trunk was most upright in the AP and approximately 4° more laterally flexed in the other conditions. Knee valgus moments were lowest in the AP, increased by 40% in the defender scenarios and 70% in the AUNP. In the 2DS, the shift from a flexor dominant co-contraction strategy in pre-contact toward extensor dominance in weight-acceptance commenced earlier for the HL players compared with the LL players. HL players also exhibited lower knee valgus moments in the 2DS.

**CONCLUSION:** Compared with the arrow conditions, SS in response to the game-realistic defender scenarios resulted in different mechanics, which further differentiated between HL and LL players in the complex 2DS. These findings highlight the importance of stimuli realism and complexity, and the visual-perceptual contribution toward SS, which has implications for ACL injury prevention.

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**2188** Board #234 MAY 31 8:00 AM - 9:30 AM  
**The Relationship Between Ankle Laxity and Fibularis Longus Spinal Reflex Excitability**  
Michelle M. McLeod, Brian G. Pietrosimone, Phillip A. Gribble. *University of Toledo, Toledo, OH.*  
(No relationships reported)

Ankle sprains are the most prevalent lower extremity injury in sport, and a risk factor for the development of chronic ankle instability (CAI). CAI is contributed to by mechanical and functional factors, such as ligamentous laxity, and neuromuscular alterations, respectively. While mechanical and functional factors individually contribute to CAI, the extent of their influence on each other is not well understood. The relationship between neuromuscular function and ankle laxity has not been determined in patients with CAI.

**PURPOSE:** Determine the relationship between mechanical and functional contributions to CAI measured through inversion-eversion (IE) laxity and spinal reflexive excitability (SRE) of the fibularis longus (FL) muscle.

**METHODS:** Twenty individuals with CAI (13F, 7M, 20.9±1.5 yrs, 171.0±11.23 cm, 67.9±11.6 kg) and 15 healthy individuals (11F, 4M, 21.4±2.6 yrs, 169.8±9.8 cm, 70.2±12.3 kg) participated. IE laxity was quantified using an ankle arthrometer. SRE was assessed via the Hoffmann reflex (H-reflex). Maximum H-reflex was determined by peak-to-peak amplitude. The stimulus was increased until a maximal muscle response (M-wave) was elicited. H-reflexes were normalized to the M-wave (H:M ratio), which has been reported to denote SRE of the motor neuron pool, with larger values indicating greater excitability. A separate nonparametric Spearman rank order correlation was used to determine the relationship between laxity and excitability. Alpha level was set a-priori  $P \leq 0.05$ .



**RESULTS:** The CAI group displayed a significant moderate correlation between laxity ( $44.24^\circ \pm 15.97^\circ$ ) and SRE ( $29.8 \pm 19.3$ ;  $\rho=0.463$ ,  $P=0.040$ ). No significant correlation was found in the healthy group ( $43.27^\circ \pm 20.17^\circ$ ,  $26.1 \pm 20.4$ ;  $\rho=-0.032$ ,  $P=0.909$ ).

**CONCLUSION:** The positive moderate correlation between laxity and SRE indicates that FL SRE is increased in patients with greater IE laxity. It is possible that as IE laxity increases, reflexive excitability of the FL is up-regulated in an attempt to prevent an inversion injury. Continued research should examine if increased SRE may be part of a more sophisticated motor control strategy attempting to compensate for increased IE ankle laxity. **ACKNOWLEDGEMENTS:** The authors would like to acknowledge the University of Toledo Interdisciplinary Grant for funding this project.

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**2189** Board #235 MAY 31 8:00 AM - 9:30 AM  
**Within And Between Session Reliability Of The Maximal Voluntary Knee Extension Torque And Activation**

Adam C. Squires, Jihong Park, David H. Chinn, Dennis L. Eggett, J Ty Hopkins, FACSM. *Brigham Young University, Provo, UT.*  
(No relationships reported)

**PURPOSE:** Calculation of central activation ratio (CAR) has been widely used to assess central activation failure. To date no data exist regarding the intersession reliability of this measurement. To report within and between session reliability and the standard error of measurement (SEM) of quadriceps maximal voluntary knee extension torque and activation.

**METHODS:** Thirteen, neurologically sound volunteers (9 males and 4 females, age:  $21.9 \pm 3.2$  year, height:  $1.7 \pm 3.1$  m, mass:  $76.6 \pm 10.1$  kg) underwent three testing sessions with 48 hours between sessions. To obtain knee extension torque, subjects performed maximal voluntary isometric contraction (MVIC) of the quadriceps with the knee locked at  $90^\circ$  flexion and the hip at  $85^\circ$ . Once the knee extension torque reached a plateau, an electrical stimulation (100 pulses/s, 600  $\mu$ s pulse duration, 10 train in 100 ms duration, 125 V with peak output current 450 mA) was manually delivered and transmitted directly to the quadriceps via stimulating electrodes. This stimulation caused a transient increase of torque by recruiting any remaining muscle fibers or maximizing the firing frequency of the quadriceps. CAR was calculated by dividing the MVIC by the sum of the torque generated by the MVIC and the superimposed burst (SIB) technique ( $CAR = MVIC / (MVIC + SIB \text{ torque})$ ). Subjects performed three trials in each session. Means were calculated from three trials of each measurement. Intraclass correlation coefficient (ICC) within a session and between sessions were calculated using maximal MVIC torques and CAR values.

**RESULTS:** We found strong reliability in MVIC both within ( $ICC_{(1,1)}=0.96$ ,  $ICC_{(2,1)}=0.97$ ) and between session ( $ICC_{(1,1)}=0.91$ ). CAR had moderate to weak reliability within a session ( $ICC_{(1,1)}=0.78$ ,  $ICC_{(2,1)}=0.67$ ) and weak in between session ( $ICC_{(1,1)}=0.63$ ). SEM for MVIC and CAR within a session was 11.9 N-m and 0.03, respectively. SEM for MVIC and CAR between sessions was 17.7 N-m and 0.04, respectively.

**CONCLUSIONS:** Knee extension MVIC torque is very reliable both within and between measurement sessions. CAR had lower reliability within a session and between sessions compared with knee extension MVIC.

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**2190** Board #236 MAY 31 8:00 AM - 9:30 AM  
**Changes in Movement Patterns Following a Fatiguing Resistance Training Protocol**

David R. Hooper, Tunde K. Szivak, Brett A. Comstock, Courtenay Dunn-Lewis, Jenna M. Apicella, Neil A. Kelly, Brent C. Creighton, Lindsay J. DiStefano, Jeff Volek, Carl M. Maresh, FACSM, William J. Kraemer, FACSM. *University of Connecticut, Storrs, CT.*  
(No relationships reported)

**PURPOSE:** Resistance training has been found to have a multitude of benefits. However, when performed with short rest, resistance training can result in substantial fatigue, which may have a negative impact on exercise technique. The purpose of this study was to establish the effects that fatigue from resistance exercise has on joint biomechanics and therefore assess the potential consequences these changes might have.

**METHODS:** 14 men underwent a 3 dimensional analysis of 5 bodyweight squats using the flock of birds electromagnetic motion analysis system (Ascension technologies, Inc., Burlington, VT) before and after a highly fatiguing resistance training workout. The workout included barbell squat, barbell bench press and barbell deadlift performed at 75% 1RM with a descending pyramid of repetitions beginning at 10 and ending at 1 for all lifts. Peak angle, total angular displacement and displacement rate were assessed for knee flexion, trunk flexion, hip flexion, hip rotation and hip adduction.

**RESULTS:** Following a fatiguing resistance training workout, independent t-tests showed a significant decrease in peak angle for knee flexion (Pre:  $120.28 \pm 11.93^\circ$ , Post:  $104.46 \pm 9.85^\circ$ ), hip flexion (Pre:  $-109.42 \pm 12.49^\circ$ , Post:  $-95.8 \pm 12.30^\circ$ ) and hip adduction (Pre:  $-23.32 \pm 7.04^\circ$ , Post:  $-17.30 \pm 8.79^\circ$ ). There was a significant reduction in angular displacement for knee flexion (Pre:  $115.56 \pm 10.55^\circ$ , Post:  $103.35 \pm 10.49^\circ$ ), hip flexion (Pre:  $97.94 \pm 10.69^\circ$ , Post:  $90.51 \pm 13.22^\circ$ ), hip adduction (Pre:  $17.79 \pm 7.36^\circ$ , Post:  $11.89 \pm 4.34^\circ$ ) and hip rotation (Pre:  $30.72 \pm 12.28^\circ$ , Post:  $20.48 \pm 10.12^\circ$ ). There was also a significant reduction in displacement rate for knee flexion (Pre:  $2.20 \pm 0.20$ , Post:  $1.98 \pm 0.20$ ), hip flexion (Pre:  $1.92 \pm 0.20$ , Post:  $1.76 \pm 0.27$ ), hip adduction (Pre:  $-0.44 \pm 0.17$ , Post:  $-0.31 \pm 0.17$ ) and hip rotation (Pre:  $0.59 \pm 0.23$ , Post:  $0.38 \pm 0.21$ ).

**CONCLUSIONS:** These findings indicate that resistance training combining high loads and short rest produce a substantial fatigue that results in significant changes in movement technique. Changes in movement technique have been associated with injury, therefore it is important for strength coaches to consider the effects that fatigue has on joint biomechanics to prevent possible injury.

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**2191** Board #237 MAY 31 8:00 AM - 9:30 AM  
**Effects Of Visual Biofeedback On Bilateral Force Symmetry In Sling Exercise Training**

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(No relationships reported)

Deterioration of bilateral muscle activation symmetry may affect spinal stability, which has been associated with low back pain (LBP). Sling exercise training (SET) was often used to improve spinal stability; however the effect of visual biofeedback (VB) on bilateral force symmetry (BFS) still remained unknown.

**PURPOSE:** To confer the effects of the SET combined with VB on BFS between the LBP and control (CON) groups.

**METHODS:** 12 LBP ( $22.6 \pm 2.3$  yrs) and 11 CON ( $22.6 \pm 2.1$  yrs) subjects were recruited in this study. Two load cells were installed for quantifying the forces applied bilaterally accompanying with custom-designed VB software for BFS were added to the SET equipments. This study contained four movements (M1 to M4), and the test sequence of movements was randomized. M1 is knelt on the bed with hands in the straps. M2 is lay supine with two legs in the straps and proceeded bridge exercise. M3 is lay prone with two legs in the straps and use the forearms to support the body. M4 is similar to M3, but it combined the knee flexion. 4 trails were collected in each movement, including two without visual biofeedback (NVB) and two with visual biofeedback (VB). Each movement was held for 15 seconds for each trial. The left-side applied force was divided by right-side to represent BFS, thus the ratio more close to 1 represent the better bilateral force symmetry.

**RESULTS:** In NVB condition, CON group (ranged from 1.10 to 1.20) had better BFS than LBP group (range from 1.12 to 1.27) for all 4 movements, but did not show the statistical difference. Comparing the difference in BFS between VB and NVB conditions, CON group exercise in M2 ( $1.10 \pm 0.03$  vs.  $1.06 \pm 0.02$ ) and LBP group exercise in M1 ( $1.04 \pm 0.01$  vs.  $1.12 \pm 0.06$ ), M2 ( $1.05 \pm 0.01$  vs.  $1.13 \pm 0.09$ ) and M4 ( $1.10 \pm 0.08$  vs.  $1.19 \pm 0.11$ ) showed significant improvement ( $P < .05$ ).

**CONCLUSION:** The CON group had a trend of better FS than LBP group. Exercising with VB improved BFS for LBP group significantly. **ACKNOWLEDGE:** This study was supported by NSC 99-2622-B-037-001-CC3

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2192 Board #238 MAY 31 8:00 AM - 9:30 AM

**Effect of Acute Feedback on Landing Patterns in a Horizontal Land and Cut Maneuver**

Sarah K. Leissing<sup>1</sup>, Mitchell L. Stephenson<sup>1</sup>, Erich J. Petushek<sup>2</sup>, Bryanne Bellovary<sup>1</sup>, Alexander R. Wolfe<sup>1</sup>, Caitlin Glendenning<sup>1</sup>, Erika Purdy<sup>1</sup>, Bailey M. Hagner<sup>1</sup>, Randall L. Jensen, FACSM<sup>1</sup>. <sup>1</sup>Northern Michigan University, Marquette, MI. <sup>2</sup>Michigan Technological University, Houghton, MI.

(No relationships reported)

Anterior Cruciate Ligament (ACL) Injury prevention programs have assessed the effects of acute feedback on valgus angle and peak GRF in drop landing tasks. Knee valgus angle and peak ground reaction force (GRF) are two variables important to the mechanism and prevention of ACL injury. However, although studies have assessed effects of acute feedback on these two variables during drop jumps, studies have failed to study them during a cutting maneuver.

**PURPOSE:** To assess the effects of acute feedback on valgus angle and peak GRF during a horizontal land and cut maneuver.

**METHODS:** Nine division II women soccer players (Mean  $\pm$  SD Age = 19.80  $\pm$  0.63 years; Height = 163.86  $\pm$  7.42 cm; Weight = 60.71  $\pm$  6.88 kg) randomly performed 12 horizontal land and cut maneuvers, with 3 left cuts and 3 right cuts pre- and post-feedback. Feedback was based on script from previous studies as well as results from studies using the Landing Error Scoring System. A three-way repeated measures ANOVA was used to compare the differences in knee valgus angle and peak GRF. The independent variables were leg (preferred plant leg/preferred kicking leg), feedback (pre/post), and trial. Significance was set at  $p < 0.05$ .

**RESULTS:** Results of the three-way repeated measures ANOVA indicated significant main effects for valgus angle between the preferred plant leg/preferred kicking leg and pre/post feedback. Values for the conditions were 13.80°  $\pm$  4.76° pre and 12.52°  $\pm$  4.79° post feedback for cuts on the preferred plant leg and 19.75°  $\pm$  4.07° pre and 18.34°  $\pm$  3.05° post feedback for cuts on the preferred kicking leg. There were no significant differences between trials and no significant interactions across conditions. There were no significant differences or interactions in GRF between legs, pre- and post-feedback, or trials. Values of GRF were 1068.25N  $\pm$  181.85N and 986.20N  $\pm$  159.32N pre- and post-feedback respectively for cuts on the preferred plant leg and 1126.81N  $\pm$  187.68N and 1073.76N  $\pm$  154.97N pre- and post-feedback respectively for cuts on the preferred kicking leg.

**CONCLUSIONS:** Knee valgus angle decreased with acute feedback while GRF were not affected by the same acute feedback given during a horizontal land and cut task. Therefore, acute feedback may be a useful tool for decreasing knee valgus angle during cutting tasks in ACL injury prevention programs.

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2193 Board #239 MAY 31 8:00 AM - 9:30 AM

**The Effects of Verbal Cueing on Muscle Coordination Patterns in the Step Up Exercise**

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(No relationships reported)

In an effort to improve dysfunctional muscle activation patterns, clinicians often use verbal cues to guide differential muscle activation and joint positioning during rehabilitation. While verbal cuing has been shown to elicit changes in muscle recruitment patterns during single joint, open kinetic chain exercises, it is unknown what effect verbal cuing has on a multi-joint movement with increased degrees of freedom.

**PURPOSE:** To determine the effects of three different clinically common verbal instructions on lower extremity muscle activation and coordination patterns during a step up exercise.

**METHODS:** Seven healthy males completed 1 un-cued control trial and 8 randomly assigned experimental trials after receiving cues to either preferentially recruit gluteal muscles, preferentially recruit vastus medialis, maintain hip and knee alignment or count backwards from a high number (distraction). Surface electromyograms (EMG) were recorded from the surface of seven muscles: vastus medialis (VM), vastus lateralis (VL), rectus femoris (RF), semitendinosus, (ST) biceps femoris (BF), gluteus maximus (GMx), gluteus medius (GMd). EMG intensities were calculated using wavelet techniques. Muscle coordination patterns were then compared across trials using principal component analysis and repeated measures ANOVA with Tukey's Post-hoc comparisons.

**RESULTS:** The gluteal and VM cue conditions were significantly different in comparison to the control, alignment and distraction conditions and also to each other ( $p < 0.05$ ). Both gluteal cues and VM cues elicited greater overall muscle activation and in particular greater ST and BF activity than the other conditions. The VM cues condition also showed greater VM, VL, RF, GMx and GMd activity and less ST and BF activity than the gluteal cues condition.

**CONCLUSION:** Our results indicate that verbal cuing for preferential muscle recruitment can alter muscle coordination patterns in a step up exercise, but that the resulting changes do not represent the pattern that was cued. Verbal instructions to modify lower extremity alignment did not significantly change the coordination patterns compared to an un-cued control trial. Caution should be taken when attempting to use verbal cues to change muscle activation patterns. Supported by the BC Sports Med Research Foundation.

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2194 Board #240 MAY 31 8:00 AM - 9:30 AM

**Effect of Feedback on Peak Torque in a Female Population**

Barbara L. Warren, FACSM, Nika Evans. University of Puget Sound, Tacoma, WA.

(No relationships reported)

**PURPOSE:** The purpose of the study was to assess the effect of feedback on peak torque during isokinetic testing.

**METHODS:** Fourteen (7 athletes: mean age=20.7 years, height=178.5 cm, weight=74.7 kg; 7 non-athletes: mean age 20.0 years, height 168 cm, weight=64.1 kg) apparently healthy college-age females participated in the study. Each subject performed 2 familiarization and 4 experimental trials on a Cybex NORM isokinetic dynamometer. Each subject executed 10 reciprocal knee flexion/extension maximal contractions at velocities of 60 deg/s, 180 deg/s and 300 deg/sec with a 1 minute rest between velocity sets. Subjects were randomly assigned feedback conditions: none, visual, verbal, visual and verbal. A 2 (athlete or not) X 3 (velocities) X 4 (feedback conditions) repeated measures ANOVA ( $\alpha < .05$ ) was used to analyze the data.

**RESULTS:** For knee extension there were no significant interaction effects, but there were significant differences in the peak torque between velocities ( $F=574.8$ ,  $p < .0005$ ). There were no significant differences in peak torque regardless of the feedback condition and no significant differences between athletes and non-athletes. For knee flexion, there was a significant interaction between velocity and athlete ( $F=6.755$ ,  $p < .002$ ), and a significant difference in peak torque by velocity ( $F=284$ ,  $P < .0005$ ). Additionally, there was a significant difference in knee flexion peak torque between athletes and non-athletes ( $F=4.882$ ,  $p < .032$ ), but no significant difference in peak torque by feedback condition.

**CONCLUSIONS:** Feedback conditions did not affect peak torque in this population of females.

Supported by Math and Science Summer Research Funds

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2195 Board #241 MAY 31 8:00 AM - 9:30 AM

**Impact of Instructor Cues on Changes in Cycling Form during a Spin Class**

Jacilyn Olson, Ashley Binns, Jennifer Bliss, Addie Swyden, Michelle Gray, Ro Di Brezzo. University of Arkansas, Fayetteville, AR. (Sponsor: Barry Brown, FACSM)

(No relationships reported)

Many people attend group fitness classes as their regular mode of exercise; however, proper form may not be consistently emphasized in these classes. In spin classes, form is especially important due to the repetitive nature of the movement putting those with improper technique at increased risk of injury.

**PURPOSE:** The purpose of this study was to examine the impact of instructor cues on joint angle changes and rating of perceived exertion (RPE) during a spin class.

**METHODS:** Fifteen participants (8M, 7F) of various cycling backgrounds participated with mean ( $\pm$  SD) age, height, and weight of 22.6  $\pm$  5.07 yr., 1.73  $\pm$  0.10 m, and 66.94  $\pm$  12.03 kg, respectively. Informed consent was obtained and reflective markers placed on the right and left sides of the body over anatomical landmarks aligned with lower and upper limb joint centers. The spin bike was set for individual comfort and was consistent for each trial. Each participant completed two testing sessions at least one week apart; order was randomized. During each session participants cycled following instructions from a recorded spin class (55 minutes). The two testing videos were exactly the same, except one version included instructor cues about proper form, while the other did not. Two video cameras were used to observe sagittal and frontal angles. Video of each participant was recorded at three 10-second periods during the class; the

beginning, middle, and end. Joint angles of interest were elbow, hip, knee, ankle, spine, and shoulders. Motion analysis software was used to calculate joint angles via inverse dynamics. A repeated measures MANOVA was used to analyze joint angles and RPE.

**RESULTS:** The MANOVA revealed a significant change in the group of variables throughout the course of the spin class ( $F = 843.52, p < .001$ ). The overall measures of interest were not influenced by instructor cues ( $F = 0.00, p = .99$ ). Significant joint angle changes were found at the hip ( $F = 7.30, p = .02$ ) and left shoulder ( $F = 7.40, p = .02$ ). RPE significantly increased as the class progressed ( $F = 41.11, p < .001$ ).

**CONCLUSIONS:** Contrary to our hypothesis, instructor cues did not influence changes in joint angles during a spin class; class duration appeared to be more influential. The biomechanics of spin classes should continue to be studied, especially in regards to maintaining form throughout the classes.

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**2196** Board #242 MAY 31 8:00 AM - 9:30 AM

**The Reliability Of Percent Voluntary Activation During Submaximal And Maximal Isometric Muscle Actions.**

Michael Cooper<sup>1</sup>, Ashley Walter<sup>2</sup>, Pablo Costa<sup>3</sup>, Eric Ryan<sup>4</sup>, Joel T. Cramer, FACSM<sup>5</sup>, Trent Herda<sup>1</sup>. <sup>1</sup>University of Kansas, Lawrence, KS. <sup>2</sup>University of Oklahoma, Norman, OK. <sup>3</sup>California State University, San Bernardino, CA. <sup>4</sup>University of North Carolina, Chapel Hill, NC. <sup>5</sup>Oklahoma State University, Stillwater, OK.

(Sponsor: Joel T. Cramer, FACSM)

(No relationships reported)

The interpolated twitch technique is a popular method used to assess percent voluntary activation (%VA) during submaximal and maximal isometric muscle actions, however, there is limited knowledge on the reliability of this technique at different contraction intensities.

**PURPOSE:** The purpose of this study was to examine the test-retest reliability of the %VA versus force relationships.

**METHODS:** 14 healthy men (mean±SD age=21±2.6 yrs) and 8 women (age=21±1.8 yrs) completed four maximal voluntary contractions and nine randomly-ordered submaximal isometric plantar flexions from 10 to 90% of the MVC. Transcutaneous electrical stimuli were delivered to the tibial nerve using a high-voltage constant-current stimulator (Digitimer DS7AH, Herthfordshire, UK) during two of the four MVC's and during all submaximal isometric plantar flexions. Submaximal isometric step contraction percentages were calculated from the higher of the two initial MVCs that were performed without the transcutaneous electrical stimuli. Doublets were administered at a supramaximal stimulus intensity during the maximal and submaximal MVC plateau and then again 3-5 s after the maximal and submaximal MVC at rest. %VA was calculated for each maximal and submaximal MVC. The intraclass correlation coefficients (ICCs) and standard errors of measurements expressed as a percentage of the mean (%SEMs) were used for test-retest reliability, while paired samples *t* tests were used to quantify systematic variability. Model "2,1" from Shrout and Fleiss (1979) was used to calculate the ICCs.

**RESULTS:** Systematic variability was not present at any of the contraction intensities ( $P > 0.05$ ). The ICCs ranged from 0.52 to 0.84, while the %SEM ranged from 6.75 to 38.45%. The ICCs were  $\geq 0.74$  at contraction intensities ranging from 40 to 100% MVC (6.75 to 16.78% SEM), while the ICCs were  $\leq 0.65$  (20.95 to 38.45% SEM) for the contraction intensities  $\leq 30\%$  MVC.

**CONCLUSIONS:** Although not statistically tested, the ICCs tended to be higher, while the %SEMs lower for contractions  $\geq 40\%$  MVC (Table 1). Future research in assessing muscle activation or predicting the true maximal force from the %VA versus force relationships may want to exclude contractions intensities below 40% MVC.

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**2197** Board #243 MAY 31 8:00 AM - 9:30 AM

**Quadriceps Strength and Corticospinal Excitability as Predictors of Disability Following Anterior Cruciate Ligament Reconstruction**

Adam S. Lepley, Hayley M. Ericksen, Jason Levine, Phillip A. Gribble, Brian G. Pietrosimone. University of Toledo, Toledo, OH.

(No relationships reported)

Disability is common in a proportion of patients following anterior cruciate ligament reconstruction (ACLR). Neuromuscular quadriceps deficits are a hallmark impairment following ACLR, yet the link between self-reported disability and quadriceps muscle dysfunction is not clearly understood.

**PURPOSE:** To evaluate the ability of a clinical measure of neuromuscular function, quadriceps strength, and corticospinal excitability to predict self-reported disability in patients with ACLR.

**METHODS:** Fifteen participants with a history of ACLR (11 Female, 4 Male; 172±9.8cm, 70.4±17.5kgs, 54.4±40.9 months post-surgery) whom had been medically cleared to fully participate in physical activity were examined. Quadriceps strength was assessed via maximal voluntary isometric contractions (MVIC) performed at 90° of knee flexion. Corticospinal excitability was assessed with active motor thresholds (AMT), which were elicited by stimulating specific areas on the motor cortex using Transcranial Magnetic Stimulation (TMS). AMT's were measured during a standardized contraction at 5% of an MVIC. A multiple linear regression model was used to determine the ability of strength and corticospinal excitability of the involved limb to predict disability measured with the International Knee Documentation Committee (IKDC) index score. The change in R<sup>2</sup> to the model from the addition of each predictor variable was also analyzed.

**RESULTS:** The overall multiple regression model significantly predicted 66% of the variance in self-reported disability as measured by the IKDC (R<sup>2</sup> = 0.66, P=0.01; IKDC= .78MVIC - .24AMT +58.89). Initial imputation of MVIC into the model accounted for 61% (R<sup>2</sup>=0.61, P=0.01) of the variance in IKDC. The subsequent addition of AMT in the model accounted for an insignificant increase of 5% ( $\Delta R^2 = 0.05, P=0.19$ ) in the prediction capability of the model.

**CONCLUSION:** Quadriceps strength and corticospinal excitability predicted two-thirds of the variance in disability of patients with ACLR, yet, strength solely accounted for a significant portion of the predictive capability of the model. Maintaining quadriceps strength following ACLR may substantially influence patient's perception of disability, however the impact of corticospinal excitability on both strength and disability remains unclear.

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**2198** Board #244 MAY 31 8:00 AM - 9:30 AM

**Does Gait Retraining To Decrease Vertical Loads Reduce Bony Loads In Runners?**

Rebecca E. Fellin<sup>1</sup>, Irene S. Davis, FACSM<sup>2</sup>. <sup>1</sup>University of Delaware, Newark, DE. <sup>2</sup>Harvard Medical School, Boston, MA.

(No relationships reported)

In runners, tibial stress fractures (TSF) most often occur between the midshaft and distal third of the tibia. TSF incidence has been linked to excessive impact loads including tibial shock (TS) and vertical load rate (VALR). Gait retraining to decrease initial impacts has been demonstrated to reduce TS, as well as the VALR of the ground reaction force. However, external loads do not directly indicate loads within the tibia. These bony loads are the ones that need to be decreased to reduce injury risk.

**PURPOSE:** To assess tensile strain rates (TSR) and compressive strain rates (CSR) from the midshaft to the distal third of the tibia following gait retraining. We hypothesized that these tibial strain rates would decrease following gait retraining.

**METHODS:** To date, 5 subjects (32.2 ± 2.9 yr), running > 10 mi/wk, with high TS (>8 g's) were recruited. They completed 8 sessions of gait retraining, which consisted of real-time visual feedback of their TS. Tibial joint contact force was calculated from a musculoskeletal model and input into a finite element model. Tibial peak principal strain rates were then calculated. VALR, TS, TSR and CSR were compared pre and post retraining. Due to the small n, data were analyzed descriptively.

**RESULTS:** TS decreased by 23-65% (Fig 1) and all values of TS were within the normal range following gait retraining. 4/5 runners decreased TSR and CSR in the region of interest by 4-45% (Fig 1). Although bony loads generally decreased, the changes were not tightly coupled with external load reductions.

**CONCLUSION:** External and bony loads appeared to decrease post gait retraining. These preliminary results suggest that reducing excessive external vertical loads may result in decreased tibial strain rates and TSF risk in runners.

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2199 Board #245 MAY 31 8:00 AM - 9:30 AM

**Relationship between Lean Mass and Coactivation during Downward Stepping with Advancing Age**

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(No relationships reported)

Older adults adopt altered neuromuscular strategies to complete activities of daily living. One adaptation includes increased levels of agonist-antagonist muscle coactivation. It has been proposed that older adults increase coactivation to improve stability in response to losses in muscle mass associated with advancing age. However, no previous investigation has directly assessed the relationship between muscle mass and coactivation ratios (CAR).

**PURPOSE:** The purpose of this study was to examine the relationship between lean mass (LM) and muscle coactivation ratio. It was hypothesized that a negative correlation would exist between LM and CAR for the young adults (YA) and old adults (OA).

**METHODS:** Ten YA and 10 OA participated in this study. Age (YA: 22.9±1.4 yrs; OA: 80.9±3.1 yrs), height, mass, and LM (YA: 59.3±14.2 kg; OA: 40.7±6.6 kg) were recorded from each participant. Five downward stepping trials were performed by each participant while surface EMG (2000Hz) was collected from the vastus lateralis (VL), biceps femoris (BF), tibialis anterior (TA) and the gastrocnemius (LG) of the right lower extremity. EMG data were then smoothed and rectified using root mean squared (RMS) with a 20ms smoothing window. The mean RMS value over the stance phase was calculated for each muscle and normalized to the peak value for each muscle across all trials of that subject. CAR at the knee and ankle were calculated as the quotient of the BF divided by the VL and the TA divided by the GM, respectively. A correlation analysis was conducted to examine the relationship between lean mass and CAR. An analysis of variance (ANOVA) was used to determine differences in CAR, total mass and LM. Alpha level was set at p<0.05.

**RESULTS:** OA had significantly less LM than YA (OA: 40.7±6.6; YA: 59.3±14.2; p=0.001). YA and OA adults exhibited similar CARs at the knee (OA: 0.80±0.28; YA: 0.71±0.16; p=0.399) but young adults had a significantly lower CAR at the ankle (OA: 0.61±0.21; YA: 0.38±0.21; p=0.025). Though no statistical comparison was made in the correlation analysis, young and old adults exhibited opposite relationships between LM and CAR at the knee.

**CONCLUSIONS:** These data suggest that the altered neuromuscular activation patterns in old adults are not solely the result of declines in the mechanical capacity for movement.

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2200 Board #246 MAY 31 8:00 AM - 9:30 AM

**Eccentric Muscle Activation Patterns During a Five-time-sit-to-stand Movement**

Bradley S. Davidson<sup>1</sup>, Dana L. Judd<sup>2</sup>, Abbey C. Thomas<sup>2</sup>, Jennifer E. Stevens-Lapsley<sup>2</sup>. <sup>1</sup>University of Denver, Denver, CO. <sup>2</sup>University of Colorado Anschutz Medical Campus, Aurora, CO. (Sponsor: Catherine M. Jankowski, FACSMS)

(No relationships reported)

Muscle dysfunction is common in patients with end-stage osteoarthritis (OA) and is exacerbated following total knee arthroplasty (TKA). This dysfunction may be problematic during eccentric tasks in which the knee extensors encounter compound duties: absorbing force and maintaining knee stability.

**PURPOSE:** To examine knee muscle coactivation, individual muscle activity, and associated ground reaction force (GRF) production in healthy participants and TKA patients during the eccentric phases of a five-time-sit-to-stand movement (FTSTS).

**METHODS:** Patients with end-stage OA (n=14; age 63.9±9.3 years) performed FTSTS before and one month after TKA. Healthy participants (HP; n=9; age 61.6±9.9 years) performed FTSTS on one occasion. Electromyography (EMG) from *vastus lateralis* (QUAD) and *biceps femoris* (HAM) and vertical GRF were recorded from each limb. Ensemble averages taken from the eccentric phases were used to calculate coactivation index, normalized integrated EMG (iEMG), and normalized GRF impulse (iGRF) for each condition (HP, PreTKA, PostTKA) and limb (Surgical, NonSurgical). Data were analyzed with two-way ANOVAs and Tukey HSD for *post hoc* comparisons.

**RESULTS:** Coactivation index PreTKA (mean±sd: 61.6±15.1) and PostTKA (64.5±17.2) were higher than HP (49.1±15.8; p=0.011). PostTKA iGRF was lower in the Surgical (0.38±0.08) versus NonSurgical limb (0.62±0.08; p=0.009). QUAD iEMG PostTKA (81.1±24.1) was higher than PreTKA (62.7±19.4) and HP (51.6±19.1; p=0.001). QUAD iEMG was higher in the Surgical (71.4±27.4) versus NonSurgical limb (58.2±16.3; p=0.010). PostTKA HAM iEMG trended higher in the Surgical (85.1±18.0) versus NonSurgical limb (60.3±12.3; p=0.059).

**CONCLUSION:** Patients produced higher levels of coactivation than HP in both limbs before and after TKA, which suggests a protective strategy against knee instability. This strategy included greater QUAD and HAM activity in the Surgical limb, and reducing load absorption demands by shifting GRF to the NonSurgical limb. Despite these protective advantages, chronic movement asymmetry may impede post-surgical rehabilitation and accelerate NonSurgical joint degeneration. As such, patients may benefit from rehabilitation strategies to restore normal muscle activity and load absorption, especially during eccentric movements.

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2201 Board #247 MAY 31 8:00 AM - 9:30 AM

**Power And Fatigue Index Differ Between Sitting And Standing During The Wingate Test In Women**

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(No relationships reported)

The Wingate Anaerobic Test (WAnT) is widely used to assess anaerobic performance. Yet, while this test has been studied in multiple contexts and populations, little is known about how the performance on this test is influenced by changes in cycling position, particularly in women. Deeper understanding of this issue has clinical implications, as cycling position is itself a form of exercise specificity, which is an important consideration in training and rehabilitation.

**PURPOSE:** The goal of this study was to explore the effects of seated and standing pedaling position on measures of peak power (PP) mean power (MP) and fatigue index (FI) during maximal cycling.

**METHODS:** Thirty two women (24.14±1.62 yr, 167.77±7.52 cm, 64.13±8.55 kg) completed this study. Criteria was used to 1) include subjects who exercise at least 30 minutes 3 or more days per week and 2) exclude individuals a) who possess any type of pathology which would, by itself, alter gross motor performance, or b) who regularly cycle. Participants visited the laboratory on two occasions, in which they completed the WAnT under seated and standing conditions. The trial order was randomized. Following a standardized warm up, each rode an electronically-braked cycle ergometer at maximal intensity for 30 seconds. Conditions were controlled and measured by computer. The following variables were assessed continuously during each trial: speed, watts, cadence, and measures of cycling efficiency (SpinScanTM, and average torque angle (ATA) throughout the 360° of pedal travel). Indices of PP, MP, and FI were calculated using 5 second time periods. Paired t-tests were used for statistical analysis.

**RESULTS:** Significant differences were found between the conditions for PP (t(31)= -2.46, p=0.02), MP (t(31)= -8.66, p=0.000), and FI (t(31)= 2.42, p=0.021). Power values were significantly higher - and the fatigue index was significantly lower - during the seated condition.

**CONCLUSIONS:** Lesser PP and MP were found for the WAnT in the standing position, compared to sitting. The FI was also more evident during the standing condition. The motor performance of the participants was clearly influenced by the cycling positions used in this study, suggesting that position-based neuromuscular coordination patterns contribute greatly to cycling performance in women.

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## C-35 Free Communication/Poster - Oxygen Uptake Kinetics

MAY 31, 2012 7:30 AM - 12:30 PM  
ROOM: Exhibit Hall

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2202 Board #248 MAY 31 9:00 AM - 10:30 AM

### A Dynamic Overshoot In Skeletal Muscle Deoxygenation Is Not Evidence Of A VO<sub>2</sub> Kinetic Limitation

T Scott Bowen<sup>1</sup>, Harry B. Rossiter, FACSM<sup>1</sup>, Alan P. Benson<sup>1</sup>, Tatsuro Amano<sup>2</sup>, Narihiko Kondo<sup>2</sup>, John M. Kowalchuk<sup>3</sup>, Shunsaku Koga<sup>4</sup>. <sup>1</sup>University of Leeds, Leeds, United Kingdom. <sup>2</sup>Kobe University, Kobe, Japan. <sup>3</sup>The University of Western Ontario, London, ON, Canada. <sup>4</sup>Kobe Design University, Kobe, Japan.  
(No relationships reported)

An overshoot (OS) in skeletal muscle deoxygenation dynamics during constant work-rate exercise is seen in pathologies where O<sub>2</sub> delivery is limited (Diederich et al., *Cardiovasc Res*, 2002). Such a transient reduction in PO<sub>2</sub> is expected to limit the maximum rate of capillary-to-myocyte O<sub>2</sub> diffusion. Whether this limitation is sufficient to slow O<sub>2</sub> uptake (VO<sub>2</sub>) kinetics, however, is currently unclear.

**PURPOSE:** To determine the relationship between VO<sub>2</sub> kinetics and absolute skeletal muscle deoxygenation during reductions of inspired O<sub>2</sub> to attenuate O<sub>2</sub> delivery.

**METHODS:** Seven healthy males performed repeats of 8 min cycle ergometry from 5 W to 80 % lactate threshold in normoxia (N, F<sub>i</sub>O<sub>2</sub> = 0.21), moderate hypoxia (MH, 0.16) and severe hypoxia (SH, 0.12). VO<sub>2</sub> was measured breath-by-breath (Minato Medical AE-300S). Deoxy-(hemoglobin+myoglobin) (HHb) dynamics were measured from *rectus femoris* and *vastus lateralis* using quantitative, time-resolved, near-infrared spectroscopy (Hamamatsu TRS-20), and corrected for adipose thickness.

**RESULTS:** The phase II VO<sub>2</sub> time constant ( $\tau$ ) was slowed ( $p = 0.02$ ) as F<sub>i</sub>O<sub>2</sub> decreased (N,  $17 \pm 3$  (mean  $\pm$  SD); MH,  $22 \pm 4$ ; SH,  $29 \pm 9$  s). The resting and baseline HHb increased ( $p = 0.01$ ) as F<sub>i</sub>O<sub>2</sub> decreased, and  $\Delta$ HHb (end-exercise - baseline) was greater ( $p = 0.01$ ) in SH ( $24 \pm 13$   $\mu$ M) than N ( $16 \pm 8$   $\mu$ M) and MH ( $18 \pm 10$   $\mu$ M). There was no relationship between the increase in  $\tau$ VO<sub>2</sub> in hypoxia and relative OS incidence (N, 38 %; MH, 52 %; SH, 43 %;  $r^2 < 0.01$ ;  $p = 0.95$ ), or OS area ( $r^2 = 0.04$ ;  $p = 0.49$ ), but the increase in  $\tau$ VO<sub>2</sub> was positively related to the increase in peak HHb ( $r^2 = 0.46$ ;  $p < 0.01$ ).

**CONCLUSIONS:** An overshoot in muscle deoxygenation in heart failure (Sperandio et al., *AJP*, 2009) or pulmonary arterial hypertension (Barbosa et al., *EJAP*, 2011) is suggested to reflect a mismatch in O<sub>2</sub> delivery-to-utilization that contributes to slowing VO<sub>2</sub> kinetics. While the peak HHb during the transient was related to slowed VO<sub>2</sub> kinetics in hypoxia, the OS incidence and OS area were not. This suggests that an overshoot in HHb *per se* is not evidence of a capillary-myocyte O<sub>2</sub> diffusion limitation to VO<sub>2</sub> kinetics. Rather, the absolute peak HHb (specifically, a reflection of a low capillary PO<sub>2</sub>) during the transient determined by quantitative NIRS may be a better index of an O<sub>2</sub> delivery limitation to VO<sub>2</sub> kinetics.

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2203 Board #249 MAY 31 9:00 AM - 10:30 AM

### Physiological Responses to an Acute Bout of Sprint Interval Cycling

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(No relationships reported)

Sprint interval training has been shown to improve skeletal muscle oxidative capacity, maximal oxygen uptake and insulin sensitivity, and reduce postprandial triglycerides.

**PURPOSE:** To determine the oxygen uptake and related cardiorespiratory responses and associated energy expenditure during an acute bout of sprint interval cycling (SIC).

**METHODS:** Twelve healthy, college-aged subjects, 6 men and 6 women, completed 2 SIC sessions with at least 7 d between trials. SIC was performed on a mechanically-braked cycle ergometer and involved a 5-min warm-up followed by four 30-s all-out sprints with 4 min active recovery. Work performed was quantified using an optical sensor to measure flywheel revolutions. Oxygen uptake was measured continuously by open-circuit spirometry during the last minute of warm-up and throughout the SIC session. The energy expenditure during each sprint was based on the estimated anaerobic energy contribution to the sprints and the net aerobic energy calculated from measured oxygen uptake above rest.

**RESULTS:** The average work performed decreased during the four sprints for males ( $19.3 \pm 2.7$ ,  $17.5 \pm 3.5$ ,  $16.2 \pm 4.0$ , and  $14.3 \pm 6.0$  kJ) and females ( $11.6 \pm 1.4$ ,  $11.1 \pm 1.5$ ,  $10.6 \pm 1.5$ , and  $10.6 \pm 1.9$  kJ). Percent fatigue increased from sprint 1 to sprint 4 ( $29.8 \pm 11.8$ ,  $34.6 \pm 15.8$ ,  $38.5 \pm 17.7$ , and  $38.5 \pm 15.4$ ). Average aerobic, anaerobic, and total energy expended during the 18 min necessary to complete the SIC session were  $130.8 \pm 31.5$ ,  $72.6 \pm 8.3$ , and  $203.4 \pm 38.2$  kcal for males and  $108.1 \pm 16.9$ ,  $47.6 \pm 6.4$ , and  $155.7 \pm 21.3$  kcal for females. Peak oxygen uptake (ml/kg/min) during the 4 sprints was 35.3, 38.8, 38.8, and 36.8. Peak heart rate (bpm) during the 4 sprints was 164, 172, 177, and 175. Peak minute ventilation (L/min) during the 4 sprints was 75, 102, 107, and 101.

**CONCLUSIONS:** An acute bout of SIC elicits submaximal oxygen uptake and cardiorespiratory responses during each interval that approximates ~80% of estimated maximal values. The energy expended is much lower than that expended in moderate-intensity aerobic exercise training programs shown to improve aerobic capacity and insulin sensitivity, and reduce postprandial triglycerides, signifying the importance of the high-intensity nature of the exercise.

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2204 Board #250 MAY 31 9:00 AM - 10:30 AM

### Optimising And Validating A Computational Model Of The Influence Of Circulatory Dynamics On VO<sub>2</sub> Kinetics

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(No relationships reported)

The dynamics of the circulation can dissociate muscle (VO<sub>2m</sub>) and alveolar (VO<sub>2A</sub>) O<sub>2</sub> uptake kinetics. Computational models to investigate this (e.g. Rossiter & Benson, *MSSE* 42:25-, 2010) are yet to be directly validated against experimental data, and the influence of the structural organisation of the venous vascular compartments on these kinetics has yet to be determined.

**PURPOSE:** To optimise and validate a computational model linking muscle and lung gas exchange kinetics, using simultaneously-measured VO<sub>2m</sub>, muscle blood flow (Q<sub>m</sub>) and VO<sub>2A</sub> from six healthy male subjects during moderate-intensity exercise.

**METHODS:** VO<sub>2m</sub> (by direct Fick) and Q<sub>m</sub> (by thermodilution) were measured on transition from unloaded to  $183 \pm 20$  W cycle ergometry (published in Grassi et al, *JAP* 80:988-, 1996). Baselines, steady-states and time constants ( $\tau$ ) for VO<sub>2m</sub> and Q<sub>m</sub> were used as inputs for a model with a single 3 L venous volume (SCM; as in Barstow et al, *JAP* 68:979-, 1990) and an optimised multi-compartment model (MCM) with volumes draining the exercising muscle, the rest of the body, and a volume carrying mixed-venous blood to the lung. Error between model-predicted and experimental breath-by-breath VO<sub>2A</sub> was calculated as the sum of absolute differences in time delay (TD) and phase II  $\tau$ .

**RESULTS:** Experimentally-measured VO<sub>2A</sub> kinetics were (mean  $\pm$  SD): TD =  $17.5 \pm 1.8$  s;  $\tau$  =  $18.7 \pm 4.2$  s. The SCM gave an error of  $8.2 \pm 9.6$  s (TD =  $16.6 \pm 0.9$  s;  $\tau$  =  $21.4 \pm 12.2$  s). With the MCM, separate muscle, body and mixed-venous volumes of  $0.8 \pm 0.7$ ,  $0.6 \pm 1.1$  and  $1.7 \pm 1.0$  L respectively (total venous volume =  $3.1 \pm 1.0$  L) improved predictions for TD ( $17.4 \pm 1.9$  s) and  $\tau$  ( $20.5 \pm 10.0$  s) and significantly reduced error to  $5.1 \pm 7.6$  s compared to SCM (paired *t*-test,  $p = 0.02$ ).

**CONCLUSIONS:** These data validate a computational model linking the kinetics of VO<sub>2m</sub> and VO<sub>2A</sub> against experimental measurements. Distributing blood between three venous vascular compartments significantly improved the accuracy with which the model reproduced experimentally-determined VO<sub>2A</sub> kinetics, suggesting that both the structure and dynamics of the circulation should be accounted for when interpreting the pulmonary expression of VO<sub>2m</sub> dynamics.

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2205 Board #251 MAY 31 9:00 AM - 10:30 AM

### Helium Breathing Abolishes The Slow Component Of Pulmonary Oxygen Uptake Kinetics In Obese Adolescents

Bruno Grassi<sup>1</sup>, Desy Salvadego<sup>1</sup>, Alessandra Patrizi<sup>2</sup>, Gabriella Tringali<sup>2</sup>, Fiorenza Agosti<sup>2</sup>, Alessandro Sartorio<sup>2</sup>. <sup>1</sup>University of Udine, Udine, Italy. <sup>2</sup>Italian Institute of Auxology, Piancavallo (VB), Italy.  
(No relationships reported)

**BACKGROUND:** Ventilatory dynamics during exercise are modified by obesity. Replacement of nitrogen by helium in inspired gas reduces the work of breathing.

**PURPOSE:** To determine, in obese adolescents (OB), if respiratory muscles unloading via helium-O<sub>2</sub> breathing would reduce the amplitude of the "slow component" of pulmonary O<sub>2</sub> uptake (VO<sub>2</sub>) kinetics and increase exercise tolerance.

**METHODS:** Seven male OB (age 16.7 ± 1.4 [x ± SD] years, body mass 101.5 ± 9.0 kg, body mass index 32.4 ± 4.7 kg/m<sup>2</sup>) were evaluated. Experiments were conducted with subjects inspiring room air (CTRL) and a 21% O<sub>2</sub>-79% helium mixture (HE). Two exercise protocols were performed on a cycle ergometer: an incremental exercise (for the determination of maximal VO<sub>2</sub> and the gas exchange threshold [GET]), and a 12-min constant-load exercise (for VO<sub>2</sub> kinetics analysis) at a work rate (122.6 ± 18.4 watt) corresponding to 120% of GET determined in CTRL.

**RESULTS:** A slow component of VO<sub>2</sub> kinetics, with an amplitude corresponding to 10.2 ± 3.5% of the total amplitude of the VO<sub>2</sub> response, was observed in CTRL; the amplitude was significantly lower in HE (1.3 ± 3.4%). The lower amplitude of the slow component in HE was associated with: lower heart rate (165.0 ± 13.5 b/min in CTRL vs. 158.0 ± 14.5 in HE); lower "gain" of the VO<sub>2</sub> response (Delta VO<sub>2</sub>/Delta work rate: 16.1 ± 1.0 mL/min/watt in CTRL vs. 14.2 ± 1.3 in HE); lower gas exchange ratio (0.93 ± 0.05 in CTRL vs. 0.89 ± 0.09 in HE); lower values of rate of perceived exertion for dyspnea/respiratory discomfort (6.4 ± 1.0 in CTRL vs. 3.9 ± 0.7 in HE) and for "leg effort" (7.5 ± 1.6 in CTRL vs. 5.4 ± 1.3 in HE).

**CONCLUSION:** Respiratory muscles unloading via helium-O<sub>2</sub> breathing determined, in obese adolescents, the virtual abolishment of the slow component of pulmonary VO<sub>2</sub> kinetics during constant work rate exercise at 120% of GET, and clear signs of increased exercise tolerance. Respiratory muscles training may represent an option for increasing exercise tolerance in obese patients.

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2206 Board #252 MAY 31 9:00 AM - 10:30 AM

### ATP Turnover And The Coupling Of Mitochondrial Oxidative Phosphorylation During Dynamic Exercise In Humans

Daniel T. Cannon<sup>1</sup>, T Scott Bowen<sup>1</sup>, Scott R. Murgatroyd<sup>1</sup>, William E. Bimson<sup>2</sup>, Graham J. Kemp<sup>2</sup>, Harry B. Rossiter, FACSM<sup>1</sup>. <sup>1</sup>University of Leeds, Leeds, United Kingdom. <sup>2</sup>University of Liverpool, Liverpool, United Kingdom.  
(No relationships reported)

During constant work rate (CWR) exercise above the lactate threshold (LT), the kinetics of oxygen uptake (VO<sub>2</sub>) are supplemented by the VO<sub>2</sub> slow component (VO<sub>2sc</sub>), reflecting reduced work efficiency. The majority of the VO<sub>2sc</sub> originates from the active locomotor muscles, yet the intracellular source of inefficiency is less clear. An increase in the ATP cost of power production (P:W) has been postulated, rather than a change in the O<sub>2</sub> cost of ATP resynthesis (P:O).

**PURPOSE:** To determine ATP turnover rate during sub- and supra-LT CWR exercise in humans.

**METHODS:** Seven healthy participants completed a series of prone, knee-extension, rest-exercise-rest protocols using a computer-controlled ergometer in a 3T superconducting magnet. <sup>31</sup>P spectra (3200 Hz bandwidth; 1024 data points; 2 s TR) were collected from the quadriceps throughout using a dual-tuned (<sup>1</sup>H and <sup>31</sup>P) surface coil. Moderate (MOD; sub-LT) and heavy (HVY; supra-LT) CWR exercise was completed for 3 and 8 min allowing total ATP turnover (ATP<sub>tot</sub>) to be estimated at cessation from the dynamics of phosphocreatine (PCr) and proton handling. Pulmonary VO<sub>2</sub> was measured breath-by-breath using a mass spectrometer and turbine.

**RESULTS:** During MOD there was no discernable VO<sub>2sc</sub> (0.07 ± 0.15 L.min<sup>-1</sup>). Conversely, during HVY the VO<sub>2sc</sub> was larger ( $p < 0.05$ ) at 0.32 ± 0.11 L.min<sup>-1</sup> or 20 ± 6 % of the fundamental VO<sub>2</sub> amplitude. Similarly, the difference in PCr between 3 and 8 min of MOD was minimal (-2.8 ± 4.0 mM), whereas this difference was larger ( $p < 0.05$ ) during HVY (2.1 ± 1.5 mM or 17 ± 13 % of the fundamental amplitude). ATP<sub>tot</sub> was constant during MOD (18.6 ± 11.7 vs. 15.3 ± 8.02 mM.min<sup>-1</sup>;  $p > 0.21$ ), but increased between 3 and 8 min of HVY (24.1 ± 13.1 vs. 28.3 ± 9.46 mM.min<sup>-1</sup>;  $p < 0.098$ ; 17.0 ± 22.0 %Δ). However, ΔATP<sub>tot</sub> was not related to the VO<sub>2sc</sub> during HVY ( $r = 0.2$ ;  $p > 0.6$ ). Three of seven participants exhibited a non-linear PCr/VO<sub>2</sub> relationship.

**CONCLUSIONS:** The rate of ATP turnover increased between 3 and 8 min of supra-LT, but not sub-LT, exercise. Importantly, this conclusion was reached without assumptions of intramuscular PCr/VO<sub>2</sub> or ADP/VO<sub>2</sub> relationships. However, the poor correlation between ΔATP<sub>tot</sub> and the VO<sub>2sc</sub> suggests that reduced work efficiency in HVY exercise is not wholly consequent to augmented P:W, but that reductions in P:O may also contribute.

Supported by the BBSRC UK BB/100162X/1

2207 Board #253 MAY 31 9:00 AM - 10:30 AM

### Acute Metabolic Responses during Postprandial Exercise of Incremental Intensity

Jie Kang, FACSM, Joseph Rosenberg, Emily Raines, Nicholas Ratamess, Fernando Naclerio, Avery Faigenbaum, FACSM. The College of New Jersey, Ewing, NJ.  
(No relationships reported)

**PURPOSE:** Exercise and digestive processes are known to elevate the metabolic rate independently. However, it remains equivocal whether these two events are additive when taking place simultaneously. The present investigation was to examine metabolic cost and substrate utilization during exercise that occurred shortly after the consumption of a meal.

**METHODS:** Twenty healthy volunteers including 10 men and 10 women completed a VO<sub>2</sub> peak test and three experimental trials: 1) consumption of a test meal (M), 2) exercise only (E), and 3) consumption of a test meal followed by exercise (M+E). All trials commenced in the morning after an overnight fasting and were preceded by a 10-min rest period (R) during which resting VO<sub>2</sub>, heart rate (HR), and respiratory exchange ratio (RER) were determined. Exercise protocol consisted of three successive 10-minute cycle exercises at 50, 60, and 70% VO<sub>2</sub> peak in an ascending order. The test meal contained 725 kilocalories composed of 40%, 35% and 25% of carbohydrate, lipids and protein, respectively. Data collection including VO<sub>2</sub>, HR, and RER began immediately after the rest period in E and 45 min after the start of the test meal in M and M+E. Delta efficiency was calculated as the ratio of the increment of power output to the increment of energy expenditure.

**RESULTS:** Resting oxygen uptake (VO<sub>2</sub>) in l.min<sup>-1</sup> was higher ( $p < 0.05$ ) in M than R (0.28 ± 0.09 vs. 0.22 ± 0.06). Exercising VO<sub>2</sub> in l.min<sup>-1</sup> was lower ( $p < 0.05$ ) at 50% VO<sub>2</sub> peak in E than M+E (1.38 ± 0.08 vs. 1.51 ± 0.08), while no differences between E and E+M were seen at higher intensities. Respiratory exchange ratio was lower ( $p < 0.05$ ) in E than E+M at 50% (0.89 ± 0.04 vs. 0.94 ± 0.04), 60% (0.92 ± 0.05 vs. 0.96 ± 0.04) and 70% VO<sub>2</sub> peak (0.95 ± 0.04 vs. 0.98 ± 0.04). No differences in delta efficiency were observed between M+E and E.

**CONCLUSION:** Exercise during postprandial period elicits a greater increase in energy expenditure than exercise in a fasted state. However, this additive effect of meal and exercise seems intensity-dependent and is not caused by a decrease in metabolic efficiency of the exercising muscle. Postprandial exercise also results in a greater percentage of energy derived from carbohydrate regardless of exercise intensity.

2208 Board #254 MAY 31 9:00 AM - 10:30 AM

### The Effect Of Work Rate On Oxygen Uptake Kinetics During Exhaustive Severe Intensity Cycling Exercise

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(No relationships reported)

During exhaustive severe intensity exercise, the oxygen uptake (VO<sub>2</sub>) increases exponentially, with a time constant of ~30 s. After ~1 to 2 min, a slow component emerges and drives the VO<sub>2</sub> to its maximum. There are clear differences in the VO<sub>2</sub> response profile across exercise intensity domains. These disparities might not be attributable to metabolic demand but, rather, to characteristics of the various intensity domains, such as the consequences of lactic acid production.

**PURPOSE:** To investigate the role of exercise intensity on the VO<sub>2</sub> response profile at intensities wholly within the severe domain.

**METHODS:** Four women (mean  $\pm$  SD: age  $22 \pm 2$  years, height  $167 \pm 7$  cm, mass  $66 \pm 5$  kg) and eight men (age  $23 \pm 2$  yr, height  $179 \pm 9$  cm, mass  $78 \pm 10$  kg) performed exhaustive constant-power cycle ergometer tests at two different severe intensity work rates ( $263 \pm 78$  W and  $214 \pm 64$  W). Smoothed breath-by-breath  $\text{VO}_2$  data were fitted to a two-component (primary response and slow component) model using iterative regression.

**RESULTS:** Times to exhaustion were  $217 \pm 27$  s and  $590 \pm 82$  s, respectively. The  $\text{VO}_{2\text{max}}$  values were the same at the two different work rates ( $2973 \pm 691$  ml $\cdot$ min $^{-1}$  and  $3011 \pm 728$  ml $\cdot$ min $^{-1}$ ). The amplitude of the primary response was greater ( $p < 0.05$ ) at the higher work rate ( $2095 \pm 716$  ml $\cdot$ min $^{-1}$ ) than at the lower work rate ( $1857 \pm 618$  ml $\cdot$ min $^{-1}$ ) and the amplitude of the slow component was smaller ( $367 \pm 177$  ml $\cdot$ min $^{-1}$  vs  $645 \pm 347$  ml $\cdot$ min $^{-1}$ ). In addition, the time delay before the emergence of the slow component was shorter at the higher work rate ( $92 \pm 22$  s vs  $116 \pm 42$  s).

**CONCLUSION:** The results show that exercise intensity *per se* affects the  $\text{VO}_2$  response profile within the severe intensity domain and suggest that metabolic demand drives the primary response of  $\text{VO}_2$  kinetics within this domain.

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**2209** Board #255 MAY 31 9:00 AM - 10:30 AM  
**Heart Rate and Oxygen Uptake Kinetics Before and After Prolonged Spaceflight**

Uwe Drescher<sup>1</sup>, Alan Moore, FACSM<sup>2</sup>, Dieter Essfeld<sup>1</sup>, Uwe Hoffmann<sup>1</sup>. <sup>1</sup>German Sport University Cologne, Cologne, Germany. <sup>2</sup>Wyle Integrated Science and Engineering Group, Houston, TX.  
(No relationships reported)

Routine assessments of the cardiovascular training state of the International Space Station (ISS) astronauts following flight have been limited to heart rate (HR) measurements during submaximal exercise tests. The kinetic responses to work rate change of HR and both respiratory and muscular oxygen uptake (RVO<sub>2</sub> and MVO<sub>2</sub>, respectively) may be used to more accurately evaluate the efficiency and regulation of the cardiorespiratory system than simple examination of HR during steady-state work stages.

**PURPOSE:** To examine the influence of long-duration spaceflight on the kinetic responses of HR (Hpeak), RVO<sub>2</sub> (Rpeak), and MVO<sub>2</sub> (Mpeak).

**METHODS:** Seven astronauts (age:  $48 \pm 4$  yr; ht:  $172 \pm 7$  cm; wt:  $73 \pm 18$  kg; ISS stay:  $154 \pm 27$  d; preflight workload (WLpeak):  $221 \pm 64$  W; preflight  $\text{VO}_2$ peak:  $2.6 \pm 0.9$  L/min) [means  $\pm$  SD] performed exercise tests comprised of dynamic workload changes between 30-80 W on a cycle ergometer (Lode). These tests were performed before (L-170  $\pm$  59 d) and twice after (early R+6  $\pm$  3 d; late R+20  $\pm$  4 d) spaceflight. Breath-by-breath gas exchange was measured using the ISS Portable Pulmonary Function System. HR was determined by measuring ECG. Mpeak was computed using a 2-compartment model comprised of exercising and non-exercising parts. Time-series analysis was applied to determine the maximal cross-correlation function as indicators for the kinetic responses of Hpeak, Rpeak, as well as Mpeak. Friedman test for related samples was used to analyze for differences across the time.

**RESULTS:** The kinetic responses for Hpeak were calculated as  $0.497 \pm 0.095$  (L-170),  $0.494 \pm 0.119$  (R+6) and  $0.524 \pm 0.098$  (R+20), respectively. Rpeak was estimated as  $0.432 \pm 0.061$ ,  $0.371 \pm 0.077$ ,  $0.365 \pm 0.054$ , and Mpeak as  $0.451 \pm 0.091$ ,  $0.373 \pm 0.087$  and  $0.401 \pm 0.091$ , respectively. No significant differences in Hpeak ( $P = 0.37$ ) were observed. Rpeak ( $P = 0.05$ ), and Mpeak ( $P = 0.05$ ) both bordered on significance.

**CONCLUSIONS:** Hpeak seems uninfluenced by long-duration spaceflight. Rpeak and Mpeak seem reduced postflight by trend. Thus, prolonged spaceflight may alter both Rpeak and Mpeak. The influence of other factors, such as the individual exercise training of the astronauts during weightlessness on these parameters, remains to be clarified.

The study was funded by the DLR (Deutsches Zentrum für Luft- und Raumfahrt), Germany (FKZ 50WB0726).

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**2210** Board #256 MAY 31 9:00 AM - 10:30 AM  
**Effects Of Caffeine On VO2 And VCO2 Kinetics During Supramaximal Cycling**

Kenneth R. Dragoo<sup>1</sup>, Kelly E. Johnson<sup>2</sup>, Eliseo A. Gonzalez<sup>1</sup>. <sup>1</sup>Eastern Washington University, Cheney, WA. <sup>2</sup>The University of Akron, Akron, OH.  
(No relationships reported)

The time course change in oxygen consumption ( $\text{VO}_2$ ) has been shown to remain unaltered following caffeine ingestion for moderate, heavy and severe domain exercise. However, carbon dioxide production ( $\text{VCO}_2$ ) kinetics remain unclear.

**PURPOSE:** To determine the effects of caffeine on  $\text{VO}_2$  and  $\text{VCO}_2$  kinetics during supramaximal cycling time-to-exhaustion (TTE) at 120% maximal oxygen consumption ( $\text{VO}_{2\text{max}}$ ).

**METHODS:** Seventeen subjects ( $23.3 \pm 3.4$  y,  $1.71 \pm 0.12$  m and  $75.3 \pm 13.8$  kg) voluntarily participated. A maximal graded exercise test and two submaximal cycling tests were used to determine the TTE intensity. A familiarization session was completed prior to the TTE with identical procedures. All subjects refrained from caffeine for 48h and vigorous exercise for 24h. The caffeine (C; spearmint flavored caffeinated gum) or placebo (P; spearmint flavored gum) was given in a double blind fashion for 5min followed by 20min seated rest and 10min warm up. Subjects then cycled at an unloaded resistance at 70revolutions per minute. The 120%  $\text{VO}_{2\text{max}}$  intensity was applied without notice. Subjects cycled until exhaustion. Breath-by-breath data for  $\text{VO}_2$  and  $\text{VCO}_2$  were fitted to the model  $X(t) = SS + A \{1 - \exp[-(t - TD)/\tau]\}$  where  $X(t)$  is  $\text{VO}_2$  or  $\text{VCO}_2$  at time  $t$ ,  $SS$  is the steady state at unloaded cycling,  $A$  is the amplitude,  $TD$  is the time delay, and  $\tau$  is the time constant. Mean reaction time (MRT) was calculated as  $MRT = TD + \tau$ . Full factorial analyses of variance were used to compare means.

**RESULTS:**  $\text{VO}_2$   $\tau$  ( $P = 52.8 \pm 16.1$  s,  $C = 59.6 \pm 11.7$  s),  $\text{VCO}_2$   $\tau$  ( $P = 70.7 \pm 14.5$  s,  $C = 79.9 \pm 18.1$  s) and  $\text{VCO}_2$  MRT ( $P = 79.3 \pm 16.8$  s,  $C = 87.4 \pm 18.0$  s) were significantly different ( $p < 0.05$ ).  $\text{VO}_2$  MRT ( $P = 55.9 \pm 16.7$  s,  $C = 61.8 \pm 11.0$  s) approached significance ( $p = 0.059$ ).

**CONCLUSIONS:** Caffeine may delay  $\text{VO}_2$  and  $\text{VCO}_2$  kinetics. Future research should study minute ventilation to determine if caffeine alters bodily  $\text{CO}_2$  stores, thereby delaying  $\text{VCO}_2$  kinetics.

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**2211** Board #257 MAY 31 9:00 AM - 10:30 AM  
**Slowed Muscle Vo2 Kinetics With Raised Metabolism: Not Dependent On Blood Flow Or Recruitment Dynamics**

Rob C.I. Wüst<sup>1</sup>, James R. McDonald<sup>2</sup>, Brian S. Ferguson<sup>2</sup>, Yi Sun<sup>2</sup>, Matthew J. Rogatzki<sup>2</sup>, Jessica Spires<sup>3</sup>, John M. Kowalchuk<sup>4</sup>, L. Bruce Gladden, FACSM<sup>2</sup>, Harry B. Rossiter, FACSM<sup>1</sup>. <sup>1</sup>University of Leeds, Leeds, United Kingdom. <sup>2</sup>Auburn University, Auburn, AL. <sup>3</sup>Case Western Reserve University, Cleveland, OH. <sup>4</sup>The University of Western Ontario, London, ON, Canada.  
(No relationships reported)

The rate of adjustment ( $\tau$ ) of pulmonary oxygen uptake ( $\text{VO}_2$ ) is slowed when initiated from a higher versus lower metabolic rate (Bowen et al., Exp Physiol 96: 1049-61, 2011). Whether this is consequent to the intrinsic properties of newly recruited muscle fibers, slowed circulatory dynamics or the effects of a raised metabolism is currently unclear.

**PURPOSE:** To determine muscle  $\text{VO}_2$  kinetics in canine muscle in situ, with independent experimental control over muscle recruitment, blood flow and metabolic rate.

**METHODS:** The gastrocnemius complex of 6 anaesthetized, ventilated dogs was surgically isolated and the tendon attached to a force transducer. Blood flow through the popliteal artery was pump-controlled at a constant flow ( $1.09 \pm 0.25$  L $\cdot$ kg $^{-1}$  $\cdot$ min $^{-1}$ ; mean  $\pm$  SD). Isometric tetanic contractions (50 Hz; 200 ms duration) were elicited via supramaximal sciatic nerve stimulation to recruit all muscle fibers. Metabolic rate was manipulated using 3 min of stimulation at 0.33 Hz (S1) followed by 3 min at 0.67 Hz (S2). Muscle  $\text{VO}_2$  was determined contraction-by-contraction using an ultrasonic flowmeter and inline venous oximetry. Tissue deoxygenation (HHbMb) was measured using near-infrared spectroscopy. Phase II  $\text{VO}_2$  and HHbMb dynamics were fitted to a mono-exponential model to give a time delay (TD),  $\tau$  and amplitude.

**RESULTS:** Upon stimulation onset, the TD for  $\text{VO}_2$  was greater ( $p < 0.05$ ) in S1 than in S2:  $7 \pm 1$  vs.  $4 \pm 2$  s. Similarly, TD for HHbMb ( $3 \pm 2$  s) in S1 was shorter ( $p < 0.002$ ) than for  $\text{VO}_2$ , but greater ( $p < 0.05$ ) than 0 s in all cases. However,  $\tau\text{VO}_2$  and  $\tau\text{HHbMb}$  were both smaller ( $p < 0.05$ ) in S1 ( $12 \pm 2$  s and  $11 \pm 4$  s, respectively) as compared to S2 ( $18 \pm 3$  s and  $21 \pm 5$  s, respectively). The  $\text{VO}_2$  amplitude was larger ( $p < 0.01$ ) in S1 than S2:  $70 \pm 15$  vs.  $43 \pm 13$  ml $\cdot$ kg $^{-1}$  $\cdot$ min $^{-1}$ .

**CONCLUSIONS:** Under conditions in which all muscle fibers were recruited and blood flow was maintained at the S2 steady-state value throughout, muscle  $\text{VO}_2$  kinetics were slower on transition from a raised metabolic rate; consistent with the proposal by Bowen et al. (2011) in humans. Despite increased mitochondrial enzyme activity following S1, the present data suggest that  $\text{VO}_2$  takes longer to achieve its steady state when contractions are initiated from a raised metabolic rate, where the muscle energetic state may be less favorable (i.e. less negative  $\Delta G_{\text{ATP}}$ ).

Supported by BBSRC, UK: BB/F019521/1

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2212 Board #258 MAY 31 9:00 AM - 10:30 AM

**High-Intensity Interval Training Speeds VO<sub>2</sub> Kinetics In Moderate-Intensity Exercise Transitions Initiated From Elevated Metabolic Rates**

Alexandra M. Williams, Donald H. Paterson, FACSM, John M. Kowalchuk. *University of Western Ontario, London, ON, Canada.*

(No relationships reported)

During step-transitions in work rate (WR) within the moderate-intensity (MOD) exercise domain, pulmonary O<sub>2</sub> uptake (VO<sub>2p</sub>) kinetics are slowed and VO<sub>2p</sub> gain ( $\Delta$ VO<sub>2p</sub>/ΔWR) is greater when exercise is initiated from an elevated metabolic rate. High-intensity interval training (HIT) has been shown to speed VO<sub>2p</sub> kinetics, without affecting kinetics of local muscle deoxygenation ([HHbMb]), when step-transitions to MOD exercise are initiated from lower, light-intensity baseline metabolic rates. The effects of HIT on step-transitions initiated from elevated metabolic rates have not been established.

**PURPOSE:** To investigate the effects HIT on VO<sub>2p</sub> and muscle deoxygenation kinetics during transitions from low and elevated metabolic rates, within the MOD domain.

**METHODS:** Eight untrained young men (27±6 yrs; mean±SD) completed 12 sessions of HIT (spanning 4 weeks). HIT consisted of 8-12 1-min intervals on a cycle ergometer, at a WR corresponding to 110% of pre-training WR<sub>max</sub> (established during ramp incremental (RI) exercise testing). Pre-, mid- and post-training, subjects completed a RI test to determine VO<sub>2max</sub>, WR<sub>max</sub> and estimated lactate threshold (LT). Participants additionally completed double-step constant-load tests, consisting of step transitions from 20W→Δ45%LT (LS) and Δ45→90%LT (US). VO<sub>2p</sub> was measured breath-by-breath using mass spectrometry and volume turbine, and the [HHbMb] profile was monitored using near-infrared spectroscopy. The ensemble-averaged VO<sub>2p</sub> and [HHbMb] profiles for each transition were modeled as mono-exponential responses using non-linear regression techniques. The time constant ( $\tau$ VO<sub>2p</sub>) and amplitude of the fundamental, phase II VO<sub>2p</sub> response were estimated for each subject and transition.

**RESULTS:** HIT led to a greater VO<sub>2max</sub> (43ml/kg/min→ 50ml/kg/min, p<0.05), and lower  $\tau$ VO<sub>2</sub> for both the lower (LS: 24s→ 15s, p<0.05) and upper steps (US: 45s→ 25s, p<0.05). However, mean response time of [HHbMb] was unchanged in the lower (LS: 18s vs. 21s) and upper steps (US: 32s vs. 28s).

**CONCLUSIONS:** These results indicate that the speeding of VO<sub>2p</sub> kinetics in both the LS and US may be due, in part, to better matching of the muscle O<sub>2</sub> utilization-to-microvascular O<sub>2</sub> delivery relationship within the working muscle following 12 sessions of HIT.

Supported by NSERC and UWO ADF

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2213 Board #259 MAY 31 9:00 AM - 10:30 AM

**Moderate Hypoxia Does Not Slow Muscular Oxygen Uptake At The Onset Of Intense Exercise**

Peter M. Christensen, Nikolai Nordsborg, Lars Nybo, Niels Secher, Mikael Sander, Jens Bangsbo. *University of Copenhagen, KBH O, Denmark.*

(No relationships reported)

Several studies have reported slower oxygen uptake (VO<sub>2</sub>) kinetics measured at the pulmonary level in response to hypoxia during cycling supporting the concept of an O<sub>2</sub> delivery limitation to the rise in VO<sub>2</sub> at the onset of exercise. However the response to hypoxia at the onset of exercise with regards to VO<sub>2</sub> at the muscular level and O<sub>2</sub> delivery has not been measured.

**PURPOSE:** To investigate whether a reduction in oxygen delivery through inspiring of hypoxic gas causes lower oxygen uptake of the contracting muscles during intense exercise.

**METHODS:** 6 healthy young male subjects performed intense 2-legged knee-extensor exercise (100±6 W, mean±SE) for 2 min in hypoxia (FiO<sub>2</sub>=0.13; H) and normoxia (N) on separate days. Catheters were placed in the femoral artery and vein allowing for blood samples and blood flow measurements at rest, just prior to exercise and after 3, 6, 9, 12, 15, 20, 40, 60 & 120 s of exercise. A 2-way ANOVA test for repeated measures using sampling time and condition (N or H) as factors was used for the statistical analysis.

**RESULTS:** Blood flow was not different between N and H, however arterial O<sub>2</sub> content was lowered (P<0.05) from 191±1 ml/l in N to 181±1 ml/l in H, resulting in a ~20-30% reduction in O<sub>2</sub> delivery in H (P<0.01). The arterial-venous O<sub>2</sub> difference was not different between conditions, thus muscular VO<sub>2</sub> was not affected by the reduced O<sub>2</sub> delivery. Lactate release and pH was not different between N and H.

**CONCLUSION:** The present study shows that muscular VO<sub>2</sub> and anaerobic lactic metabolism during intense two-legged knee-extensor exercise is unaffected despite a 20-30% reduction in O<sub>2</sub> delivery caused by inspiring hypoxic air, suggesting that in normoxia O<sub>2</sub> delivery does not limit muscle VO<sub>2</sub> during intense exercise.

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2214 Board #260 MAY 31 9:00 AM - 10:30 AM

**A Measurement of the Energy Cost of Resistance Training Activities in Young Men**

Jesse W. Vezina, Nathanael Meckes, Cheryl A. Der Ananian, Kathryn D. Campbell, Barbara E. Ainsworth, FACSM. *Arizona State University, Phoenix, AZ.*

(No relationships reported)

Many studies have been conducted to evaluate the energy expenditure of various types of physical activity. Very few however, have focused on the energy expenditure of resistance training. Moreover; the studies that have examined resistance training often report energy expenditure for an entire resistance training session, rather than for individual activities.

**PURPOSE:** To determine the energy cost of four modes of resistance training (push-ups, curl-ups, pull-ups, and lunges) in young men.

**METHODS:** Twelve well trained men (minimum three days per week of resistance training over the past year), aged 23.6 (SD=2.84) years were recruited to participate in the study. Each of the 12 men completed three trials of each of the four exercises, in a randomly assigned order, on one visit to the laboratory which lasted slightly longer than one hour (M=72 min, SD=5.9 min). Each activity was performed to the beat of a metronome set at 40 beats per minute. Participants were asked to complete repetitions of the exercises at this rate for 60 seconds. A total of 20 repetitions were completed if the subject was able to complete the activity for the entire duration. Average time spent in push-ups (M=59.4 sec, SD=1.5), curl-ups (M=60.0 sec, SD=0.0), pull-ups (M=29.3 sec, SD=6.7), and lunges (M=60.0 sec, SD=0.0) was recorded. The oxygen consumption of the men was monitored constantly throughout the trial by indirect calorimetry, and data were recorded every five seconds. Mean VO<sub>2</sub> values were calculated for each exercise by averaging the VO<sub>2</sub>, in ml/kg/min, over the final two trials of each activity. These VO<sub>2</sub> values were converted to metabolic equivalents (METs) to express energy expenditure.

**RESULTS:** The mean VO<sub>2</sub> values obtained for the four resistance activities were as follows: push-ups (M=11.57 ml/kg/min, SD=1.99), curl-ups (M=10.99 ml/kg/min, SD=1.48), pull-ups (M=10.87 ml/kg/min, SD=2.51), and lunges (M=14.18 ml/kg/min, SD=1.78). The corresponding MET values (push-ups: 3.31, curl-ups: 3.14, pull-ups: 3.11, and lunges: 4.05 respectively) were all within the range of moderate intensity activity.

**CONCLUSIONS:** The findings of this study indicate that a single set of any of the above exercises will qualify as a moderate intensity activity and can be used to meet recommendations on daily physical activity.

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2215 Board #261 MAY 31 9:00 AM - 10:30 AM

**Metabolic Comparison Between Barefoot, Zero-drop Shoe, And Standard Shoe Running In Well-trained Runners**

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(No relationships reported)

Barefoot running has been touted as metabolically superior to running shod. In an effort to mimic barefoot running (a more mid to forefoot foot strike), while protecting the foot, shoe manufacturers have begun developing low mass shoes with minimal damping material in the heel. This process minimizes offset between the heel and forefoot and is referred to as zero-drop.

**PURPOSE:** The purpose of this study was to determine if running in zero-drop shoes (261g; size 43cm) is metabolically similar to running barefoot in well-trained runners, as well as to compare metabolic differences between zero-drop and standard, low mass running shoes (286g; size 43cm).

**METHODS:** Nine well-trained distance runners (25.7±3.5 yrs, 178.6±5.9 cm, 67.6±8.5 kg, 72.0±5.2 ml/kg/min) participated in this study. Runners completed two bouts of treadmill running separated by 48 hrs to 7 days. The first bout included a graded exercise test to exhaustion to determine maximal O<sub>2</sub> consumption (VO<sub>2max</sub>). The second bout involved running on a treadmill at 16 km/hr and a 1% grade. Runners ran 6 min in zero-drop shoes (ZD), standard low mass shoes (ST), or barefoot (BF), in a randomized order. Expired gases were collected throughout each 6 min interval, and VO<sub>2</sub>, respiratory exchange ratio (RER), and heart rate (HR) values were averaged over the last two min of each interval. A two min break was allowed between intervals for shoe changes. Comparisons were made using a repeated measures ANOVA.



**RESULTS:** There were no significant differences in  $\text{VO}_2$  ( $57.8 \pm 3.7$ ;  $58.0 \pm 3.1$ ;  $57.5 \pm 3.1$  ml/kg/min), RER ( $.88 \pm .03$ ;  $.89 \pm .04$ ;  $.87 \pm .03$ ), or HR ( $169.1 \pm 14.8$ ;  $171.6 \pm 13.4$ ;  $170.1 \pm 14.9$  bpm) between ZD, ST, and BF conditions.

**CONCLUSION:** Interestingly, there were no differences in the selected metabolic variables between the conditions. At 16 km/hr and a 1% grade, subjects were running at ~80% of their  $\text{VO}_{2\text{max}}$  in each condition. Although the intensity utilized during this investigation may have reduced the ability to detect metabolic differences between conditions, it may also indicate that well-trained runners may spontaneously adapt to the most efficient running style regardless of shod or barefoot condition as a result of years of consistent training.

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**2216** Board #262 MAY 31 9:00 AM - 10:30 AM  
**Running Economy Differences in Shod and Barefoot States**

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(No relationships reported)

**Abstract:** Running with minimalist footwear or barefoot has become a popular alternative to traditional shod running. The promoted benefits of barefoot running (BFR) range from biomechanical improvements to economic enhancements during competition.

**PURPOSE:** The purpose of this study was to examine running economy differences in the shod and barefoot states; the running economy protocol included flat and inclined modes. In addition, the mass affect of shoes on running economy was examined.

**METHODS:** Six males and 7 females participated in the study. The mean age was  $22.2 \pm 3.1$  years, the average height was  $167.2 \pm 7.3$  cm, the average mass was  $59.5 \pm 7.88$  kg, and the average BMI was  $21.2 \pm 1.5$  kg/m<sup>2</sup>. Self-reported competitive runners were recruited. All participants underwent baseline  $\text{VO}_2$  max tests. After at least 24 hours post max test, participants underwent standardized running economy protocol that randomized four stages: running flat shod (FS), running flat barefoot (FBF), running inclined shod (IS) at, and running inclined barefoot (IBF); flat stages were performed at 7 mi/hr with no incline and inclined stages were performed at 6 mi/hr at 5% incline. Flat and inclined stages were compared independently of each other. Expired gasses were measured and analyzed by a Medgraphics Ultima CPX metabolic cart.

**RESULTS:** The average  $\text{VO}_2$  for the economy tests were,  $35.3 \pm 3.2$  ml/kg/min,  $35.2 \pm 3.2$  ml/kg/min, and  $37.1 \pm 2.8$  ml/kg/min for FS, FBF, IS, and IBF respectively. An independent sample t-test showed no significant difference between barefoot and shod running economy at a flat or an incline state ( $p = \text{NS}$ ). No relationship between shoe weight and differences in running economy was observed ( $p = \text{NS}$ ). **CONCLUSION:** Previous research looking at the affect of shoe mass would suggest that  $\text{VO}_2$  differences would occur between shod and barefoot states; however, this was not observed in the current study. In addition, inclined running was performed in an attempt to correct for differences in strike pattern, and observe mass affects of the shoe. Nonetheless, no differences or relationships due to shoe mass were observed.

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**2217** Board #263 MAY 31 9:00 AM - 10:30 AM  
**Sex Differences In The Oxygen Uptake Kinetic Response To Moderate Intensity Exercise In Obese Adolescents**

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(No relationships reported)

The pulmonary oxygen uptake ( $\text{VO}_2$ ) kinetic response to exercise provides insight into aerobic performance and overall efficiency of the cardiovascular, pulmonary, and muscular systems to meet oxygen demand upon initiation of exercise. Previously, investigators have reported no significant differences in the  $\text{VO}_2$  kinetic response to moderate intensity exercise in normal weight male and female children. However, the small sample size in conjunction with a large effect size may have confounded the interpretation of the time constant. Additionally, few studies have been devoted to investigating the  $\text{VO}_2$  kinetic response in obese adolescents.

**PURPOSE:** To determine if sex differences exist in the  $\text{VO}_2$  kinetic response to moderate intensity exercise in obese male and female adolescents.

**METHODS:** 102 obese subjects volunteered to participate. Male ( $n=25$ ,  $13.5 \pm 1.6$  yrs,  $40.6 \pm 6.1$  %FAT) and female ( $n=77$ ,  $14.1 \pm 1.8$  yrs,  $41.5 \pm 3.8$  %FAT) adolescents completed a graded exercise test to exhaustion on a treadmill. Breath by breath data from the first 4-min of treadmill walking (2.5 mph, 0% grade) at moderate intensity (<60% of  $\text{VO}_2\text{peak}$ ) was averaged into 10s intervals and fit with a monoexponential equation to determine the phase II time constant.

**RESULTS:** The phase II time constant was significantly different ( $P=0.014$ ) between obese male and female adolescents ( $16.8 \pm 7.8$  s vs.  $21.8 \pm 8.9$  s, respectively). Additionally,  $\text{VO}_2\text{peak}$  was significantly greater ( $P<0.001$ ) in males compared to females ( $2.7 \pm 0.4$  vs.  $2.4 \pm 0.3$ ; L/min). The initial 4-min walking stage during the graded exercise test elicited a similar relative exercise intensity between the two groups ( $P=0.118$ ; male,  $47.4 \pm 6.7\%$  vs. female,  $49.8 \pm 6.4\%$ ). A weak, but significant relationship between the time constant and  $\text{VO}_2\text{peak}$  was found only in females ( $r=0.233$ ,  $P=0.041$ ).

**CONCLUSIONS:** In the current study, sex differences were observed in the  $\text{VO}_2$  kinetic response to moderate intensity exercise, which is indicative of a greater ability for obese adolescent males to intake, transport and/or utilize oxygen as compared to their female counterparts. A longer time constant may reflect a greater dependency upon anaerobic energy sources, therefore the initiation and maintenance of functional exercise may be more difficult in obese female adolescents.

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**2218** Board #264 MAY 31 9:00 AM - 10:30 AM  
**Pulmonary O<sub>2</sub> Uptake and Muscle Deoxygenation Responses to Repeated Bouts of Fast Ramp Exercise**

Nicholas T. Kruse, Trent E. Cayot, Aaron G. Fosnaugh, Erin C. Garmyn, Sarah A. McGlinchy, Barry W. Scheuermann. *The University of Toledo, Toledo, OH.*  
(No relationships reported)

Results of previous studies using a prior "priming" exercise to examine pulmonary (and muscle)  $\text{O}_2$  uptake ( $\text{VO}_2$ ) at the onset of a subsequent bout of exercise have provided considerable insight into metabolic regulation. While most studies use constant load exercise to examine  $\text{VO}_2$  kinetics, relatively few studies have examined  $\text{VO}_2$  kinetics during ramp exercise where the relationship between muscle perfusion and  $\text{O}_2$  uptake appear to be nonlinear; even fewer studies have examined  $\text{VO}_2$  responses to repeated bouts of ramp exercise. The use of near infrared spectroscopy (NIRS) to measure changes in muscle oxygenation during exercise has provided important mechanistic insight into the matching between  $\text{O}_2$  supply-to- $\text{O}_2$  utilization.

**PURPOSE:** To determine  $\text{VO}_2$  and muscle deoxygenation (HHb) responses to repeated bouts of fast ramp exercise.

**METHODS:** Pulmonary  $\text{VO}_2$  and HHb of the vastus lateralis muscle was recorded on five ( $28.8 \pm 9.4$  yrs,  $\pm$  SD) healthy males during successive bouts of a fast ramp exercise ( $F_1$ ;  $F_2$ ) where the forcing function was increased by 64 W/min. The "priming" bout ( $F_1$ ) was initiated from a baseline of 20 W cycling and continued to fatigue.  $F_2$  was initiated following 6 min of recovery cycling at 20W and continued to fatigue.  $\text{VO}_2$  and HHb were continuously measured during exercise and recovery.

**RESULTS:** Baseline  $\text{VO}_2$  was higher in  $F_2$  compared to  $F_1$  ( $F_1$ :  $1153 \pm 0.205$ ;  $F_2$ :  $1495 \pm 247$  ml/min,  $p<0.05$ ). Although there was no difference in peak work rate between  $F_1$  and  $F_2$ ,  $\text{VO}_2\text{PEAK}$  was higher in  $F_2$  versus  $F_1$  ( $F_1$ :  $4114 \pm 497$ ;  $F_2$ :  $4352 \pm 599$  ml/min,  $p<0.05$ ). Results of linear regression analysis of the  $\Delta\text{VO}_2/\Delta\text{WR}$  relationship revealed no difference between  $F_1$  ( $8.8 \pm 0.8$  ml/min/W) and  $F_2$  ( $9.0 \pm 0.4$  ml/min/W). Compared to  $F_1$ , the increase in HHb from baseline to end exercise (i.e.  $\Delta\text{HHb}$ ) was greater during  $F_2$  than  $F_1$  ( $F_1$ :  $11.2 \pm 7.7$ ;  $F_2$ :  $16.3 \pm 11.1$   $\mu\text{M}$ ,  $p<0.05$ ). Analysis of the HHb response (normalized for differences in amplitude) using a sigmoid function indicated that the time to achieve 50% of the total amplitude was not significantly different between  $F_1$  and  $F_2$ .

**CONCLUSIONS:** A prior bout of priming exercise resulted in a higher peak  $\text{VO}_2$  during a subsequent bout of exercise, which may be associated with altered HHb responses. However, priming exercise did not lead to an appreciable change in either  $\text{VO}_2$  or HHb during submaximal exercise.

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2219 Board #265 MAY 31 9:00 AM - 10:30 AM

**Power and VO<sub>2</sub> During Three Consecutive Wingates in Untrained Individuals Compared to Trained Cyclists**

Stephen J. McGregor, Jason R. Boynton, Lynne Shetron-Rama, Chris Herman, Andrea D. Workman, Tim Muth, Josh Gordon, Ian Ratz, Zach Maino. *Eastern Michigan University, Ypsilanti, MI.*

(No relationships reported)

The multiple Wingate protocol has previously been used to elucidate physiological responses to multiple supra-maximal efforts. To our knowledge though, it has not been used to contrast responses between trained and untrained individuals.

**PURPOSE:** To compare changes in power output and VO<sub>2</sub> over the course of multiple consecutive Wingate efforts in untrained individuals (UT) and trained cyclists (T). We hypothesized that T would produce more power and consume more oxygen, both in absolute terms and relative to power, than UT.

**METHODS:** All procedures were approved by the EMU-CHHS Human Subjects Review Committee. 11 UT (age 22.4 yr, weight 83.8 ± 11.8 kg, VO<sub>2peak</sub> = 40.05 ± 6.96 ml/kg/min) and 9 T (age 25.4 yr, weight 77.8 ± 9.26 kg, VO<sub>2peak</sub> = 59.56 ± 5.66) performed three consecutive Wingates with 4 min of rest between each bout. Exercise was performed on an electronically braked ergometer (Velotron, Racermate WA) with a sampling rate of 10 Hz. Breath-by-breath metabolic gasses were recorded using an Oxycon Mobile (Viasys, CA) and averaged over 5 s. Peak power (best 1 sec), average power, VO<sub>2</sub> and VO<sub>2</sub>/Watt were analyzed for statistical differences between groups using 2-way ANOVA, and when appropriate, within groups by Wingate using ANOVA (SPSS 19.0; IBM, NY).

**RESULTS:** As anticipated, numerous variables were higher in T vs UT including, relative peak power (10.39 ± 0.87 W/kg vs. 8.80 ± 1.44 W/kg; *p* < .001), relative average power (8.36 ± 0.54 W/kg vs. 6.38 ± 0.84 W/kg; *p* < .001), relative VO<sub>2</sub> (42.38 ± 9.32 mL/kg/min vs. 23.96 ± 7.18 mL/kg/min; *p* < .001) and VO<sub>2</sub>/Watt (5.02 ± 1.02 mL/min/W vs. 3.83 ± 0.81 mL/min/W; *p* < .001). Within groups, by Wingate, average power (absolute and relative) was significantly lower in UT by the third Wingate (*p* = .011), while average power in T tended to be lower (*p* = .14) and no interaction was observed. VO<sub>2</sub>/Watt was significantly lower in the first bout for both the untrained and trained group (VALUES; *p* = .001, *p* = .002) compared to the second and third bouts.

**CONCLUSION:** During MWE, trained cyclists produce more power and consume more oxygen relative to power than untrained individuals. Despite these distinct differences between groups, there did not seem to be an interaction between training status and number of Wingates that would signify differential rates of fatigue.

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**C-36 Free Communication/Poster - Population-based Surveillance**

MAY 31, 2012 7:30 AM - 12:30 PM

ROOM: Exhibit Hall

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2220 Board #266 MAY 31 8:00 AM - 9:30 AM

**Competitive Sport Attrition: A Retrospective Analysis Of The Trois-Rivieres Study**

François Trudeau, FACSM<sup>1</sup>, Louis Laurencelle<sup>1</sup>, Roy J. Shephard, FACSM<sup>2</sup>, Richard Larouche<sup>1</sup>. <sup>1</sup>Université du Québec à Trois-Rivières, Trois-Rivières, QC, Canada. <sup>2</sup>University of Toronto, Toronto, QC, Canada.

(No relationships reported)

**PURPOSE:** Our aim was to gain a better understanding of attrition from competitive sports and its effect on subsequent participation.

**METHODS:** Subjects (aged 44.0 ± 1.2 years; 42 previously involved (18 females and 24 males) and 23 never involved (17 females and 6 males) in sport) were a sub sample from the Trois-Rivières Growth and Development Study who participated in a semi-structured retrospective interview that revolved around two main themes: 1) attrition from competitive sport and its associated life events; and 2) participation in physical activity and/or another competitive sport after leaving their first sport.

**RESULTS:** Of the 42 subjects previously involved in competitive sport, attrition occurred in most individuals (32 of 42) during their school years

(including higher education). Only 5 of the 42 became inactive after dropping out of competitive sport; 10 remained slightly active, (0 to 150 min weekly), 9 moderately active (150 to 300 min weekly) and 8 very active (more than 300 min per week). Of the 23 subjects who had never practiced a competitive sport, 10 individuals became sedentary or rarely active. The content analysis indicated 3 principal reasons motivating subjects to quit competitive sports: 1) lack of time, conflict with work, social and familial life, and school requirements, 2) lack of or loss of interest for the sport that was dropped, and 3) excessive competition (stressful, difficult to maintain competitive level).

**CONCLUSIONS:** Our results suggest that attrition from competitive sports happened mainly during schooling; nevertheless, former participation in competitive sport translated into a lower risk of sedentary behaviour during middle age. Supported by a grant from CRSH/SSHRC

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2221 Board #267 MAY 31 8:00 AM - 9:30 AM

**Comparison of Physical Activity Performed at Two U.S. Army Basic Combat Training Sites**

Kathleen Simpson<sup>1</sup>, Nathan R. Hendrickson<sup>1</sup>, Jan E. Redmond<sup>1</sup>, Bruce S. Cohen<sup>1</sup>, Barry A. Spiering<sup>1</sup>, Joseph J. Knapik, FACSM<sup>2</sup>, Marilyn A. Sharp<sup>1</sup>. <sup>1</sup>U.S. Army Research Institute of Environmental Medicine, Natick, MA. <sup>2</sup>U.S. Army Institute of Public Health, Aberdeen Proving Ground, MD.

(No relationships reported)

**PURPOSE:** During Army Basic Combat Training (BCT), there are extensive physical demands placed upon recruits, including fitness training and other activities. There are concerns that total physical activity (PA) at various BCT sites may differ and result in different injury rates. The purpose of this study was to measure and compare PA performed during 10 weeks of BCT at two training sites.

**METHODS:** Data were collected from 11 companies (Ft Jackson, SC and Ft Sill, OK). Trained observers (n=5-6) performed continuous observation of these companies during waking hours with novel Smartphone-based PA tracking software. Each activity was coded for type and load carried. Intensity was rated as resting, light, moderate, vigorous, or maximum. Percent time (%T) recruits spent in each activity type, load, and intensity were calculated. T-tests were used to determine whether PA differed between the BCT sites.

**RESULTS:** Recruits were followed 13.2 ± 0.1 hr/d for 49.5 ± 2.2 days at Ft Jackson and 11.8 ± 0.1 hr/d for 46.6 ± 2.2 days at Ft Sill. %T recruits from Ft Jackson and Ft Sill spent in each activity and load category is shown in Table 1. Recruits at Ft Sill spent more time cadence marching, running, doing menial tasks, obstacles/climbing, and carrying 11-34kg (*p* < 0.05). Conversely, recruits at Ft Jackson spent more time stationary and engaging in combatives training (*p* < 0.05). There were no differences in %T spent in each intensity between soldiers at Ft Jackson and Ft Sill (*p* > 0.05).

**CONCLUSIONS:** We observed differences in the %T spent in various types of activities and load carried between the BCT sites, but no differences in activity intensity.

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**Table 1. Percent Time (%T, Mean ± SD) in each Activity and Load Category**

|                    | Ft Jackson<br>(n=6) | Ft Sill<br>(n=5) | t-test<br>p-value |
|--------------------|---------------------|------------------|-------------------|
| Activity           |                     |                  |                   |
| Stationary         | 59.9 ± 10.6         | 42.2 ± 7.9       | 0.013             |
| Combatives         | 1.4 ± 0.6           | 0.4 ± 0.3        | 0.007             |
| Cadence March      | 3.2 ± 1.3           | 4.8 ± 0.9        | 0.041             |
| Run                | 1.1 ± 0.4           | 1.6 ± 0.2        | 0.026             |
| Walk               | 10.3 ± 2.9          | 8.2 ± 1.5        | 0.180             |
| Menial Task        | 19.7 ± 5.1          | 37.6 ± 7.6       | 0.001             |
| Calisthenics       | 3.6 ± 1.1           | 3.9 ± 0.5        | 0.580             |
| Obstacles/Climbing | 0.5 ± 0.3           | 1.0 ± 0.1        | 0.010             |
| Load (kg)          |                     |                  |                   |
| 0-4                | 85.1 ± 6.1          | 80.7 ± 3.5       | 0.192             |
| 5-10               | 11.5 ± 4.7          | 9.1 ± 4.2        | 0.400             |
| 11-22              | 3.2 ± 1.7           | 9.0 ± 1.8        | 0.000             |
| 23-34              | 0.2 ± 0.2           | 1.0 ± 0.6        | 0.012             |
| >34                | 0.1 ± 0.0           | 0.2 ± 0.2        | 0.110             |

**2222 Board #268 MAY 31 8:00 AM - 9:30 AM**  
**Leisure Time Physical Activity and Health-Related Quality of Life in Women**

Mary K. Dinger, FACSM, Danielle R. Brittain. *University of Northern Colorado, Greeley, CO.*  
*(No relationships reported)*

A positive relationship between health-related quality of life (HRQoL) and physical activity has been fairly well established in clinical populations. However, less is known about this relationship among healthy adults.

**PURPOSE:** The purpose of this study was to examine HRQoL among sufficiently and insufficiently physically active community dwelling women aged 50-75 years.

**METHODS:** Participants were 118 healthy women [age = 60.0 ± 6.9 years, Body Mass Index (BMI) = 26.1 ± 4.1 kg/m<sup>2</sup>, body fat percent (%fat) = 35.0 ± 7.2%, 91% Caucasian] recruited from the Oklahoma City metropolitan area. They completed the long version of the International Physical Activity Questionnaire (IPAQ) and the Medical Outcomes Survey Short Form 36 (SF-36v2). Sufficiently active women accumulated ≥ 150 minutes of walking, moderate, or vigorous physical activity during leisure time the previous week; whereas, insufficiently active women accumulated < 150 minutes of these activities during their leisure time. HRQoL norm-based subscale scores were compared between the two groups.

**RESULTS:** Sufficiently active participants (n = 57, age = 59.6 ± 7.0 years, BMI = 25.3 ± 3.3 kg/m<sup>2</sup>, %fat = 33.9 ± 7.2%) accumulated 399.6 ± 304.8 minutes of leisure time physical activity during the previous week; whereas, insufficiently active participants (n = 61, age = 60.4 ± 6.8 years, BMI = 27.0 ± 4.7 kg/m<sup>2</sup>, %fat = 36.1 ± 7.2%) accumulated 42.2 ± 47.8 minutes. Sufficiently active women scored significantly higher on role-physical (t = 2.7, p = .009) and social functioning (t = 2.36, p = .02) subscales than those who were insufficiently active. The two groups did not differ significantly on physical functioning (p = .08), bodily pain (p = .35), general health (p = .40), vitality (p = .12), role-emotional (p = .81), or mental health (p = .80) subscales.

**CONCLUSIONS:** Two of eight HRQoL norm-based subscales differed between sufficiently and insufficiently physically active women. Additional research is needed to continue examining the relationship between HRQoL and physical activity among healthy women.

**2223 Board #269 MAY 31 8:00 AM - 9:30 AM**  
**Quantitative Genetic Analysis Of Sports Participation In Portuguese Nuclear Families**

Denisa Mendonça<sup>1</sup>, André Seabra<sup>2</sup>, Michele Souza<sup>2</sup>, Raquel Chaves<sup>2</sup>, Ana Seabra<sup>2</sup>, Daniel Santos<sup>2</sup>, Fernanda Santos<sup>2</sup>, Thayse Gomes<sup>2</sup>, Rojapon Buranarugs<sup>2</sup>, Rui Garganta<sup>2</sup>, José Maia<sup>2</sup>. <sup>1</sup>*Institute of Public Health (ISPUP), Institute of Biomedical Sciences Abel Salazar, University of Porto, Porto, Portugal.* <sup>2</sup>*Research, Education, Innovation and Intervention in Sport, Faculty of Sport, University of Porto, Portugal (CIFID2), Faculty of Sport, University of Porto, Porto, Portugal.*  
*(No relationships reported)*

The number of studies that focus on familial aggregation and genetic contribution in the variation of the sport participation (SP) habits is very limited.

**PURPOSE:** To estimate familial aggregation and quantify the genetic and environmental contributions to the phenotypic variation on SP among Portuguese families.

**METHODS:** The sample consisted of 2375 nuclear families (parents and two offspring each) from different regions of Portugal with a total of 9500 subjects. SP assessment was based on a psychometrically established questionnaire. Phenotypes used were based on the participation in sports (yes/no), intensity of sport, weekly amount of time in SP and the proportion of the year in which a sport was regularly played. Familial correlations were calculated using FCOR in the SAGE 6.0 software. Heritability was estimated using variance-components methods implemented in SOLAR 4.0 software.

**RESULTS:** (1) Subjects of the same generation tend to be more similar in their SP habits than subjects of different generations. (2) All familial correlations (father, mother, and their different off-spring) were significantly greater than zero, ranging from 0.12 to 0.48. (3) In all SP phenotypes studied, adjusted for the effects of multiple covariates (age, sex and their interactions), the proportion of phenotypic variance due to additive genetic factors ranged between 40% and 50% (SP: h<sup>2</sup>= 50%; intensity of sport: h<sup>2</sup>= 40%; weekly amount of time: h<sup>2</sup>= 46%; proportion of the year: h<sup>2</sup>= 49%). (4) The proportion of variance attributable to environmental factors ranged from 50% for the participation in sports to 60% for intensity of sport.

**CONCLUSIONS:** In this large population-based family study, there was significant familial aggregation on SP. These results highlight that the variation on SP phenotypes have a significant genetic contribution although environmental factors are also important in the familial resemblance of SP, which points out the likely success of both individual and family-based lifestyle interventions in the promotion of SP.

**2224 Board #270 MAY 31 8:00 AM - 9:30 AM**  
**Do Kinesiology Majors Practice What They Preach?**

Renee Zeltwanger, Mindy Mayol, Matthew D. Beekley, FACSM. *University of Indianapolis, Indianapolis, IN.*  
*(No relationships reported)*

Kinesiology students should score better on indicators of health and fitness compared to other majors.

**PURPOSE:** The purpose of this study was to compare the health-and fitness results of Kinesiology majors to other non-Kinesiology majors.

**METHODS:** Kinesiology students (KINS, N=109, 52 female, 57 male; majors: Physical Education and Health, Exercise Science, Sport Management, Community Health Education, Athletic Training) were age, gender, race, and height matched to non-Kinesiology majors (non-KINS, n=109) and tested in a wellness class. VO2max was predicted by Rockport walk test. Body fat was predicted by electrical impedance. Flexibility was determined by sit and reach box. Handgrip strength, number of push-ups and curl-ups in one minute were determined by ACSM guidelines. Blood lipids and fasting glucose were determined (not all students completed the blood draw; KINS N=62, non-KINS N=57).

**RESULTS:**

| Measure                       | KINS         | Non-KINS    |
|-------------------------------|--------------|-------------|
| Age (y)                       | 19.3+ 1.2    | 20.1+ 4.1   |
| Height (cm)                   | 173.3+ 10.7  | 174.0+ 11.0 |
| Weight (kg)                   | 76.3+ 15.9   | 78.5+ 20.2  |
| BMI                           | 19.3+ 7.7    | 21.2+ 8.9   |
| Blood Pressure (mm Hg)        | 122/73+14/12 | 123/76+11/8 |
| Predicted Body Fat            | 21.2+ 8.9    | 23.4+ 7.9   |
| Predicted VO2 Max (ml.kg.min) | 38.3+ 7.9    | 38.7+ 9.8   |
| Sit and Reach (cm)            | 23.4+ 7.9    | 21.8+ 8.0   |
| Grip Strength (lb; R + L)     | 72.9+ 27.8   | 73.7+ 26.5  |
| Push-ups (1 min)              | 41.6+ 14.3   | 39.6+ 15.5  |
| Curl-ups (1 min)              | 58.7+ 19.6   | 53.9+ 16.9  |

| Blood measure         | KINS       | Non-KINS   |
|-----------------------|------------|------------|
| Glucose (mg/dL)       | 59.2+31.9  | 64.3+32.1  |
| Triglyceride (mg/dL)  | 76.1+56.7  | 85.6+69.9  |
| Cholesterol (mg/dL)   | 137.1+75.2 | 133.5+73.1 |
| HDL (mg/dL)           | 43.9+25.4  | 45.8+29.9  |
| LDL (mg/dL)           | 76.3+48.6  | 71.3+42.9  |
| Cholesterol/LDL ratio | 2.61+1.71  | 2.52+1.41  |
| LDL/HDL ratio         | 1.51+1.21  | 1.39+0.87  |

Via t-test, no measure was significantly different between KINS and non-KINS majors; p > 0.05

**CONCLUSIONS:** Kinesiology students did not differ from non-Kinesiology majors for all major health and fitness-related parameters.

**2225 Board #271 MAY 31 8:00 AM - 9:30 AM**

**Relationships Between Perceived Health and Objective Health Status of Rural Appalachian Adults**

Wayne C. Miller, FACSM, Brian N. Griffith, Timothy O. Leonard, Gretchen D. Lovett, Jill D. Cochran, Haylee B. Heinsberg. *West Virginia School of Osteopathic Medicine, Lewisburg, WV.*  
(No relationships reported)

Appalachia is characterized by poor health behaviors, poor health status, and health disparities. Recent interventions have not demonstrated success in improving health status or reducing health disparities in the Appalachian region.

**PURPOSE:** Since one's perception of personal health precedes his or her health behaviors, the purpose of this project was to evaluate the self-rated health of Appalachian adults in relation to objective health status and current health behaviors.

**METHODS:** Appalachian adults (n = 616) were surveyed regarding health behaviors - sugared drink consumer (drink ≥ 12 oz/d), or non-consumer (drink < 12 oz/d), fast food consumer (eating fast food ≥ 1 time/wk) or non-fast food consumer (eating fast food < 1 time/wk), smoking (smoker or non-smoker), exercise (exerciser > 30 min > 1d/wk) and sedentary (exercise < 30 min 1 d/wk), blood pressure medication (yes, no), and self-rated health (0-100 scale). Blood pressure was measured through brachial artery auscultation and serum cholesterol measured via needle prick. Weight status was based on BMI: normal weight (NW ≥ 18.5 and < 25.0), overweight (OW ≥ 25.0 and < 30.0), and obese (OB ≥ 30.0). Jaccard Binary Similarity coefficients, odds ratios, chi-square, and prevalence ratios were calculated to evaluate the relationships among self-rated health, objective health status, and health behaviors. Significance was set at p < 0.05.

**RESULTS:** Respondents reported being healthy, while being sedentary (56%), hypertensive (84%), OW (67%), or hyperlipidemic (79%). Between 55% and 99% of the respondents who considered themselves healthy had at least two disease conditions or poor health behaviors. Jaccard Binary Similarity coefficients showed the chance of somebody perceiving themselves as healthy when they were sedentary was (0.58), OW (0.47), OB (0.33), eating fast food often (0.32), rarely eating fruit (0.30), taking blood pressure medication (0.29), taking cholesterol medication (0.20) and depressed (0.23).

**CONCLUSION:** The association between perceived health and actual health in Appalachian adults is distorted. The public health challenge is to formulate messages and programs about health and health needs which take into account the current distortion about health in Appalachia and the cultural context in which this distortion was shaped.

**2226 Board #272 MAY 31 8:00 AM - 9:30 AM**

**Physical Activity, Walking And Leanness: Analysis Of The Northern Ireland Sport And Physical Activity Survey**

Marie H. Murphy, FACSM<sup>1</sup>, Paul Donnelly<sup>2</sup>, Simon Shibli<sup>3</sup>, Charlie Foster<sup>4</sup>, Alan Nevill<sup>5</sup>. <sup>1</sup>University of Ulster, Co Antrim, United Kingdom. <sup>2</sup>Sport Northern Ireland, Belfast, United Kingdom. <sup>3</sup>Sheffield Hallam University, Co Antrim, United Kingdom. <sup>4</sup>University of Oxford, Oxford, United Kingdom. <sup>5</sup>University of Wolverhampton, Wolverhampton, United Kingdom.  
(No relationships reported)

**PURPOSE:** Walking is a popular form of physical activity shown to be associated with indicators of health. The purpose of this study was to determine the contribution walking makes to total weekly physical activity and the relationship between the volume and intensity of walking and leanness in the Northern Ireland population.

**METHODS:** 4563 adults participated in this cross-sectional survey of physical activity behaviour. Data was collected through face-to-face interviews using computer assisted personal interviewing. Self-reported height and weight was used to determine inverse body mass index (iBMI) as a measure of leanness. Data across all domains of physical activity including self-reported volume and intensity of walking (in bouts of 10 minutes or more) were analysed to determine their contribution to inverse BMI as our measure of leanness using an ANCOVA, having controlled for age, gender, socio-economic and smoking status.

**RESULTS:** Over 68% of the participants reported walking >10 minutes during the previous week but only 24% report walking at a brisk or fast pace. Time walking at a brisk or fast pace to get somewhere was identified as having the strongest positive association with being lean (F<sub>1,4256</sub>=10.45, β=0.051 cm<sup>2</sup>.kg<sup>-1</sup>.min<sup>-1</sup> (SE=0.016),P=0.001).

**CONCLUSION:** In addition to increasing the amount of walking and the percentage of people walking regularly, public health messages encouraging an increase in walking pace may be valuable to increase in the proportion of the population meeting physical activity guidelines and gaining associated health benefits.

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**2227** Board #273 **MAY 31** **8:00 AM - 9:30 AM**

**Motor Skill Competence and Physical Activity: Perceived Competence as a Mediator**

Tao Zhang<sup>1</sup>, Zan Gao<sup>2</sup>. <sup>1</sup>University of North Texas, Denton, TX. <sup>2</sup>Texas Tech University, Lubbock, TX.  
(No relationships reported)

It has been well documented that the development of motor skill competence is a major correlate in promoting physical activity (PA) and perceived competence in middle to late childhood (Stodden et al., 2008). However, limited empirical evidence has supported the mediating effect of perceived competence on relationships between motor skill competence and PA among US children. Examining these relationships is necessary to develop effective strategies to promote students' PA.

**PURPOSE:** To test a hypothesized mediating effect of perceived competence on relationships between motor skill competence and PA among a sample of elementary school students.

**METHODS:** 294 students (152 boys, 142 girls, M<sub>age</sub> = 11.0 years) from three elementary school completed validated questionnaires assessing their perceived competence and self-report PA (William et al., 1998; Kowalski et al., 1997). Students' motor skill competence in overhand throwing, basketball, and striking were assessed by PE Metrics™ (NASPE, 2010). After examining the correlations among the variables, the hypothesized model was tested using structural equation modeling (SEM; AMOS 16, Arbuckle, 2007).

**RESULTS:** Correlation analyses revealed a pattern of positive relationships among the study variables (*r* ranging from .12 to .40). The SEM analyses indicated that the hypothesized model produces a good fit to the data according to the various indices of fit:  $\chi^2/df = 1.93 < 5$ ; CFI = .97; NFI = .94; RMSEA = .056 (Hu & Bentler, 1999). Specifically, the model accounted for 10.2 % and 14.1 % of the variances in perceived competence and PA, respectively. Path coefficients suggested that overhand throwing ( $\beta = .23$ ) was directly and positively associated with perceived competence, which in turn significantly predicted PA ( $\beta = .38$ ). The effect of overhand throwing on PA was mediated fully through perceived competence. No direct effect was found between basketball, striking and students' PA.

**CONCLUSIONS:** The results highlight that overhand throwing significantly predicted students' perceived competence, which in turn positively predicted their PA. However, basketball and striking didn't emerge as predictors of students' perceived competence and PA. The findings have practical implications for intervention strategies aimed at promoting students' PA.

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**2228** Board #274 **MAY 31** **8:00 AM - 9:30 AM**

**Likelihood of Meeting Physical Activity Guidelines Comparing those Who Walk Dogs and Those That Don't**

Jesus Soares, Chantelle Owens, Jacqueline Epping, David R. Brown, FACSM, Tina Lankford. CDC, Atlanta, GA. (Sponsor: David R. Brown, FACSM)  
(No relationships reported)

Little evidence exists on whether dog walkers are more likely to gain health benefits through physical activity (PA) than persons who do not walk dogs.

**PURPOSE:** To determine the likelihood of meeting the aerobic component of the 2008 Physical Activity Guidelines (PAGs) for adults when comparing dog owners who walk their dogs versus those who do not.

**METHODS:** Abstracts were retrieved through a systematic search of 10 databases from 1990 to 2011 and hand searching of reference lists. The primary inclusion criterion for review was having published data for total time spent in PA to compare dog owners who walk their dogs versus those who do not walk their dogs with the goal being to identify those who met recommended levels of PA (at least 150 minutes of moderate-vigorous PA per week). We used a random effects model to estimate the unadjusted odds ratio and corresponding 95% confidence interval (CI) of persons who met PAGs when comparing dog owners who walk dogs versus those that do not. We used Comprehensive Meta Analysis Software for calculations.

**RESULTS:** Among 236 relevant articles (including 2 under review) there were eight cross-sectional studies and one cohort study that met the inclusion criterion and which allowed calculation of odds ratios. For these studies there were 6980 dog owners aged 18 to 81 years old, with 41% being male, and among whom 63.9% (n=4463) actually reported walking their dogs. All the studies, except one, relied on self-reported PA measures. Based on total weekly time spent in PA, 2710 (60.7%) met the recommended PA guidelines among those who walked their dogs, and 950 (37.7%) among those who did not walk their dogs. The random effects estimated odds ratio was 2.74 with a 95% CI: 2.16-4.22.

**CONCLUSION:** Our systematic review of published articles revealed that across 9 published studies almost 2 in 3 dog owners report walking their dogs, and they are more than two and one-half times more likely to have met recommended levels of PA when considering total weekly PA. Further research need to consider whether adjustment for covariates affects this association. However, dog walking may be a viable strategy for dog owners to help reach recommended levels of PA to enhance their health.

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**2229** Board #275 **MAY 31** **8:00 AM - 9:30 AM**

**Initial Effects of a National Men's Health Programme Delivered in English Premier League Football Clubs**

Andy Pringle, Stephen Zwolinsky, Andy Daly-Smith, James McKenna, Steven Robertson, Alan White. Leeds Metropolitan University, Leeds, United Kingdom.  
(A. Pringle: Contracted Research - Including Principle Investigator; contracted research was undertaken for the Football Foundation.)

In the UK, men not only have an increased risk of cardio-vascular diseases, fat related cancers and poor mental health, but also a low uptake of primary health care (PHC) services. Sporting settings offer health professionals a potentially exclusive channel to reach men, including those hard-to-reach-men (HTRM) not using PHC, with interventions designed to improve health. The English Premier (soccer) League (EPL) is attended by 11 million male fans and the basis for Premier League Health (PLH), the first nationally evaluated programme of health promotion for men in EPL clubs.

**PURPOSE:** To examine the initial reach and impact of PLH on the health behaviour of men.

**METHODS:** Health interventions delivered in clubs (N=16) including, educational activities on match days for fans and weekly lifestyle classes. Interventions were delivered at soccer stadia/training venues and community facilities and led by health professionals who received specific training on men's health activities. After ethics/consent, men completed validated self-report measures for demographics and health behaviours. Differences in measures were identified pre vs post-intervention (3 months).

**RESULTS:** Among PLH recruits, 2214 provided pre-intervention data; 84% (1714/2214) were white British aged 18-44. 78% (n=909/1159) did not see themselves as unhealthy, but only 6% (n=58/1044) used PHC regularly. In a sub-sample providing lifestyle data, the percentage failing to meet recommendations for healthy behaviours was: physical activity, 85% (n=1106/1301); daily consumption of fruit/vegetables, 88% (n=948/1072); weekly alcohol units, 29.9% (n=203/679); body-mass-index (BMI), 63% (n=570/893) and smoking, 33.4% (n=422/1262). Significant increases were found for mean sessions of physical activity pre (2.06±1.52) v post-intervention (3.06±1.28), p=0.000 (n=185); daily consumption of fruit/vegetables pre (2.06±1.44) v post (2.97±1.20), p=0.000 (n=154); mean weekly decreases in alcohol units pre (17.41±14.18) v post (12.69±9.94), p=0.000 (n=105); and BMI pre (27.27±4.37) v post (26.65±4.03), p=0.0039 (n=91).

**CONCLUSIONS:** A national programme of men's health delivered in EPL soccer clubs reached men not meeting health guidelines and HTRM not using PHC regularly. Positive change was found for men's selected health behaviours.

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**2230** Board #276 **MAY 31** **8:00 AM - 9:30 AM**

**Adaptation Of The Academia Da Cidade Program (acp) For Implementation In The United States: Academia Fit**

Elizabeth Mejia, Simon J. Marshall, Ermilia Medina, Megan Duesterhaus, Humberto Parada, Guadalupe X. Ayala, John P. Elder, Elva Arredondo, Thomas L. McKenzie, FACSM, Ming Ji. San Diego State University Research Foundation, San Deigo, CA.

(No relationships reported)

In Latin America, the widespread popularity of community physical activity (PA) classes provides evidence that free group exercise classes have potential to yield substantial public health benefit.

**PURPOSE:** To describe translation science methodology in adapting ACP, an evidence-based community PA program in Brazil, for implementation with Latino communities in the US.

**METHODS:** An assets-based community engagement model was used to identify key partnerships, including the American Council on Exercise (ACE®) and local parks and recreation departments. Guided by socio-ecological framework, a community-based participatory research model was used to create a sustainable community program through which free PA classes could be taught in public spaces by Spanish-speaking instructors. A program logic model was used to identify inputs and activities that would contribute to successful program implementation and the building of community capacity to support long-term program maintenance. The RE-AIM framework is being used to evaluate reach and the public health impact of the program.

**RESULTS:** Key informant interviews (n=16) conducted with local stakeholders identified needs, facilitators, and barriers to offering a free Spanish-language community PA program. A fitness advisory panel (n=9) was established to provide input on program development, sustainability, and cultural appropriateness. ACE education materials were translated into Spanish, culturally adapted, and delivered as part of a 14-week program to 25 Spanish-speaking community members recruited to a newly established Academia (Academia Fit). Environmental audits were conducted in 70 public sites to assess their suitability for hosting free PA classes; 23 were selected as meeting criteria. To date, 10 newly certified instructors have taught free PA classes in 9 public settings averaging 17 hours per week; and 553 community residents have participated in the classes, with 123 participants enrolled in a year-long evaluation study. Complete data on the public health impact of Academia Fit will be available in Fall 2012.

**CONCLUSION:** Through leveraging existing local resources, ACP has been successfully translated to a Mexico-US border community. Funded by a research grant (1R18DP002138-01) from the Centers for Disease Control and Prevention.

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**2231 Board #277 MAY 31 8:00 AM - 9:30 AM**  
**Physically Active Residential Communities And Schools (parcs) - A Service-learning University-community Partnership To Promote Health**

Sarah N. Herrerah, Stephanie Greer, Rachel Swinford, Brian Culp, NiCole R. Keith, FACSM. *IUPUI, Indianapolis, IN.*  
(No relationships reported)

Physically Active Residential Communities and Schools (PARCS) is a 9-year-old community-based exercise partnership between an urban university and public school community. Exercise Science and Fitness Studies majors deliver exercise options to adult participants as part of service learning required throughout the curriculum. Participants with physician referrals attend for free and others attend at a membership price of \$20/year. Public schools are host sites.

**PURPOSE:** To describe the experiences of university students who have completed one semester of service learning at a PARCS site and the demographics of adult participants who received exercise programming from students.

**METHODS:** A team comprised of student research assistants, a behavioral scientist, an exercise physiologist, and a physical educator reviewed de-identified student reflections to find common themes and created a system that was used to code each reflection. We conducted the coding by hand, individually reading reflections to identify themes and then discussed themes for each reflection at team meetings. Two varying team members coded each reflection and all members discussed results. This process occurred for 3 months until all transcripts were coded and discussed. We coded 120 student reflections. Identified student themes included pre-conceptions, contextual comparisons, first impressions, influence on learning, academic understanding, professional development, and change recommendations. IBM SPSS Statistics 19 was used to describe PARCS participants' demographic characteristics.

**RESULTS:** Students pre-conceptions included descriptions of people who were unhealthy, uneducated, and unlike themselves. Students found PARCS participants to be informative sources of learning. Students discussed personal strengths and weaknesses within the framework of their academic and professional preparation. Future recommendations were similar. Of the PARCS participants (N=1352), 74% were female, 38% were white, 51% were black, 79% had a household income of < \$40,000 per year, and 89% had a high school diploma or higher.

**CONCLUSION:** Results show partnerships such as PARCS provide students with the opportunity to have practical experiences, work with a diverse population and give exercise opportunities to a community in need.

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**2232 Board #278 MAY 31 8:00 AM - 9:30 AM**  
**Walking To Meet The 2008 Physical Activity Guidelines In Knee OA: The MOST Study**

Daniel K. White<sup>1</sup>, Catrine Tudor-Locke, FACSM<sup>2</sup>, David Felson<sup>1</sup>, K.Doug Gross<sup>3</sup>, C.Elizabeth Lewis<sup>4</sup>, James Torner<sup>5</sup>, Michael Nevitt<sup>6</sup>, Tuhina Neogi<sup>1</sup>. <sup>1</sup>*Boston University, Boston, MA.* <sup>2</sup>*Pennington Biomedical Reserach Center, Baton Rouge, LA.* <sup>3</sup>*MGH Institute of Health Professions, Boston, MA.* <sup>4</sup>*University of Alabama Brimingham, Brimingham, AL.* <sup>5</sup>*University of Iowa, Iowa City, IA.* <sup>6</sup>*University of California San Francisco, San Francisco, CA.* (Sponsor: Catrine Tudor-Locke, FACSM)  
(No relationships reported)

**PURPOSE:** Physical activity (PA) provides health benefits even to those with knee osteoarthritis (OA) and therefore national organizations promote PA, and specifically walking for this population. However, PA guidelines include minimal intensity and duration requirements, and it is unknown whether people meet these specific parameters by walking.

**METHODS:** The Multicenter Osteoarthritis Study (MOST) is a cohort of older adults who have or who are at high risk of knee OA. Participants wore a StepWatch activity monitor to record steps/day over 7 days. Proportions were calculated for 1) walking a single minute  $\geq$  100 steps/min (indicative of minimally moderate intensity), 2) walking a single minimal bout duration of  $\geq$  10 minutes at this intensity, and 3) attaining 150 minutes/week accumulated with these intensity and bout duration requirements.

**RESULTS:** Of 1795 participants who wore the monitor for at least 3 days (age  $67 \pm 8$  yrs, BMI  $31 \pm 6$  kg/m<sup>2</sup>, 60% women), over 90% walked at minimal intensity, however only 33% met a single minimal duration bout. PA guidelines were fully met by 7% of men and 5% of women.

**CONCLUSIONS:** An overwhelming majority of people with or at high risk of knee OA appear capable of walking at minimal intensity to meet PA guidelines, however, only a third walked at a minimal duration, and few met PA guidelines by walking. Since intensity does not seem to be a limiting factor, promotion efforts should focus on accumulating more bouts at a minimal duration to facilitate achievement of PA guidelines by walking.

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**2233 Board #279 MAY 31 8:00 AM - 9:30 AM**  
**Potential for Enhanced Safety to Stimulate More Bicycling**

James F. Sallis, FACSM<sup>1</sup>, Lianne Dillon<sup>2</sup>, Terry L. Conway<sup>1</sup>, Lawrence D. Frank<sup>3</sup>, Brian E. Saelens<sup>4</sup>, Kelli Cain<sup>1</sup>, James E. Chapman<sup>5</sup>, Joni Mayer<sup>6</sup>. <sup>1</sup>*University of California, San Diego, San Diego, CA.* <sup>2</sup>*California Department of Public Health, Sacramento, CA.* <sup>3</sup>*University of British Columbia, Vancouver, BC, Canada.* <sup>4</sup>*University of Washington, Seattle, WA.* <sup>5</sup>*Urban Design for Health, Seattle, WA.* <sup>6</sup>*San Diego State University, San Diego, CA.*  
(No relationships reported)

About half of all trips in the US are 2 miles or less, a feasible distance for bicycling. Bicycling for leisure or transportation can increase physical activity, reduce chronic disease, improve air quality, and reduce greenhouse gas emissions. Yet, fewer than 1% of trips are taken by bicycle in the US. Many studies show that concern about traffic dangers is the primary barrier to bicycling, and US investments in safe bicycling infrastructure are minimal compared to other countries.

**PURPOSE:** The present study examined correlates of projected increases in cycling if perceived safety from cars was improved.

**METHODS:** Participants were 1780 adults aged 20-65 recruited from the Seattle, WA and Baltimore, MD regions (48% female; 25% ethnic/racial minority). The outcome variable was based on this item: "How often would you bike if you thought it was safe from cars?". The difference between current and projected bicycling frequency is the estimated impact of improving safety from cars. Multivariate mixed models were conducted to examine demographic and built environment correlates of projected cycling increases.

**RESULTS:** For the whole sample, bicycling at least once per week was projected to increase from 9% to 39% if bicycling was safe from cars. Ethnic/racial minority groups reported greater projected increases ( $p < .009$ ) in cycling compared to whites. Scores on the item "safe to ride bike in neighborhood" were inversely related ( $p < .001$ ) to projected increases in cycling. Street connectivity was positively related ( $p < .007$ ) to projected increases in cycling.

**CONCLUSION:** Implementing measures used widely outside the US to improve bicyclists' safety from cars would primarily benefit minority groups who cycle less but have higher rates of chronic diseases, as well as those who currently feel least safe. Bicycling improvements are also projected to be largest in areas with connected streets that provide many alternative routes so bicyclists can avoid busy streets. Improving bicycle safety appears to target subgroups who could benefit most.

Supported by NIH grant HL67350.

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**2234** Board #280 **MAY 31** **8:00 AM - 9:30 AM**  
**Examination of the Physical and Social Environments Effect on Health Promotion Program and Exercise Participation**

Lisa J. Leininger, Debra Harris, Susan M. Tracz, James E. Marshall. *CSU Fresno, Fresno, CA.*  
(No relationships reported)

**PURPOSE:** The purpose of this study was to examine if the social and physical environment is associated with participation in university worksite health promotion programs and self initiated physical activity.

**METHODS:** Three state university campuses without health promotion programs and four campuses with a health promotion program participated in this study. Physical activity participation was assessed via survey to all campus employees. Physical activity was compared for those with (N=426) and without a program (N=371). In addition, the campuses with a program were classified as high, medium or low social and physical support as indicated on the Environmental Assessment Tool (EAT). Program participation and amount of physical activity were compared between employees on campuses designated as high (N=76), medium (N=187) and low (N=167) support campuses.

**RESULTS:** The results indicated that there was no significant difference ( $p > .05$ ) in the amount of vigorous physical activity between those with ( $M = 1.87 \pm 2.29$ ) and without a program ( $M = 1.6 \pm 1.87$ ). In addition, there was no significant difference ( $p > .05$ ) in the amount of moderate physical activity between those with ( $M = 2.18 \pm 2.43$ ) and without a program ( $M = 1.88 \pm 2.03$ ). There were significant differences ( $p < .05$ ) for walking days per week, with the employees with a program having the highest number of days ( $M = 4.06 \pm 3.57$ ) compared to those without a program ( $M = 3.38 \pm 2.28$ ). Program participation was influenced by support level, with the high support campus reporting the highest percentage of employees participating in health promotion activities (76.5%), followed by the medium support campuses (41%) and low support campus (20.7%).

**CONCLUSIONS:** Overall findings indicate that support was highly related to program participation, and increased levels of walking. Despite the differences, employees were not meeting minimum requirements for weekly physical activity. Therefore, health promotion directors on university campuses should strive to increase physical and social support and implement best practices to increase physical activity among employees to improve health outcomes, reduce absenteeism and increase productivity.

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**C-37** Free Communication/Poster - Respiratory

MAY 31, 2012 7:30 AM - 12:30 PM  
ROOM: Exhibit Hall

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**2235** Board #281 **MAY 31** **8:00 AM - 9:30 AM**  
**Acute Protection Against Hyperpnoea-Induced Bronchoconstriction By Terbutaline In Athletes**

Pascale Kippelen<sup>1</sup>, Aldona S. Greenwood<sup>1</sup>, Andrew J. Simpson<sup>1</sup>, Lee M. Romer, FACSM<sup>1</sup>, Sandra D. Anderson<sup>2</sup>. <sup>1</sup>Brunel University, Uxbridge, United Kingdom.  
<sup>2</sup>Royal Prince Alfred Hospital, Camperdown, NSW, Australia.  
(No relationships reported)

Exercise-induced bronchoconstriction (EIB) is highly prevalent in elite athletes. Short-acting inhaled beta2-agonists are widely prescribed to prevent EIB in asthmatic patients. The pathophysiology of EIB, however, seems to differ between asthmatic patients with EIB and otherwise healthy athletes with EIB.

**PURPOSE:** We aimed to test the efficacy of a single-dose of the inhaled short-acting beta2-agonist terbutaline in preventing EIB in athletes.

**METHODS:** We conducted a randomized double-blind placebo-controlled study of the effects of inhaled terbutaline (0.5 mg) and placebo administered as dry powder at different study days in 11 summer sports recreational athletes (age range 19-33 years) with documented EIB. Forced expiratory volume in 1 sec (FEV<sub>1</sub>) was measured at baseline, 15 min after inhaling terbutaline or placebo, and at intervals up to 30 min after an 8 min eucapnic voluntary hyperpnoea (EVH) test (a surrogate for exercise). Data were analysed with repeated measures ANOVA and paired t-tests.

**RESULTS:** Terbutaline induced a slight but significant bronchodilation at rest (mean  $\pm$  SD FEV<sub>1</sub> increase  $0.24 \pm 0.15$  L,  $p < 0.001$ ) and fully prevented hyperpnoea-induced bronchoconstriction in 7 out of 11 (64%) subjects. The percentage protection afforded by terbutaline was  $36 \pm 22\%$  (range 0-88%), with a mean FEV<sub>1</sub> fall post-EVH of  $14 \pm 4\%$  in the placebo condition versus  $9 \pm 5\%$  in the terbutaline condition ( $p < 0.05$ ).

**CONCLUSIONS:** Pre-treatment with inhaled terbutaline prevents hyperpnoea-induced bronchoconstriction in a majority of recreational summer sports athletes. However, the degree of bronchoprotection afforded by terbutaline is lower in athletes than previously reported in asthmatic patients with EIB.

Funded by the World Anti-Doping Agency.

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**2236** Board #282 **MAY 31** **8:00 AM - 9:30 AM**  
**Docosahexaenoic Acid Does Not Attenuate Hyperpnea-Induced Bronchoconstriction in Adults With Asthma**

Sally K. Head<sup>1</sup>, Timothy D. Mickleborough, FACSM<sup>2</sup>. <sup>1</sup>Indiana University School of Medicine, Indianapolis, IN. <sup>2</sup>Indiana University, Bloomington, IN.  
(No relationships reported)

**BACKGROUND:** Hyperpnea, or rapid breathing, can be used to identify exercise-induced bronchoconstriction, which is a complication of asthma that has been shown to be attenuated by supplementation with fish oil. An optimal formula for fish oil has not been determined, although previous *in vitro* studies have suggested that, in terms of reducing inflammation, docosahexaenoic acid (DHA) may be the more potent omega-3 fatty acid in fish oil.

**PURPOSE:** Determine whether supplementation with DHA can attenuate hyperpnea-induced bronchoconstriction (HIB) in adults with asthma as compared to placebo.

**METHODS:** Nine subjects (18-30 years; 6 males, 3 females) with asthma and HIB participated in a randomized, double-blind, placebo-controlled crossover trial where they received either DHA or placebo capsules for 3 weeks. Following a 2-week washout, subjects received the opposite supplement for 3 weeks. Subjects were tested in a laboratory following an initial 2-week run-in phase and after each supplementation phase. At each test, bronchoprovocation was elicited with eucapnic voluntary hyperventilation (EVH), a surrogate exercise challenge involving rapid breathing. Prior to and following the EVH challenge, the forced expiratory volume in one second (FEV<sub>1</sub>) and concentrations of 8-isoprostane and the DHA metabolite protectin D1 in exhaled breath condensate were measured. Repeated measures ANOVA assessed differences among the study phases; significance was held at  $p < 0.05$ .

**RESULTS:** There were no significant changes ( $p > 0.05$ ) in the maximum drop in FEV<sub>1</sub> among the pre-supplementation ( $21.07 \pm 2.65\%$ ), placebo ( $17.20 \pm 3.27\%$ ), and DHA supplementation ( $17.27 \pm 3.73\%$ ) phases. The pre-EVH concentration of 8-isoprostane was not significantly different ( $p > 0.05$ ) among the pre-supplementation ( $3.08 \pm 1.50$  pg/ $\mu$ L), placebo ( $6.16 \pm 2.12$  pg/ $\mu$ L), and DHA supplementation ( $4.48 \pm 1.20$  pg/ $\mu$ L) phases. The concentration of protectin D1 was undetectable ( $< 0$  pg/ $\mu$ L) at each laboratory test.

**CONCLUSION:** The data indicate that supplementation with 4.0 g DHA for 3 weeks does not significantly attenuate HIB in adult asthmatic subjects compared to baseline or placebo.

Supplementation with the omega-3 fatty acid eicosapentaenoic acid should be similarly tested to determine if it is the more effective component of fish oil for attenuating HIB.

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**2237** Board #283 **MAY 31** **8:00 AM - 9:30 AM**  
**Post-Exercise Airway Response To Atropine In Healthy Elite Swimmers**

Mona Luke-Zeitoun, Ben Wildman-Tobriner, Emily Ghio, Nicolas Hatamiya, Anthony Luke, FACSM, Dennis Nielson, Stephen Lazarus, Warren Gold. *University of California San Francisco, San Francisco, CA.*  
(No relationships reported)

**PURPOSE:** There is a high prevalence of airway hyperresponsiveness (AHR) in endurance athletes, particularly in elite swimmers. Athletes develop exercise-induced bronchoconstriction at a

higher rate than the general population. Vagal activity has been shown to be increased in high level athletes and is known to promote bronchoconstriction. The goal of this study was to determine the direct effects of parasympathetic tone on airway responsiveness in healthy elite swimmers.

**METHODS:** Bronchial response to exercise was measured in 7 healthy collegiate swimmers from a local NCAA Division 1 University team (4 males, 3 females) on 2 different occasions. To provoke EIB, the athletes exercised for 8 minutes on a cycle ergometer at 90% of their maximal heart rate while breathing dry air. In one of the visits, the athletes received intravenous saline (placebo). In the other visit, they received intravenous atropine (0.04 mg/kg), given in divided doses (0.01 mg/kg every 30 seconds) between minutes 8 and 10 of exercise to selectively achieve parasympathetic blockade by the end of the exercise challenge. Airway conductance was measured by body plethysmography before and after 3, 6, 10, 15, 20 and 30 minutes after the exercise challenge. A one-way repeated measures ANOVA was used to identify differences in bronchial response after exercise with and without parasympathetic blockade.

**RESULTS:** Postexercise airway conductance as percent of pre-exercise values showed significant changes over time ( $p < 0.05$ ), significant differences among the 2 experimental conditions ( $p < 0.05$ ) and a significant condition  $\times$  time interaction ( $p < 0.05$ ). Airway conductance was significantly lower for placebo, as compared with atropine at 6, 10, and 30 minutes post-exercise ( $p < 0.05$ ). The lowest values for airway conductance occurred during the placebo trial at 3 minutes post-exercise (88% pre-exercise). The highest values for airway conductance occurred during the atropine trial at 30 minutes post-exercise (173% pre-exercise).

**CONCLUSION:** Parasympathetic blockade results in airway dilation in healthy elite swimmers. These data suggest that vagal mechanisms play a major role in post-exercise airway response and possibly the development of exercise-induced bronchoconstriction in competitive swimmers.

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**2238** Board #284 MAY 31 8:00 AM - 9:30 AM

**Respiratory Muscle O<sub>2</sub> Uptake and Deoxygenation During Incremental Exercise to Fatigue: Is There a “Steal”?**

Andrea D. Marjerrison, Mark A. Babcock, Donald H. Paterson, FACSM, John M. Kowalchuk. *The University of Western Ontario, London, ON, Canada.*

(No relationships reported)

Muscle deoxygenation reflects the relationship between O<sub>2</sub> utilization (VO<sub>2</sub>) and (microvascular) perfusion (Q). During incremental exercise, O<sub>2</sub> requirement for muscle work occurs in active “locomotor” muscles and in respiratory muscles (RM), and competition for Q and O<sub>2</sub> delivery impacts local deoxygenation. During incremental exercise (IE) involving only increases in RM work, the relationship between muscle VO<sub>2</sub>-to-Q may differ compared to cycling exercise.

**PURPOSE:** To examine RM deoxygenation using near-infrared spectroscopy (NIRS) during incremental RM-specific exercise to fatigue (IE<sub>RM</sub>) and compare deoxygenation changes to those seen with incremental leg cycling exercise to fatigue (IE<sub>LC</sub>).

**METHODS:** Healthy men (n, 6; age, 29  $\pm$  6 yrs (mean  $\pm$  SD); ht, 184  $\pm$  9 cm; mass, 89  $\pm$  10 kg) performed 4 IE<sub>RM</sub> and 1 IE<sub>LC</sub>. The IE<sub>RM</sub> was performed seated, at a breathing frequency of 15 br/min; after 5-min breathing without resistance, inspiratory resistance increased by 50 g every 2-min until the subject was unable to generate the required inspiratory pressure to overcome the added resistance. For the IE<sub>LC</sub>, subjects sat at rest for 5-min, and began cycling at 20 W for 2-min after which power output increased by 40 W every 2-min until volitional fatigue. During IE, V<sub>E</sub> and VO<sub>2</sub> were measured breath-by-breath using a volume turbine and mass spectrometer. Deoxygenation (tissue %O<sub>2</sub>sat) of the intercostal (IC) and vastus lateralis (VL) muscle groups was monitored using NIRS.

**RESULTS:** Peak VO<sub>2</sub> in IE<sub>RM</sub> was 1.06 L/min ( $\Delta$  = 0.58 L/min) and in IE<sub>LC</sub> was 4.3 L/min ( $\Delta$  = 3.6 L/min). Compared to baseline (BL), peak V<sub>E</sub> decreased ( $p < 0.05$ ) during IE<sub>RM</sub> (24  $\pm$  6 to 17  $\pm$  2 L/min) and increased ( $p < 0.05$ ) during IE<sub>LC</sub> (15  $\pm$  3 to 155  $\pm$  27 L/min). During IE<sub>RM</sub>, tissue %O<sub>2</sub>sat increased ( $p < 0.05$ ) from BL to mid-exercise (73  $\pm$  6 to 76  $\pm$  4 %) and returned to BL values at peak; deoxygenation was not seen in VL during IE<sub>RM</sub>. During the IE<sub>LC</sub>, tissue %O<sub>2</sub>sat decreased ( $p < 0.05$ ) from BL to peak (69  $\pm$  2 to 59  $\pm$  6 %) in IC and in VL (71  $\pm$  5 to 62  $\pm$  7 %) ( $p < 0.05$ ).

**CONCLUSIONS:** The increase in RM VO<sub>2</sub> during IE<sub>RM</sub> represented ~ 16% of the whole body VO<sub>2</sub> observed in IE<sub>LC</sub>. At the peak exercise, the increase in RM deoxygenation during IE<sub>LC</sub> but not IE<sub>RM</sub> is consistent with a redistribution of Q away from the RM (and higher VO<sub>2</sub>-to-Q) during IE<sub>LC</sub> compared to IE<sub>RM</sub>.

Supported by NSERC and UWO ADF

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**2239** Board #285 MAY 31 8:00 AM - 9:30 AM

**Does Deoxygenation Of The Intercostals Reflect On That Of The Accessory Respiratory Muscle?**

Takuya Osawa<sup>1</sup>, Ryotaro Kime<sup>2</sup>, Masako Fujioka<sup>3</sup>, Takuya Osada<sup>2</sup>, Norio Murase<sup>2</sup>, Toshihito Katsumura<sup>2</sup>. *Japan Institute of Sports Sciences, Tokyo, Japan.* <sup>2</sup>Tokyo Medical University, Tokyo, Japan. <sup>3</sup>Ritsumeikan University, Shiga, Japan.

(No relationships reported)

Deoxygenation, measured by near-infrared spectroscopy (NIRS), in the intercostals is increased during high intensity exercise. Although previous studies have reported that this phenomenon was induced by an increase in the accessory respiratory muscle O<sub>2</sub> consumption, it was possible that sympathetic nerve activity-induced vasoconstriction decreased the O<sub>2</sub> supply in the muscle and increased the deoxygenation level, similar to non-active muscles. Additionally, it was unclear if the relationship between minute ventilation (VE) and deoxygenation in the intercostals during incremental exercise would be similar to that in other exercise protocols.

**PURPOSE:** To compare deoxygenation between the intercostals and non-active (the biceps brachii) muscle during incremental and decremental bicycle exercise, and to investigate the relationship between VE and deoxygenation in the intercostals.

**METHODS:** Seven male subjects (age; 23  $\pm$  2 yr) performed a ramp incremental bicycle exercise test (20 W $\cdot$ min<sup>-1</sup>) to exhaustion, and the peak power output (PPO) was determined. After 48 h, they performed a ramp decremental bicycle exercise test (-20 W $\cdot$ min<sup>-1</sup>) from 90-95% of PPO. Pulmonary O<sub>2</sub> uptake (VO<sub>2</sub>) and VE were calculated by breath-by-breath methods, and muscle O<sub>2</sub> saturation in the intercostals (SO<sub>2IM</sub>) and the biceps brachii (SO<sub>2BB</sub>) were evaluated by NIRS.

**RESULTS:** The peaks of VO<sub>2</sub> and VE during incremental exercise were 63.5  $\pm$  6.3 mL $\cdot$ kg<sup>-1</sup> $\cdot$ min<sup>-1</sup> and 146  $\pm$  19 L $\cdot$ min<sup>-1</sup>, respectively. SO<sub>2IM</sub> and SO<sub>2BB</sub> decreased during incremental exercise, and these values at PPO were 34.2  $\pm$  7.2% and 26.5  $\pm$  12.8%. The two changes did not differ significantly throughout the test. During decremental exercise, both SO<sub>2IM</sub> and SO<sub>2BB</sub> were acutely decreased at the onset of exercise, and these minimum values occurred at the 75 to 80% of PPO. These values were also similar throughout the test. The relationship between VE and SO<sub>2IM</sub> was not significantly different between both protocols. However, in hyperventilation (at ~80% of PPO), SO<sub>2IM</sub> tended to be higher during decremental exercise than during incremental exercise.

**CONCLUSIONS:** It is likely that deoxygenation in the intercostals during high intensity exercise was induced by low O<sub>2</sub> supply, similar to non-active muscle.

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**2240** Board #286 MAY 31 8:00 AM - 9:30 AM

**The Effect of IMT on Muscle Deoxygenation during Exercise with Resistive Inspiratory Loading**

Louise A. Turner<sup>1</sup>, Sandra Tecklenburg-Lund<sup>2</sup>, Robert F. Chapman<sup>3</sup>, Joel M. Stager<sup>3</sup>, Joseph W. Duke<sup>3</sup>, Timothy D. Mickleborough, FACSM<sup>3</sup>. <sup>1</sup>Northumbria University, Newcastle Upon Tyne, United Kingdom. <sup>2</sup>Nebraska Wesleyan University, Lincoln, NE. <sup>3</sup>Indiana University, Bloomington, IN.

(No relationships reported)

High levels of respiratory muscle work during exercise have been shown to increase the metabolic demands of the respiratory musculature and increase limb and respiratory muscle deoxygenation, however, the role of inspiratory muscle training (IMT) on these parameters remains unclear.

**PURPOSE:** To determine the effect of IMT on respiratory (RM) and limb locomotor (LM) muscle deoxygenation during exercise while undergoing periods of increased inspiratory loading.

**METHODS:** Using a double blind, placebo controlled design, 16 male cyclists completed 6-wk of inspiratory muscle training (IMT) using an inspiratory load of 50% (IMT; n=8) or 15% [placebo] (CON; n=8) of maximal inspiratory pressure (P<sub>I,max</sub>). Pre- and post-training all subjects completed three, 6-min experimental trials in a randomized order, separated by 20-min. The exercise intensity of each trial was performed at a workload equivalent to ~80% VO<sub>2max</sub> (EX<sub>80%</sub>); during the final 3-min of each trial each subject received an intervention consisting of; (1) moderate resistive inspiratory loading, (2) heavy resistive inspiratory loading, or (3) maximal exercise. LM and RM oxy- ([HbO<sub>2</sub>]), deoxy- ([HHb]) and total- ([THC]) hemoglobin concentration was continuously monitored using near-infrared spectroscopy. Statistical significance was accepted when  $p < 0.05$ .

**RESULTS:** P<sub>I,max</sub> was significantly increased from pre- to post- training by 26  $\pm$  19% (114  $\pm$  12 to 142  $\pm$  19 cmH<sub>2</sub>O) in the IMT group and remained unchanged in the CON group. Following IMT, a significant reduction in the change in VO<sub>2</sub> (96 ml/min), LM [HHb] (1.7  $\pm$  1.3  $\mu$ m) and RM [HHb] (2.8  $\pm$  2.6  $\mu$ m) from EX<sub>80%</sub> to heavy inspiratory loading was observed during submaximal exercise. There was no significant difference in [HHb], [HbO<sub>2</sub>], [THC] during any of the other loading trials, from pre- to post- training, in either the IMT or CON group.

**CONCLUSION:** After IMT, highly-trained competitive cyclists demonstrate decreased whole-body VO<sub>2</sub>, and LM and RM deoxygenation during exercise with heavy inspiratory loading.



These data suggest that IMT reduces respiratory muscle demand and decreases oxygen extraction by the active muscles, which may reflect IMT-induced changes in respiratory and limb locomotor muscle oxygen delivery.

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**2241** Board #287 MAY 31 8:00 AM - 9:30 AM

**Effects of Inspiratory Muscle Training on 15-Km Time Trial Physiological Responses in Trained Cyclists**

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(No relationships reported)

**PURPOSE:** Inspiratory muscle training (IMT) has shown some performance improvements in athletes. The effects of IMT on peak anaerobic power and mean anaerobic power in bicycle racers, specifically during the last 30 seconds of a simulated 15-km time trial were examined. Physiological responses and time were monitored during the time trial to determine IMT influence.

**METHODS:** Eighteen males and eight females were randomly divided into a training (T) or placebo (P) group and had testing of maximal inspiratory pressure (MIP) to set IMT workloads. T performed each set at 85% of their MIP while P performed each set at 15% of their MIP. Each group performed 5 sets of 12 repetitions of IMT for 6 weeks, 5 days per week, using a spring loaded resistive device. A 15-km time trial, with the last 30 seconds of the time trial being a 30 second Wingate Anaerobic Test was performed pre and post IMT. Every five minutes during the time trial, heart rate (HR), arterial oxygen-hemoglobin saturation (SaO<sub>2</sub>) via pulse oximeter, and ratings of perceived exertion (RPE) were measured. Overall 15-km time was also collected. A repeated measures ANOVA group by time was applied.

**RESULTS:** There were no significant interaction effects (P>0.05). Mean anaerobic power increased in both groups (P<0.05; P: 529.6 ± 124.6 watts to 574.4 ± 99.3 watts T: 612.3 ± 81.7 watts to 632 ± 81.7 watts), SaO<sub>2</sub> values increased in both groups (P<0.05; P: 94.8 ± 2.1% to 95.3 ± 1.8% T: 93.8 ± 1.9% to 95.1 ± 1.6%), and MIP increased (P<0.05) in both the P (110 ± 40cmH<sub>2</sub>O to 150 ± 40 cmH<sub>2</sub>O) and T (130 ± 30 cmH<sub>2</sub>O to 160 ± 20 cmH<sub>2</sub>O). There were no significant main effects for RPE, HR, or time trial.

**CONCLUSIONS:** Since both groups showed improvements in mean anaerobic power, MIP, and SaO<sub>2</sub>, it cannot be concluded that IMT helped the subjects improve these factors. However, the placebo condition may not have been a true placebo effect since the subjects improved their MIP, as well as the higher intensity training group.

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**2242** Board #288 MAY 31 8:00 AM - 9:30 AM

**Effects of an Inspiratory Muscle Training Program on Cardiopulmonary Capacity of Collegiate Cross-Country Runners**

Justin Severance, Stephen Lux, Marlene Wentz. *Alma College, Alma, MI.*

(No relationships reported)

The issue has been raised that the effectiveness of the ventilatory system during maximal exercise in elite runners may be a limiting factor to performance. Research on this topic has been variable, thus no conclusive evidence has been found to support respiratory muscle fatigue in highly trained athletes.

**PURPOSE:** The purpose of this study was to investigate the effects of inspiratory muscle training (IMT) on VO<sub>2</sub>max, Maximum Voluntary Ventilation (MVV), Vital Capacity (VC), Inspiratory Capacity (IC), and Expiratory Reserve Volume (ERV) on highly trained endurance athletes.

**METHODS:** Eight (3 female, 5 male) Division III collegiate cross-country runners (mean age = 20 years) participated in the study. Baseline measurements were taken for VO<sub>2</sub>max and MVV, VC, IC, and ERV using a maximal graded exercise test and spirometry, respectively. Four subjects were randomly chosen to undergo IMT in conjunction with standard cross-country conditioning, with the remaining 4 subjects comprising the control group with no IMT. The training regimen consisted of 6-weeks of progressive inspiratory muscle training using a Smith's Inspiratory Muscle Trainer. VO<sub>2</sub> and pulmonary function measurements were taken pre-IMT training, mid-IMT training (2 weeks) and post-training.

**RESULTS:** Pre-test results indicated a mean VO<sub>2</sub>max of 66.5 ml/kg/min for the experiment group and 61.0 ml/kg/min for the control group. Average pulmonary function results for the experimental and control groups were; MVV of 157.3L/min v 150.7L/min, VC of 4.87L v 4.82L, IC of 2.93L v 2.88L, ERV of 1.93L v 1.95L, respectively. Post-test results showed a mean VO<sub>2</sub>max of 61.15 ml/kg/min for the experimental group and 65.7 ml/kg/min for the control group. The average pulmonary function post-test results for the experimental and control groups were; MVV of 165.1L/min v 167.3L/min, IC of 2.93L v 2.70L, VC of 4.87L v 4.75L, ERV of 1.97L v 2.05L, respectively.

**CONCLUSIONS:** There was no significant difference (p>.05) in cardiopulmonary capacity measures between the experimental and control group. Similar results have been reported in previous research on this topic, which supports the necessity for further investigation into cardiopulmonary limitations during exercise in elite, endurance-trained athletes.

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**2243** Board #289 MAY 31 8:00 AM - 9:30 AM

**Pulmonary Adaptations To Swim And Inspiratory Muscle Training In Sub-elite Swimmers**

Joshua Weavil<sup>1</sup>, Ren-Jay Shei<sup>1</sup>, Martin Lindley<sup>2</sup>, Timothy D. Mickleborough, FACSM<sup>1</sup>. <sup>1</sup>Indiana University, Bloomington, IN. <sup>2</sup>Loughborough University, Loughborough, United Kingdom.

(No relationships reported)

**PURPOSE:** We have previously shown that there are no significant differences in respiratory changes between elite swimmers undergoing a 12 week swim training (ST) program and those undergoing the same ST program and flow-resistive inspiratory muscle training (IMT). The aim of this study was to assess respiratory muscle and pulmonary function of 24 competitively trained sub-elite swimmers assessed at the beginning and end of an intensive 12-week ST program using the same IMT device we used previously (RT2 trainer, DeVilbiss).

**METHODS:** Swimmers (n=8) combined ST with either IMT set

at 80% sustained maximal inspiratory pressure with progressively increased work-rest ratios until task failure for 3 d/wk. (ST + IMT), or ST with sham-IMT (ST + SHAM-IMT, n=8), or acted as controls (ST only, n=8). Measures of pulmonary and respiratory muscle function were assessed at the beginning and end of the 12-week study period.

**RESULTS:** There were no significant differences (p>0.05) in

respiratory muscle and pulmonary function between groups at baseline, or at the end of the 12-week study for the ST + SHAM-IMT and ST group only. However, while no significant changes (p>0.05) in pulmonary function, except for forced inspiratory time in 1-sec (%Δ, +15%), were observed within the ST + IMT group at the end of the 12 week study compared to baseline, significant increases (p<0.05) were observed in a number of respiratory muscle function variables at the end of the 12-week study, such as maximal inspiratory pressure (%Δ, +90%), sustained maximal inspiratory pressure (%Δ, +42%), maximal inspiratory muscle power output (%Δ, +61%), inspiratory time of contraction (%Δ, +34%), and maximal voluntary ventilation in 12-sec (%Δ, +39%).

**CONCLUSIONS:** This study has demonstrated that there are substantial differences in respiratory muscle function between sub-elite swimmers undergoing a competitive ST program only and those undergoing IMT in conjunction with the same ST program. This is in contrast to our previous study which showed no appreciable differences between ST + IMT and ST only in elite swimmers. Whether the enhanced respiratory muscle function in the ST + IMT group in the present study translates into improved swimming performance using this specific inspiratory muscle trainer has yet to be determined.

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**2244** Board #290 MAY 31 8:00 AM - 9:30 AM

**Ventilatory Efficiency, Body Composition, Dyspnea, And Exercise Mode In Lean And Obese Females**

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(No relationships reported)

Obesity reduces ventilatory efficiency (V<sub>E</sub>/VCO<sub>2</sub>) during exercise through a combination of increased metabolic cost of breathing and reduced pulmonary capacity. An elevated V<sub>E</sub>/VCO<sub>2</sub> slope may suggest the presence of exercise induced dyspnea, which is the most commonly reported physiologically barrier of exercise adherence. Little research has investigated the relationship between ventilatory efficiency, regional adiposity, exercise mode, and dyspnea in females.

**PURPOSE:** This study compared ventilatory efficiency and perceived dyspnea between lean (LN) and obese (OB) females during randomized sub-maximal cycle ergometer (CE) and treadmill (TM) exercise. We also investigated the relationships between total (BF) and truncal adiposity (TA), truncal lean (TL), and cardiopulmonary outcomes.

**METHODS:** Twenty females participated (Mean  $\pm$ SE: LN n=10, BMI=22.8 $\pm$ 0.6, OB n=10, BMI=38.6 $\pm$ 1.4 kg/m<sup>2</sup>). BF, TA, and TL were assessed via iDXA. Subjects completed randomized sub-maximal TM and CE exercise to 6 METS or 75% of predicted HR<sub>max</sub>, the termination point of the first randomized test was utilized for the second. V<sub>E</sub>/VCO<sub>2</sub> slope was determined as the slope of the rise in V<sub>E</sub> (L·min<sup>-1</sup> BTPS) to the increase in VCO<sub>2</sub> (L·min<sup>-1</sup> STPD).

**RESULTS:** There were between group differences ( $p \leq 0.05$ ) in BF (LN 29.6 $\pm$ 1.7, OB 46.4 $\pm$ 1.4 %Fat), TA (LN 8.5 $\pm$ 0.8, OB 25.6 $\pm$ 2.6 kg), and TL (LN 20.7 $\pm$ 0.6, OB 24.6 $\pm$ 1.0 kg). There were no differences in exercise durations or VO<sub>2peak</sub> between group or mode. V<sub>E</sub>/VCO<sub>2</sub> was different between groups on the bike and between modes within OB (CE LN 23.6 $\pm$ 1.2, OB 27.8 $\pm$ 0.5; TM LN 23.8 $\pm$ 0.5, OB 25.9 $\pm$ 0.7 V<sub>E</sub>/VCO<sub>2</sub>). OB minute ventilation (LN 37.8 $\pm$ 3.5, OB 61.3 $\pm$ 1.8 L·min<sup>-1</sup>) and respiratory rate (RR LN 27.2 $\pm$ 2.2; OB 32.9 $\pm$ 1.5 breaths·min<sup>-1</sup>) was greater during CE. OB reported greater exercise dyspnea than LN during CE (LN 1.6 $\pm$ .36, OB 3.2 $\pm$ .38 Borg Dyspnea Scale) which was associated with TA ( $p \leq 0.00$ ,  $r=0.796$ ), BF ( $p \leq 0.00$ ,  $r=0.781$ ), and TL ( $p \leq 0.00$ ,  $r=0.731$ ).

**CONCLUSIONS:** Our results suggest that weight bearing exercise (treadmill walking) supported an increased ventilatory efficiency over non-weight bearing exercise (cycle ergometer) which our obese female group perceived as lower exercise induced dyspnea. Thus, prescribing weight bearing exercise to obese females may limit dyspnea and in turn support greater exercise adherence.

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**2245 Board #291 MAY 31 8:00 AM - 9:30 AM**  
**Prevalence And Determination Of Expiratory Flow Limitation During Exercise In Men And Women**

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(No relationships reported)

Expiratory flow limitation (EFL) can occur in healthy young women and men during exercise. Women, however have been reported to have smaller lungs and airways than height and aged matched men potentially leaving them more susceptible to EFL.

**PURPOSE:** We questioned whether the prevalence of EFL during exercise was greater in women compared to men.

**METHODS:** Data from healthy men (n=74, 23.3 $\pm$ 4.4 yrs) and women (n=76; 21.8 $\pm$ 3.7 yrs) were examined from previously published studies from our lab. All subjects completed either a progressive treadmill or cycle test to exhaustion. Subject's maximal flow volume loop (MFVL) was compiled from several effort graded vital capacity maneuvers before and after exercise. The MFVL, along with inspiratory capacity maneuvers was used to determine lung volumes, expiratory flows and to quantify EFL. To determine relative airway size, we used a ratio sensitive to both airway size and lung volume; referred to as the dysanapsis ratio (DR). The subjects were divided into groups based upon the appearance of  $\geq 5\%$  EFL at max exercise.

**RESULTS:** EFL was present in significantly more women (60/76, 79%) than men (18/74, 24%). Both women with EFL (W-EFL) and with no EFL (W-NEFL) had significantly lower VO<sub>2max</sub>, forced vital capacity (FVC), and DR (indicating smaller airways) than men with EFL (M-EFL) or with no EFL (M-NEFL). W-EFL had similar ( $p > 0.05$ ) VO<sub>2max</sub> as W-NEFL, but significantly lower FVC (3.93 $\pm$ 0.56 vs 4.23 $\pm$ 0.32 l) and DR (0.19 $\pm$ 0.04 vs 0.23 $\pm$ 0.02). M-EFL had higher ( $p < 0.05$ ) VO<sub>2max</sub> (57.4 $\pm$ 4.0 vs 49.7 $\pm$ 7.3 ml/kg/min) than M-NEFL but similar ( $p > 0.05$ ) FVC, and DR.

**CONCLUSION:** EFL during exercise is more prevalent in women compared to men and can largely be explained by smaller lung volumes and airways in women. In women, EFL is largely due to smaller airways; while in men, EFL is likely due to higher ventilation associated with greater aerobic capacity.

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**2246 Board #292 MAY 31 8:00 AM - 9:30 AM**  
**Expiratory Flow Limitation during Maximal Exercise in Young Competitive Swimmers Following One-Year of Swim Training**

Kosuke Kojima, Daniel P. Wilhite, Masataka Ishimatsu, Brian V. Wright, Joel M. Stager. *Indiana University, Bloomington, IN.*  
(No relationships reported)

Expiratory flow limitation (EFL) during maximal exercise in prepubescent children has been principally explained by disproportionate growth of the lung-airway system and a conflict between ventilatory demand and capacity. Previous research comparing prepubescent swimmers and controls has shown that swim training improves the conductive properties of the airways independent of growth (Courteix et al., 1997).

**PURPOSE:** To examine how an additional 1-year of swim training influences pulmonary function and metabolic demands of maximal exercise, and consequently the degree and prevalence of EFL in young children.

**METHODS:** Ten healthy young competitive swimmers (5 boys and 5 girls; 10.3  $\pm$  1.1 years; 145.0  $\pm$  7.3 cm; 39.3  $\pm$  8.8 kg, an average of two years of competitive swimming experience) performed pulmonary function and VO<sub>2max</sub> tests before and after the 2010/2011 season. Pulmonary function values were collected during a set of maximal inspiratory and expiratory maneuvers for the determination of the maximal flow-volume loop (MFVL). Metabolic variables and minute ventilation were collected each minute during an incremental exercise test to exhaustion on a cycle ergometer. The degree of EFL was determined by the percentage of the exercise tidal flow-volume loop that overlapped the expiratory portion of the MFVL. In order to compare pre- and post-training data (boys and girls were combined due to no sex-based differences), a paired two-sample t-test was used.

**RESULTS:** After an additional 1-year of swim training, absolute VO<sub>2max</sub> (L·min<sup>-1</sup>) increased by 13.2% ( $P < 0.05$ ). Peak expiratory flow (PEF) increased by 13.7% ( $P = 0.01$ ). There were no significant increases in any other resting pulmonary function variables. At maximal exercise, PEF of tidal volume was increased by 10.6% ( $P < 0.01$ ), while expiratory and inspiratory reserve volumes did not change. The degree of EFL did not differ ( $P > 0.05$ ) although its prevalence altered from 6 to 7 out of 10 young swimmers.

**CONCLUSION:** Despite an increase in demand during maximal exercise and an additional year of swim training, pulmonary function was similar in these children to our prior measures. When compared to previous data and sedentary control values from the literature, young swimmers continue to show unique adaptations to swim training.

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**2247 Board #293 MAY 31 8:00 AM - 9:30 AM**  
**Assessment of Pulmonary Restriction in Athletes with Cervical Spinal Cord Injury: a Method Comparison**

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(No relationships reported)

Pulmonary restriction is rarely assessed by the criterion standard method of total lung capacity (TLC) below the lower 5<sup>th</sup> percentile of the able-bodied (AB) predicted value (lower limit of normal; LLN). More often, restriction is inferred using a vital capacity (VC) below the LLN and a normal-to-high forced expiratory volume in 1 second (FEV<sub>1</sub>)-to-VC ratio. SCI causes a greater loss of expiratory relative to inspiratory muscle strength, and therefore a disproportionate reduction in VC compared to TLC. Accordingly, there may be a greater chance of misclassifying pulmonary restriction in individuals with SCI.

**PURPOSE:** To determine whether the VC method results in a greater misclassification of pulmonary restriction in SCI vs. AB.

**METHODS:** Twelve Paralympic athletes with cervical SCI (injury level, C5-C7) and twelve AB controls matched for age, stature, and body-mass were assessed for TLC (body-plethysmography), FEV<sub>1</sub> and VC (spirometry), and maximal inspiratory and expiratory mouth pressures (P<sub>L,max</sub> and P<sub>E,max</sub>).

**RESULTS:** All participants with SCI exhibited a VC < LLN, whereas significantly fewer (8 of 12) participants with SCI exhibited a TLC < LLN ( $p=0.046$ ) and a normal-to-high FEV<sub>1</sub>-to-VC ratio. For the AB group, no participant exhibited a VC or TLC < LLN. Percent-predicted VC was lower than percent predicted TLC in SCI ( $p=0.013$ ), whereas percent predicted VC was higher than percent-predicted TLC in AB ( $p=0.001$ ). Percent-predicted P<sub>L,max</sub> was higher than P<sub>E,max</sub> in SCI ( $p=0.001$ ) but not AB ( $p=0.146$ ).

**CONCLUSION:** A VC < LLN with normal-to-high FEV<sub>1</sub>/VC does not accurately predict pulmonary restriction in athletes with cervical SCI. When using spirometry to infer pulmonary restriction in athletes with cervical SCI we recommend using a VC below 60% of the AB predicted value.

2248 Board #294 MAY 31 8:00 AM - 9:30 AM

### Measurement of Ventilatory Parameters During Voluntary Wheel Running in Mice

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(No relationships reported)

Ventilation and metabolism, i.e. oxygen consumption (VO<sub>2</sub>), are coordinated with fine precision to regulate the physiological demands during exercise. Although several reports have described the regulation of either ventilation or VO<sub>2</sub>, the regulatory link between the two variables has not yet been fully elucidated.

**PURPOSE:** The aim of present study was to investigate the interaction in the dynamic changes in ventilatory parameters and VO<sub>2</sub> during exercise in mice.

**METHODS:** C57BL/6 mice (n=5, 26 ± 1 g) were anesthetized for implantation of a telemetric ECG transmitter for monitoring heart rate (HR) and body temperature (T<sub>B</sub>). Following 3 days of recovery, the mouse was placed into the plethysmograph equipped with a running wheel and rotation counter. Using whole-body plethysmography and a high-resolution O<sub>2</sub>-CO<sub>2</sub> analyzer, we monitored respiratory waveform and the inspired and mixed expired O<sub>2</sub>-CO<sub>2</sub> concentrations simultaneously. Tidal volume (V<sub>T</sub>), ventilatory frequency (V<sub>f</sub>), minute ventilation (V<sub>E</sub>) and VO<sub>2</sub> were calculated and corrected for changes of T<sub>B</sub>. Each variable was analyzed from the mean of a 10-sec data block under resting or running conditions.

**RESULTS:** Mice performed intermittent voluntary running at a speed of ~20-25 m/min in the wheel chamber. Resting values for each variable were, HR: 502 ± 14 bpm, T<sub>B</sub>: 36.5 ± 0.2 °C, V<sub>T</sub>: 6.2 ± 0.3 ml/kg, V<sub>f</sub>: 196 ± 8 bpm, V<sub>E</sub>: 1218 ± 69 ml/kg/min, VO<sub>2</sub>: 2822 ± 228 ml/kg/h. Importantly, running significantly increased HR (Δ169 ± 14 bpm), T<sub>B</sub> (Δ1.2 ± 0.1 °C), V<sub>T</sub> (Δ2.5 ± 0.3 ml/kg), V<sub>f</sub> (Δ230 ± 17 bpm), V<sub>E</sub> (Δ2443 ± 137 ml/kg/min), and VO<sub>2</sub> (Δ2220 ± 187 ml/kg/h).

**CONCLUSION:** In conclusion, dynamic responses of ventilation and oxygen consumption during voluntary exercise were evaluated in the present mice model. This experimental model has the potential to uncover the mechanism(s) underlying the link between ventilatory responses to exercise using specific genetic knock-out mice in future studies.

2249 Board #295 MAY 31 8:00 AM - 9:30 AM

### The Effects of Voluntary Hyperventilation on Performance of Intermittent Intense Exercise

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(No relationships reported)

**PURPOSE:** To determine if voluntary hyperventilation between short bouts of intermittent, intense exercise would affect acid-base status resulting in an increased work capacity.

**METHODS:** Seven males (VO<sub>2</sub>max 55 ± 5 ml/kg/min) volunteered (age: 21 - 28). The exercise trials were three 30sec Wingate anaerobic tests (B1,B2,B3) with 4 min recovery. Pedal resistance was set at .075kg/kg body wt. Each subject performed two trials separated by one week, one trial with normal breathing (NB), and one with voluntary hyperventilation (VH). Blood was drawn from a heated forearm vein at rest, immediately post (IP) each exercise bout, and each min of recovery. Blood acid-base variables were measured on a Radiometer BMS3. VE, VO<sub>2</sub>, VCO<sub>2</sub>, RER, f, and ECG were monitored continuously.

#### RESULTS:

|       |       | VE      | VA      | VCO2      | VO2      | PCO2  | [H+]  |
|-------|-------|---------|---------|-----------|----------|-------|-------|
| Trial | Bout  | L/4min  | L/4min  | L/4min    | L/4min   | mm Hg | nM    |
| NB    | PreB2 | 243±43  | 226±44  | 9.8±1.6   | 6.7±0.7  | 36±7  | 62±4  |
| NB    | PreB3 | 265±46  | 244±46  | 8.2±.8    | 6.8±0.9  | 28±5  | 74±7  |
| VH    | PreB2 | 320±49* | 301±49* | 10.8±1.6* | 7.0±1.1* | 33±4  | 57±4  |
| VH    | PreB3 | 372±45* | 350±46* | 9.4±1.3*  | 8.0±1.1* | 26±6  | 72±10 |

NB mean power output was significantly higher during B2(600 ± 61W) and B3(521 ± 59W) when compared to B2(552 ± 58W) and B3(490 ± 55W) of VH. Despite a significant increase in estimated VA (calculated from VT & f with an assumed VD), VE and VCO<sub>2</sub>, no significant differences was obtained in PCO<sub>2</sub> (and consequently pH) immediately prior to B2 and B3.

**CONCLUSION:** Possibly the intensity of the exercise was severe enough to stimulate involuntary ventilation to near maximum, as indicated by the low mean PCO<sub>2</sub> immediately prior B3 with NB. The increased ventilatory cost during VH trial may help to explain the decreased power output during this trial.

Supported by the Research Institute, Iowa State University

2250 Board #296 MAY 31 8:00 AM - 9:30 AM

### Electrical Activity of the Diaphragm in Trained Subjects During Progressive Cycling to Exhaustion Trials

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(No relationships reported)

Previous studies of the dynamics of transdiaphragmatic pressure have shown progressive increase in diaphragmatic strength with workload (WL). Esophageal measurement of electrical activity of the diaphragm (EA<sub>di</sub>) may elucidate whether neural respiratory drive follows a similar pattern or is adapted differently to the changing ventilatory demands during exercise.

**PURPOSE:** To measure EA<sub>di</sub> changes during cycling to exhaustion and determine whether measured EA<sub>di</sub> is reproducible within subjects.

**METHODS:** 7 trained male subjects (Mean ±SD Age: 28 ±6 yrs; VO<sub>2</sub>max: 59.1 ±3.9 ml.min<sup>-1</sup>.kg<sup>-1</sup>) performed progressive cycling to exhaustion trials on a cycle ergometer. Trials consisted of 4 min warmup at 0 W, then 4 min segments at WL of 40, 55, 70 and 85%, ended by 100% WL until exhaustion, 100% WL estimating VO<sub>2</sub>max. WL from previous trial. Crural EA<sub>di</sub> was measured using a commercial esophageal probe with 9 electrodes. Each subject repeated the trial after 6-24 days. Median maximal breath EA<sub>di</sub> recorded during the last 25 s at 40, 55, 70 and 85% WL were used for analysis.

**RESULTS:** Trial 1 mean ±SD EA<sub>di</sub> were 39 ±22 μV, 55 ±17 μV, 64 ±18 μV and 67 ±13 μV for WL of 40, 55, 70 and 85%, respectively. For trial 2, these were 40 ±19 μV, 50 ±21 μV, 60 ±19 μV and 60 ±6 μV for 40, 55, 70 and 85% WL. Bland-Altman plots of EA<sub>di</sub> within subject differences between trials showed bias of 13 μV and limits of agreement of -30 - 56 μV, largest relative differences being for EA<sub>di,40%.</sub> Patterns of changes were similar within subjects, and repeated measures ANOVA showed EA<sub>di</sub> differences among WL for both trials (P<0.05), with Bonferroni adjusted post hoc tests showing EA<sub>di,40%<EA<sub>di,70%</sub> and EA<sub>di,40%<EA<sub>di,85%</sub> for trial 1, and EA<sub>di,40%<EA<sub>di,70%</sub> for trial 2 (P<0.05).</sub></sub></sub>

**CONCLUSIONS:** Results showed poor within subject agreement over time for EA<sub>di</sub>. Possible causes include probe placement and subject variation over time. In contrast, trends in EA<sub>di</sub> changes with workload were similar within subjects. In general, EA<sub>di</sub> increased from WL of 40% to 55% and 70%. On average, a plateau at 85% WL was indicated in agreement with previous studies of EA<sub>di</sub>, but individual subjects showed no clear pattern of changes in EA<sub>di</sub> from 70 to 85% WL. Esophageal EA<sub>di</sub> measurement equipment was sponsored by the manufacturer.

2251 Board #297 MAY 31 8:00 AM - 9:30 AM

### Fitness Levels In Smokers And Healthy Controls: Predictability By Carbon Monoxide And Fagerström Test

Christopher S. Oh, Michael K. Chronley, Brian K. Le, Christian K. Roberts, FACSM. University of California, Los Angeles (UCLA), Los Angeles, CA.  
(No relationships reported)

**PURPOSE:** Cigarette smoking affects human metabolism and exercise capacity, but these relationships are not fully understood. This study aims to compare: 1) cardiorespiratory fitness (CRF) and muscle strength in chronic smokers and recreationally-active, non-smoking young adults as part of a randomized-controlled trial to investigate the effects of resistance training on vascular function and; 2) the effectiveness of self-reported number of cigarettes smoked per day (CPD), Fagerström Test for Nicotine Dependence (FTND), and breath carbon monoxide (CO) levels to assess predictability of exercise capacity markers and arterial stiffness in young adult chronic smokers.

**METHODS:** 26 young adult male smokers (age  $25.1 \pm 4.5$  yr, BMI  $25.4 \pm 5.9$ ) were assessed for breath CO concentration, CPD, and by FTND. Smokers and 25 non-smokers (age  $23.8 \pm 4.1$  yr, BMI  $24.5 \pm 2.6$ ) were assessed for CRF by  $\text{VO}_{2\text{max}}$ , composite 1-repetition maximum (1RM) strength by bench press, leg press and machine row, and arterial stiffness by arterial tonometry.

**RESULTS:** Smokers exhibited lower absolute ( $2.39 \pm 0.49$  vs.  $2.97 \pm 0.67$  L/min,  $p = 0.004$ ) and relative ( $29.1 \pm 1.2$  vs.  $40.4 \pm 2.0$  ml/kg/min,  $p < 0.0001$ )  $\text{VO}_{2\text{max}}$  and total ( $825 \pm 39.5$  vs.  $989 \pm 49.6$  lbs,  $p = 0.01$ ) and relative ( $4.6 \pm 0.1$  vs.  $6.1 \pm 1.0$  lbs/lbs body weight,  $p < 0.0001$ ) 1RM. CO was highly related to FTND ( $R = 0.62$ ,  $p = 0.0003$ ) and CPD ( $R = 0.56$ ,  $p = 0.0006$ ). CO significantly predicted total 1RM ( $R = -0.51$ ,  $p = 0.009$ ),  $\text{VCO}_2$  ( $R = 0.55$ ,  $p = 0.033$ ), subendocardial viability ratio ( $R = 0.44$ ,  $p = 0.02$ ),  $\text{HR}_{\text{rest}}$  ( $R = -0.39$ ,  $p = 0.047$ ). FTND significantly predicted  $\text{VT}_{\text{max}}$  ( $R = -0.46$ ,  $p = 0.03$ ), aortic augmentation index ( $R = -0.35$ ,  $p = 0.048$ ), aortic systolic pressure ( $R = 0.36$ ,  $p = 0.03$ ), and central pulse height ( $R = -0.35$ ,  $p = 0.049$ ). Both CO and FTND predicted  $\text{HR}_{\text{max}}$  (CO:  $R = -0.61$ ,  $p = 0.007$ ; FTND:  $R = -0.65$ ,  $p = 0.036$ ) and  $\text{VE}_{\text{max}}$  (CO:  $R = -0.52$ ,  $p = 0.023$ ; FTND:  $R = -0.50$ ,  $p = 0.03$ ). CPD showed no significant predictions.

**CONCLUSION:** Preliminary results suggest that cigarette smoking negatively impacts CRF and strength fitness in young adult males. Additionally, higher CO levels are associated with lower muscle strength. CO and FTND are associated with both complementary and unique indices of exercise capacity and vascular function, suggesting studies would benefit most from determining CO levels and administering FTND tests.

**2252 Board #298 MAY 31 8:00 AM - 9:30 AM**  
**Compensation for Breathing Valve Leak during Pneumotachograph Calibration**

Erik M. Groves, Rosie Neil, David J. Smith. *University of Calgary, Calgary, AB, Canada.*  
(No relationships reported)

Metabolic carts are often used with a two-way, non-rebreathing mouthpiece (NRB) connected to a pneumotachograph (PNT) to measure expiratory flow rates. In order to calibrate this flow measurement system, a number of strokes of varying flow rates from a 3L calibrated syringe are used to generate a conductance curve for the PNT. The algorithm developed by Yeh et al. (1982) achieved an accuracy  $\pm 1\%$  based upon a direct connection between the syringe and PNT. In a clinical setting, calibration of the flow measurement system, including a NRB, assumes that all 3L passes through the expired PNT.

**PURPOSE:** To assess NRB valve leak (i.e. flow out the inspiratory (INSP) port during an EXP syringe stroke) and develop an algorithm to account for volume discrepancies in determination of PNT calibration conductance curves. **METHOD:** Unheated screen PNTs were connected directly to the INSP and EXP ports of a standard NRB. A minimum of 100 strokes of varying flow rates were used ( $0.3\text{--}15\text{L}\cdot\text{s}^{-1}$ ). Two calibration conditions were used: unplugged (UNP) (i.e. standard setup) and opposing port plugged (PLU). In the latter, the INSP and EXP ports were alternately blocked to ensure no leak during each stroke. Conductance curves were generated for both PNT's and conditions.

**RESULTS:** Mean volume for INSP and EXP in the PLU condition was  $3.001 \pm 0.024\text{L}$  and not different from 3L. The difference in total measured volume (systematic error) between INSP and EXP was  $< 0.1\text{mL}\cdot\text{stroke}^{-1}$ . The systematic error between INSP and EXP, when the PLU calibration was applied to the stroke data from the UNP condition was  $18.9\text{mL}\cdot\text{stroke}^{-1}$ . A novel algorithm was used to estimate the volume of the leak and offset the assumed volume passing through the PNT (i.e. 3L) in UNP. Calculated leak volume was maximal ( $\sim 80\text{mL}$ ) at the slowest flows and varied inversely with flow rate stopping by  $\sim 3\text{L}\cdot\text{s}^{-1}$ . The mean INSP and EXP volumes were  $3.001 \pm 0.022\text{L}$ . Importantly, there was low systematic error ( $< 0.9\text{mL}\cdot\text{stroke}^{-1}$ ) between INSP and EXP using this correction.

**CONCLUSION:** The use of an INSP PNT attached to a NRB-EXP PNT setup has demonstrated systematic error in standard EXP flow calibration and volume measurement resulting from valve leak. This effect is prominent at lower flow rates. A known syringe volume does not necessarily result in that volume passing through a PNT during calibration with a NRB.

**C-38 Free Communication/Poster - Sports Science II: Team Sports**

MAY 31, 2012 7:30 AM - 12:30 PM  
ROOM: Exhibit Hall

**2253 Board #299 MAY 31 9:00 AM - 10:30 AM**  
**GPS Technology In Team Sports**

Cloe Janine Cummins. *The University of Sydney, Sydney, Australia.* (Sponsor: Michael Climstein, FACSM)  
(No relationships reported)

Global Positioning System (GPS) technology is a satellite-based navigation system widely used for navigation, vehicle or personal tracking, robotics and surveying. GPS use in team sport is still relatively novel but permits quantitative assessment of player position, velocity, heart rate, and movement patterns through traditional GPS triangulation methods and accelerometer and heart rate monitoring software. GPS provides scope for better understanding the positional and specific physiological demands of team sport.

**PURPOSE:** A systematic review of GPS technology applied in team sports.

**METHODS:** A Systematic search of electronic databases (Medline, SPORTdiscus, CINAHL, Web of Science, Scopus, Embase and Cochrane) was performed from earliest record to September 2011. Permutations of key words included Global Positioning System, able-bodied male and female, age 15-50 years, recreational to elite competitive team sports.

**RESULTS:** There were 21 eligible papers reporting on Rugby League (2), Australian Football (AFL) (7), Rugby Union (3), Netball (1), Lacrosse (1), Hockey (1) and Soccer (6). Manuscripts reported the GPS variables of heart rate demands (maximum, minimum and mean heart rate, time and exertions) and movement demands (speed, distance, time, accelerations, maximum and mean speed). In most papers, movement demands were further categorised into six zones comprised of speeds (0 to 36 km/h) and descriptions (from walking to sprinting). Except for cricket, speed zones and descriptors were inconsistent and not standardized within sports, eg in AFL, Zone 3 speeds varied from 7 to 16 km/h whilst Zone 4 definitions ranged from jog, run, high velocity to high intensity run. Variations were also observed between sports eg Zone 4 speeds spanned hockey and soccer (7-18 km/h), cricket (13-14 km/h), rugby union and rugby league (12-21 km/h) and AFL (14-20 km/h).

**CONCLUSIONS:** This systematic review highlights the variability of movement demand associated with GPS application in team sports. There is a need for within sport standardization of speed zones attached to clearly defined movement patterns. Clarity and consistency of speed zones and movement pattern definitions within a team sport facilitates precise comparison and analysis of performance between players, teams and competitive seasons.

**2254 Board #300 MAY 31 9:00 AM - 10:30 AM**  
**Testosterone, Not Dietary Composition, Predicts Power in Elite Soccer Players**

Vittorio E. Bianchi, FACSM<sup>1</sup>, Roberto C. Burini<sup>2</sup>. <sup>1</sup>Laboratory of Physiology of Exercise and Human Performance, Rimini, Italy. <sup>2</sup>UNESP - Univ Estadual Paulista, Botucatu, Brazil.  
(No relationships reported)

**BACKGROUND:** Dietary composition has been widely studied as factor

influencing endurance performance. Less is known regarding hormonal influences, particularly in short-term performance requiring power. We assessed detailed hormonal and dietary influences on a novel sprint test in elite soccer players.

**METHODS:** Eighteen professional soccer players were studied using a 10-meter sprint test (10-MST) involving the chronometric evaluation with photocells (Globus Italia, Codognè, Italy). Dietary composition was determined by 7-day food records by self-reported food questionnaire, while resting energy expenditure (REE) and RQ were measured by indirect calorimetry ( $\text{Vmax}29$ , Sensormedics, Yorba Linda, CA, USA). Oxygen consumption and carbon dioxide production were measured for 20 minutes continuously. Blood samples were taken after a 12 hr fast for basal biochemistry and hormones. The following hormones were evaluated: Insulin-like Growth Factor-1 (IGF-1), total testosterone, and free testosterone.

**RESULTS:** Resting metabolic rate, indices of body dimensions, and dietary factors were poorly related to 10-MST performance (see table). Total and free testosterone were strongly associated with 10MST,  $r=0.80$   $P<0.001$  (see figure), but no correlation was found between IGF1 and 10MST. IGF1 is correlated to Kcal ( $r=0.39$   $p<0.01$ ) and carbohydrates ingested ( $r=0.40$   $p<0.001$ ). RQ has negative correlation with CHO ( $r=-0.39$ ) and lipids ( $r=-0.38$ ).

**CONCLUSION.** Testosterone levels, rather than dietary factors, predict sprint performance in elite soccer players, but not IGF1 and RQ that are related only to the macronutrients ingested. Then further the physical testing the hormonal evaluation is fundamental to predict the performance in soccer.

**2255 Board #301 MAY 31 9:00 AM - 10:30 AM**  
**Correlation Of VO<sub>2max</sub> Between The Bruce Protocol And Yo-yo Test In Mexican Professional Soccer Players**

Alejandro Soria-Contreras<sup>1</sup>, Johanna Yvette Silva-Laguna<sup>1</sup>, Angélica Becerra-Magaña<sup>1</sup>, Juan Ricardo López y Taylor<sup>1</sup>, Juan Antonio Jiménez-Alvarado<sup>1</sup>, Rubens Valenzuela-Lazo<sup>2</sup>, Edna Jáuregui-Ulloa<sup>1</sup>. <sup>1</sup>Universidad de Guadalajara, Guadalajara, Mexico. <sup>2</sup>Club Deportivo Leones Negros, Guadalajara, Mexico.  
(No relationships reported)

The maximal oxygen uptake (VO<sub>2max</sub>) has been considered the most important determinant of aerobic endurance in soccer players. On the other hand, Bangsbo in 1994, using the Yo-Yo Test, assessed the maximum aerobic capacity in professional soccer teams, demonstrating the importance of intermittent resistance in soccer players.

**PURPOSE:** To evaluate the results of VO<sub>2max</sub> in soccer players with two different indirect test and analyze the correlation between them

**METHODS:** A total of 54 Mexican professional soccer players aged 26 years (SD= 2.12) were evaluated. Weight was 74.5 Kg. (SD=2.5) and height 177.3 cms. (SD=6.68). Each player was submitted to a VO<sub>2max</sub> test using the Bruce protocol and the Yo-Yo intermittent endurance Level 2 test.

**RESULTS:** The mean VO<sub>2max</sub> obtained by treadmill running was 55.0 ml / kg / min (SD = 4.6). VO<sub>2max</sub> obtained by Yo-Yo test was 55.1 ml / kg / min (SD = 2.9). We found a  $r = 0.297$  and a  $p < 0.25$ .

**CONCLUSIONS:** This study reports that the average VO<sub>2max</sub> level of players was found in the lower limit (Reilly 1993, 56 to 69 ml/kg/min). By comparing the average data from the Bruce protocol with the Yo-Yo test, the results were similar, however there was no correlation between both tests. This study shows that the aerobic capacity of these players was deficient and need more aerobic training. We found that both tests are useful for the assessment of football because they measure different characteristics of the cardio respiratory fitness. More research and evaluations regarding this issue are suggested in order to increase the performance of the players.

**2256 Board #302 MAY 31 9:00 AM - 10:30 AM**  
**Relation Between The H:Q Ratio And Age And Lower Limb Dominance In Young Soccer Players**

Tomas Maly, Frantisek Zahalka, Lucia Mala. Charles University, FPES, Prague, Czech Republic.  
(No relationships reported)

During the game, strength and power movements are accumulated on both lower extremities (LE). This occurs in an asymmetrical manner and may gradually leads to higher shifts of myodynamic characteristics and strength asymmetries of LE. The hamstring to quadriceps (H:Q) ratio has been used in several studies to examine the similarity between H:Q moment-velocity patterns and to assess knee functional ability and muscle balance, but mainly in adults players. However, less is known about the bilateral difference in H:Q ratio among different age groups.

**PURPOSE:** The purpose of the study was to find out the level of H:Q ratio and differences in terms of age and limb dominance.

**METHODS:** Elite players of 4 age categories (U16=16, U17=18, U18=17 and U19=19) were tested on the isokinetic dynamometer Cybex at three velocities (60, 180, 300 °.s<sup>-1</sup>) for the dominant (DL) and non-dominant leg (NL) during the knee flexion and extension. The ratio between peak muscle torque of hamstring to quadriceps for both legs (H<sub>D</sub>:Q<sub>D</sub>; H<sub>N</sub>:Q<sub>N</sub>) was evaluated. Three-way Mixed-design ANOVA with two between subject effect (age (A), laterality (L)) and one within subject effect (velocity) was used for evaluation of H:Q differences between the factors.

**RESULTS:** The factors of A and L do not significantly influence the level of H:Q in young elite players (age:  $F_{(3,132)} = 1.07$ ,  $p > 0.05$ ,  $\eta^2 = 0.024$ , laterality:  $F_{(1,132)} = 0.278$ ,  $p > 0.05$ ,  $\eta^2 = 0.002$ ). Similarly, the effect of interaction between A and L was not significant ( $p > 0.05$ ). With increasing angular velocity, significant changes in H:Q ratio appeared (H:Q<sub>60</sub> = 56.80, HQ<sub>180</sub> = 60.83, HQ<sub>300</sub> = 61.75,  $F_{(1,132)} = 32.71$ ,  $p < 0.001$ ,  $\eta^2 = 0.199$ ). Post-hoc analysis showed a significant difference in H:Q<sub>60</sub> compared to H:Q<sub>180</sub> or H:Q<sub>300</sub> ( $p < 0.001$ ), while no significant difference was found between H:Q<sub>180</sub> and H:Q<sub>300</sub> ( $p > 0.05$ ). Totally, 44 risk results of H:Q (24 for DL and 20 for NL) were identified in 23 players (32.9%).

**CONCLUSIONS:** Neither calendar age, nor limb dominance have significant impact on the level of H:Q ratio in young elite players, on the contrary, the speed of the movement during knee flexion and extension has a significant effect. In the individual assessment, we have revealed strength asymmetries that should be eliminated by means of appropriate sports training.

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**2257 Board #303 MAY 31 9:00 AM - 10:30 AM**  
**Effects of a Water Exercise Training Program on Biochemical Parameters and Aerobic Fitness in Indoor Soccer Players**

Dalila Tusset<sup>1</sup>, Mabel Olkoski<sup>2</sup>, Kenji Fuke<sup>3</sup>, Silvana Matheus<sup>4</sup>, Félix Soares<sup>2</sup>, Rafael Portella<sup>2</sup>, Edovando da Rosa<sup>2</sup>, Rômulo Barcelos<sup>2</sup>. <sup>1</sup>University of Brasilia, Brasilia, Brazil. <sup>2</sup>Federal University of Santa Maria, Santa Maria, Brazil. <sup>3</sup>Federal University of Santa Maria, Santa Maria, Brazil. <sup>4</sup>Federal University of Brasilia, Santa Maria, Brazil. (Sponsor: Lee E. Brown, FACSM)  
(No relationships reported)

Studies have shown that chronic dry land and chronic water exercise training improves oxygen uptake. Furthermore, studies have reported that acute levels of creatine kinase (CK) after water exercise are less when compared to performing dry land exercise. However, it is unclear if the water exercise training affects physical fitness, muscle oxidative stress, or indirect markers of muscle damage.

**PURPOSE:** To compare the effects of dry land and water exercise training programs on oxidative stress, indirect markers of muscle damage, and aerobic fitness of indoor college soccer players.

**METHODS:** Twelve university indoor soccer players were randomly divided into two training groups: 1) 6 subjects performed on dry land (LG), and 2) 6 subjects performed water exercise (WG), twice a week for 5 weeks. Aerobic fitness (Yo-Yo Intermittent Test) was evaluated before and after 10 training sessions. Muscle damage (CK) and oxidative stress (catalyze [CAT] activity) markers were analyzed at rest [R-1<sup>st</sup>] before the first session, immediately after the first session [A-1<sup>st</sup>], 24 hours [24h-1<sup>st</sup>] and 48 hours after [48h-1<sup>st</sup>]. Also, CK and CAT were analyzed at rest [R-10<sup>th</sup>] before the 10<sup>th</sup> training session, immediately after session [A-10<sup>th</sup>], 24 hours [24h-10<sup>th</sup>] and 48 hours after [48h-10<sup>th</sup>].

**RESULTS:** Both groups increased their aerobic fitness ( $p \leq 0.05$ ; LG 1104.29 to 1294.29 m; WG 970.00 to 1214.00 m) after the training program but no differences were found between groups. Also, no significant changes were observed in CK or CAT for the LG after the training program. However, WG showed greater CAT activity at R-10<sup>th</sup> (28  $\mu\text{molH}_2\text{O}_2/\text{min}/\mu\text{L}$ ) in relation to R-1<sup>st</sup> (23  $\mu\text{molH}_2\text{O}_2/\text{min}/\mu\text{L}$ ;  $p \leq 0.05$ ). By comparing both groups, WG presented lower levels of CK ( $p \leq 0.05$ ) at R-10<sup>th</sup> (93 vs 127 U.I./L), A-10<sup>th</sup> (101 vs 168 U.I./L) and 24h-10<sup>th</sup> (80 vs 125 U.I./L).

**CONCLUSION:** These data suggest that water exercise training increases soccer players' aerobic fitness, antioxidant markers in addition to a minor muscle damage level. Thus, water exercise can be useful as an alternative method for indoor soccer players during their training and recovery periods due to its low potential to generate muscle injury.

**2258 Board #304 MAY 31 9:00 AM - 10:30 AM**  
**Effects of Season-Long High-Intensity Interval Training on Conditioning of High School Soccer Players**

Neal F. Howard, Stasinios Stavrianeas. Willamette University, Salem, OR.  
(No relationships reported)

High-intensity interval training (HIIT) has been put forth as a viable alternative to more traditional endurance conditioning for the improvement of aerobic conditioning.

**PURPOSE:** We hypothesized that HIIT will compare favorably to traditional soccer conditioning over the course of a high school soccer season.

**METHODS:** High school junior varsity soccer players were split into control (n=17) and experimental (n=17) groups during the 10-week study. The HIIT consisted of 4-6 30 second "all-out" sprint efforts with 4.5 minute recovery, 3 times a week. The control group performed endurance training for the same duration. The groups did not differ in any other aspect of their training. Participants completed the yo-yo intermittent recovery test level 1 (IR1), a 40-yard dash, vertical jump, agility test, and a sit-and-reach test, in 2 different testing sessions (pre and post season).

**RESULTS:** Both control (n=10 at post) and experimental groups (n=6 at post) showed significant increase in IR1 test performance pre and post training (720±99.6m vs. 1196±80.0m,  $p<0.000$  and 480±67.6m vs. 860±161.6m,  $p<0.045$  respectively), with no significant difference between groups ( $p<0.854$ ). Both experimental (n=5) and control (n=9) groups showed a significant difference in the 40-yard dash between pre and post training (5.48s vs. 5.17s, (5.6%)  $p<0.005$  and 5.73s vs. 5.36s (6.4%),  $p<0.001$  respectively). There was no difference between experimental and control groups between pre ( $p<0.550$ ) and post ( $p<0.089$ ). There was no difference in vertical jump between experimental (n=7,  $p<0.803$ ) and control (n=12,  $p<0.954$ ) groups pre and post testing. Similarly, there was no difference in the agility test between the experimental (n=7,  $p<0.683$ ) and control (n=12,  $p<0.094$ ) groups pre and post test. Finally, there was no difference in the sit-and-reach test for the experimental group pre to post (n=7,  $p<0.798$ ). There was, however, a significant decrease in the control group (n=12, 29.13 cm vs. 27.75 cm,  $p<0.024$ ).

**CONCLUSION:** Our results indicate that HIIT is an adequate training stimulus offering similar endurance improvements to more traditional soccer training.

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**2259** Board #305 MAY 31 9:00 AM - 10:30 AM

**Short Duration High-Intensity Interval Training Improves Aerobic Conditioning of Female College Soccer Players**

Tannin Kueffner, Andrea Rowan, Stasinios Stavrianeas. *Willamette University, Salem, OR.*

(No relationships reported)

High-intensity interval training (HIIT) has been shown to improve aerobic conditioning at a considerable savings in time compared to the more traditional endurance training.

**PURPOSE:** We hypothesized that maximal oxygen consumption ( $VO_{2max}$ ) and performance in the Yo-Yo Intermittent Recovery Test 1 (IRT1) between the HIIT group and the endurance training group (END) would be similar between over a short 4-week spring training period.

**METHODS:** Following a valid  $VO_{2max}$  test and the IRT1, female Division III college soccer players were matched and randomly assigned to the HIIT (n=7) or the END (n=6). The HIIT consisted of 5 30-second "all-out" sprint efforts with a 4.5 minute active recovery, twice per week. The END completed a 40-min run at 80% of  $VO_{2max}$  twice per week. All other aspects of the training were identical for the two groups. Comparisons of  $VO_{2max}$  and IRT1 test data between groups (END vs. HIIT) or between conditions (pre- vs. post-training) were made using Student's t-test and ANOVA ( $\alpha=0.05$ ).

**RESULTS:** The distance covered during the IRT1 test was significantly different between the pre- and post-tests (1680±480 m vs. 1895±524 m respectively,  $p=0.002$ ). The differences were true for the HIIT group (pre-test: 1857±423 m vs. post-test: 2131±436 m,  $p=0.001$ ) and END group (pre-test: 1473±494 m vs. post-test: 1613±510 m,  $p=0.042$ ). There were no significant differences between the HIIT and END groups for the pre-test ( $p=0.108$ ) or the post-test ( $p=0.076$ ). The 4-week training program resulted in significant improvements in team  $VO_{2max}$  values between the pre- and post-training tests (50.66±3.52  $ml\cdot kg^{-1}\cdot min^{-1}$  vs. 52.71±3.24  $ml\cdot kg^{-1}\cdot min^{-1}$  respectively,  $p=0.002$ ). There were no differences in  $VO_{2max}$  between the SPR and END groups for the pre-test ( $p=0.493$ ) and the post-test ( $p=0.362$ ). Improvements in  $VO_{2max}$  between the pre- and post- tests were 2.36  $ml\cdot kg^{-1}\cdot min^{-1}$  (4.73%) for the HIIT group and 1.66  $ml\cdot kg^{-1}\cdot min^{-1}$  (3.42%) for the END group.

**CONCLUSIONS:** Our results indicate that HIIT as little as twice per week offers an adequate aerobic training stimulus at considerable time savings.

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**2260** Board #306 MAY 31 9:00 AM - 10:30 AM

**Response of Plasma Creatine Kinase After Pre Season Compared with an Official Soccer Game**

Luciano Capelli<sup>1</sup>, Leandro Dias<sup>1</sup>, Júlio Tadao Murakawa<sup>2</sup>. <sup>1</sup>São Bernardo Futebol Clube, São Bernardo do Campo, Brazil. <sup>2</sup>Cemafé, São Paulo, Brazil.

(No relationships reported)

Plasma creatine kinase (CK) concentration has been widely used as an indicator of skeletal muscle damage in sports. The increase of CK concentration occurs 4 hours after the exercise, reaching the peak after 48-72 hours.

**PURPOSE:** The aim of this study was to evaluate serum CK concentration in professional soccer players after ten days of intense physical training compared with an official soccer game.

**METHODS:** Ten professional soccer players (25 ± 3.63 yrs, 78.52 ± 6.97 kg and 8.18 ± 2.95 % fat) participated in this study. Plasma CK concentration was measured in three moments, at the beginning of pre season (baseline), after ten days of intense physical training (780 minutes) with aerobic and anaerobic resistance exercises (post-training) and 48 hours after an official soccer game (post-game). CK was checked using Reflotron Plus (Roche). Data were analyzed by one way ANOVA and Tukey's post hoc test.

**RESULTS:** The values of plasma CK was significant higher ( $p<0.05$ ) comparing the baseline (177.83 ± 70.46 U/l) with post-training (542.40 ± 224.35 U/l) and post-game (627.40 ± 399.10 U/l). No significant differences were found between post-training and post-game.

**CONCLUSIONS:** The training routine of the soccer players on the pre season has the same physical stress as an official soccer game, the variability of response plasma CK concentration is individual both in rest and workout. This procedure can be used to monitor the intensity of training and games.

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**2261** Board #307 MAY 31 9:00 AM - 10:30 AM

**The Influence of Acute Exercise on Torque Decline Between Positions in Collegiate Female Soccer Players**

Matthew J. Hawkey, Brennan J. Thompson, Eric C. Conchola, Ryan E. Fiddler, Nathaniel D.M Jenkins, Douglas B. Smith, Eric J. Sobolewski, Eric D. Ryan, Mallory L. Craig, K. Lee Everett, Jennifer, L. Klufa, Aric J. Warren, Matthew D. O'Brien, Kazuma Akehi, Jennifer L. Volberding, Crishel Kline. *Oklahoma State University, Stillwater, OK.*

(No relationships reported)

The ability among players to sustain muscular activity following intense bouts of muscular exertion that may frequently occur during soccer match play may play an important role in successful performance and injury prevention. Muscular fatigue results in decreased muscular torque production and consequently may hinder playing performance. Research findings have suggested that various positions in elite level soccer players may be functionally unique in regards to the distances covered and metabolic demands imposed during match play

**PURPOSE:** To examine the effects of a fatigue inducing bout of isokinetic exercise on peak torque decline for the leg flexor and leg extensor muscle groups between playing positions in Division I collegiate female soccer players.

**METHODS:** Eighteen healthy female individuals (seven defenders: mean ± age= 19.86 ± 0.83; seven midfielders: mean ± age= 20.57 ± 1.59; four forwards: mean ± age= 20 ± 0) volunteered to participate in the study. Peak torque of the right leg extensors and flexors was assessed on a Biodex System 3 dynamometer (Biodex Medical Systems, Inc., Shirley, NY USA) at 180° s-1. Following a general warm-up, participants performed 50 consecutive maximal leg extensions and leg flexions in tandem. Peak torque and least torque values across the 50 repetitions for both leg flexors and leg extensors were used to calculate the percent of torque decline. Percent decline values were calculated by taking the highest peak torque minus the least torque divided by peak torque and multiplying by 100. A one-way analysis of variance (ANOVA) was used to analyze the peak torque percent decline values. An alpha level of  $p \leq 0.05$  was used to determine statistical significance.

**RESULTS:** There was no significant difference ( $p = 0.78$ ) for peak torque percent decline for any of the player position groups.

**CONCLUSIONS:** These findings indicated that there appears to be no difference in leg flexor or leg extensor peak torque decline between playing positions during a repeated bout of fatigue inducing isokinetic exercise in Division I collegiate female soccer players. Thus, strength and conditioning professionals may choose to develop muscle endurance conditioning programs to maximize time and efficiency given the similarity of lower body muscle endurance capacities among player positions.

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**2262** Board #308 MAY 31 9:00 AM - 10:30 AM

**The Level, Dependence And Structure Of Speed Indicators In Young Elite Soccer Players**

Tomas Maly, Frantisek Zahalka, Lucia Mala, Mario Buzek, Jaroslav Teplan, Tomas Gryc. *Charles University, FPES, Prague, Czech Republic.*

(No relationships reported)

In-game analysis of professional soccer players showed that players perform a high intensity activity which lasts for 2-4 seconds every 90 seconds during a game. These activities occur at irregular intervals, across unequally covered distances and with different types of player's movement (running sideways, backwards, with the ball, without the ball, acceleration, deceleration, etc.). It is believed that, in adult players, acceleration speed, maximum speed and agility are independent components.

**PURPOSE:** To determine the level, dependence and structure of speed indicators in young elite soccer players.

**METHODS:** The screened sample consisted of players from the U16 Czech national team (n = 22, age = 15.6 ± 0.4 years, body height = 177.7 ± 6.9 cm, body weight = 67.9 ± 8.7 kg). Speed indicators were detected in the following tests: sprint at 5 and 10 m (S5, S10), maximum speed at 20 m flying sprint (MS20), agility test 505 with turns for the dominant (A5D) and non-dominant lower limb (A5N), agility K-test (AK), the speed of instep kick for the dominant (SKD) and non-dominant lower limb (SKN). Photocell gates (Brower Timing System) were used for speed diagnostics and radar gun STALKER ATS was used for the measuring of ball speed. Pearson's correlation coefficient and factor analysis (Extraction method: Principal component analysis with Varimax rotation) were applied to detect dependence and structure of the variables

**RESULTS:** Players' speed in the tests was as follows: S5 = 1.09 ± 0.06 s, S10 = 1.85 ± 0.08 s, MS20 = 2.48 ± 0.09 s, A5D and A5N = 2.42 ± 0.09 s, AK = 10.65 ± 0.37 s, SKD = 102.89 ± 4.45 km·h<sup>-1</sup>, SKN = 90.50 ± 7.71 km·h<sup>-1</sup>. A significant correlation was found between these parameters: S5 vs. S10 (p < 0.01), S10 vs. MS20 (p < 0.05), MS20 vs. A5N (p < 0.01), A5N vs. AK (p < 0.01) and SKD vs. SKN (p < 0.01). Factor analysis revealed 3 speed components with the following proportion of variance explained (% of total variance explained): acceleration and maximum speed (27.5%), agility and maximum speed (21%) and acyclic speed (16.8%).

**CONCLUSIONS:** Results indicated 3 speed components in the soccer players. Acceleration speed, agility and acyclic speed form independent speed components. This knowledge should be respected when stimulating speed abilities in sports training. Supported by GACR P407/11/P784 and MSM 0021620864

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2263 Board #309 MAY 31 9:00 AM - 10:30 AM

**Changes In Peak Oxygen Uptake And Substrate Utilization In Male Collegiate Soccer Players**

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<sup>3</sup>Wichita State University, Wichita, KS. <sup>4</sup>University of Bologna, Bologna, Italy. (Sponsor: Bryan L Haddock, FACSM)

(No relationships reported)

It is accepted that some sports (cycling/endurance running) have demonstrable changes in energy substrate utilization in training and competition phases. However, less is known about team sports.

**PURPOSE:** To assess changes in energy substrate utilization in a group of well-trained college soccer players pre and post competitive season.

**METHODS:** Participants for this study were 20 male soccer players, 19.2 ± 1.5 years of age; all were members of an NCAA Division II soccer team. Average height for field players was 175.6 ± 4.9 cm, weight was 71.8 ± 7.9 kg, Body Mass Index (BMI) was 23.3 ± 2.3 kg/m<sup>2</sup>, and body fat, assessed with the 7-site skinfold test, was 10.3 ± 4.4%. For physiological testing, participants ran the Yo-Yo Intermittent Recovery Test (YIRT) while wearing a portable metabolic cart (Viasys, Oxycon) to measure oxygen use. The YIRT is a 20-metre shuttle test with a progressively increasing pace. Athletes start out at a relatively slow pace and then quickly increase their speed according to the pace set by the beeps. Each bout of intense running (a 2x20m shuttle) is followed by 10 seconds of active recovery prior to the athlete resuming a sprint (Bangsbo et al.) Substrate utilization was estimated using indirect calorimetry methodology, and values for fat, carbohydrate, and protein use were calculated as absolute units (grams per test). Dependent samples t-tests were used to determine whether physiological parameters changed from Time 1 (T1-pre-season) to Time 2 (T2-end of season).

**RESULTS:** The majority of parameters did not significantly differ from T1 to T2. Average number of shuttles was 12 ± 3 at T1 and 13 ± 3 at T2 (p > 0.05). Average heart rate (171 ± 11 bpm vs. 173 ± 10 bpm), protein use, fat use, and carbohydrate use did not differ from T1 to T2 (p > 0.05). Energy expenditure (16.6 ± 1.9 vs 17.4 ± 2.2 kcal/min) approached a significant difference (p = 0.09). Peak VO<sub>2</sub> was the only parameter that differed significantly between T1 and T2 (57.6 ± 6.7 ml/kg/min vs 62.3 ± 6.2 ml/kg/min); the athletes had a higher VO<sub>2</sub> at T2 (p < 0.01).

**CONCLUSIONS:** No differences in energy substrate use were found during field based VO<sub>2</sub> peak testing in male collegiate soccer players across a competitive season, despite changes in absolute VO<sub>2</sub> peak.

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2264 Board #310 Abstract Withdrawn

2265 Board #311 MAY 31 9:00 AM - 10:30 AM

**Match Demands of professional Futsal Players**

Carles Tur<sup>1</sup>, Carlos González-Haro<sup>1</sup>, Jordi Ferré<sup>2</sup>. <sup>1</sup>School of Medicine, University of Zaragoza, Zaragoza, Spain. <sup>2</sup>Faculty of Sport, Education and Social Sciences, University of Chichester, Chichester, United Kingdom.

(No relationships reported)

Futsal is a professional sport that is played in many countries around the world; nonetheless there is scarce information in literature about the demands of professional Futsal players during competition. To our knowledge it is important to know the specific demands of this sport to build up specific training programs for these kinds of players in the best way possible.

**PURPOSE:** To describe the physical characteristics and the physiological demands of Futsal professional players during matches.

**METHODS:** 10 elite Spanish Futsal players (Age: 30.1 ± 2.8 yrs, experience: 11.1 ± 3.0 yrs, BMI: 23.9 ± 1.4 kg·m<sup>-2</sup>) carried out some physical tests during the second week of the 2008-2009 training pre-season, to assess the aerobic metabolism (Probst test to measure the maximal aerobic speed (MAS), total distance covered (TDC), and maximum heart rate (HR<sub>max</sub>)) during a first day; and to measure some strength qualities (peak power in ½ squat (PO<sub>peak</sub>), height in a Squat Jump (SJ), and in a Counter Movement Jump (CMJ)) a second day. After that, some physiological and physical parameters during 8 consecutive matches were recorded (Activity periods (rotations): Number of rotations (NRot), average time (RotTime<sub>avg</sub>), heart rate peak (HR<sub>peak</sub>), heart rate average (HR<sub>avg</sub>), and percentage of maximum heart rate (%HR<sub>max</sub>) of HR<sub>peak</sub> and HR<sub>avg</sub>; recovery periods: Number of recovery periods (NRec), and average time (RecTime<sub>avg</sub>). It was performed a descriptive analysis of all data, and it was expressed as mean ± SD.

**RESULTS:** Physical profile of Futsal players was: MAS: 13.7 ± 0.5 km·h<sup>-1</sup>, TDC: 1,372 ± 77 m, HR<sub>max</sub>: 190 ± 7 bpm, PO<sub>peak</sub>: 806 ± 213 W, SJ: 39.8 ± 4.9 cm, CMJ: 42.7 ± 7.2 cm. Physiological and physical demands during matches were: NRot: 2.8 ± 0.9, RotTime<sub>avg</sub>: 4:37 ± 2:06 min, HR<sub>peak</sub>: 185 ± 4 bpm corresponding to %HR<sub>max</sub>: 96 ± 2 %, HR<sub>avg</sub>: 168 ± 6 bpm corresponding to %HR<sub>max</sub>: 88 ± 4 %, NRec: 1.8 ± 0.9 with a RecTime<sub>avg</sub>: 13:18 ± 17:12 min.

**CONCLUSION:** These results show that professional Futsal players have moderate endurance, power and explosive strength levels, moreover Futsal played at professional level have to develop high-intensity exercise during short and moderate periods of time, although they provide of few periods of rest to recover moderately the fatigue accumulated during rotations or periods of exercise.

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2266 Board #312 MAY 31 9:00 AM - 10:30 AM

**Comparison Of Fitness Characteristics Between Men's And Women's Rugby Sevens Players**

David B. Pyne, FACSM<sup>1</sup>, Dean G. Higham<sup>1</sup>, Anthea Clarke<sup>1</sup>, John Mitchell<sup>2</sup>, Anthony Eddy<sup>2</sup>. <sup>1</sup>Australian Institute of Sport, Belconnen, Australia. <sup>2</sup>Australian Rugby Union, St Leonards, Australia.

(No relationships reported)

Both Men's and Women's Rugby Sevens have been added to the program for the 2016 Olympic Games in Rio de Janeiro, Brazil, but little is known about the comparative fitness requirements.

**PURPOSE:** To determine magnitudes of difference, and degree of variability, in standard anthropometric and fitness characteristics of national level men and women Rugby Sevens players.

**METHODS:** National Sevens squad players (males n=32, age 22 ± 3 years; height 1.82 ± 0.06 m; mass 90 ± 8 kg; females n=32, age 25 ± 6 years, height 1.68 ± 0.06 m; mass 70 ± 9 kg; mean ± SD) age were tested during routine training camps. All testing was conducted indoors on a synthetic running track after instruction, warm-up and familiarization with each test protocol. Each player completed a 40 m maximal sprint test, standing vertical jump and the YoYo Intermittent Recovery Level 1 (YoYo-IRL1) tests. Difference in mean scores between male and female players were expressed as a percentage, and variability as a ratio of the coefficients of variation (CV).

**RESULTS:** Male players had ~40% more lean mass and 40% lower skinfolds than the women. Speed (40 m sprint time and maximal running velocity V<sub>max</sub>) was only ~10-20% faster for the Men, while lower body power and momentum (mass x V<sub>max</sub>) were 40-50% higher in Men. The most marked difference was in endurance capacity (YoYo distance covered) where the Men

(2260 ± 270 m; mean ± SD) were ~two-fold better on the YoYo-IRL1 than Women (990 ± 320 m; mean difference ± 90% confidence limits of 1234 ± 184 m). The Women were more than twice as variable (ratio of CV <0.4) in endurance fitness than the Men.

**CONCLUSION:** Women Rugby Sevens players should focus conditioning programs on power, size and endurance to improve these aspects of fitness.

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**2267** Board #313 MAY 31 9:00 AM - 10:30 AM

**The Influence of Different Weighted Warm-up Bats on Swinging Performance**

Nicole C. Dabbs, John C. Garner, Robert C. Ricks, Harish Chander, Cade Wilderson, Jordan Young. *The University of Mississippi, University, MS.* (Sponsor: Mark Loftin, FACSM)

(No relationships reported)

In sport performance today it is vital to maximize performance to stay a top competitive athlete. In softball, this is very prevalent and is seen through a variety of hitting performance enhancements. Implementing a weighted bat prior to maximum swinging performance has traditionally been utilized but recent research has shown a decrease in bat swing velocity.

**PURPOSE:** The purpose of this study was to determine the influence of different weighted warm-up bats on swinging performance in varsity softball players.

**METHODS:** Ten active participating Division I female softball athletes volunteered to participate. The order of the three warm-ups were randomized at the beginning of testing session and all conditions were completed in one visit. Subjects performed a self-selected warm up (instructed to simulate their on-deck warm up routine) with a normal weight (NW); 29oz, heavy (HW); 45oz or light-weight (LW); 13oz bat immediately following 5 maximal bat swings using a normal weight bat. Following each condition a 3mins washout/rest period was given prior to the following condition. This wash out/rest period allows adequate time decreased fatigue between conditions. Each swing in conditions was analyzed to assess swing kinematics and bat speed using Vicon Nexus Software. The swing with the highest motion capture clarity was used for analysis of the trajectory and velocity of a marker placed on the most distal portion of the bat.

**RESULTS:** A 1x3 repeated measures analysis of variance was used to analyze mean differences. There were no significant ( $p > .1$ ) differences in maximal bat swing velocity following NW (56.97 ± 14.82mph), LW (48.34 ± 20.47mph) and HW (51.22 ± 22.70mph).

**CONCLUSIONS:** These results indicate that warming up with different weighted bats has no effect on bat swing velocity. However, there is a practical trend that supports previous research that HW warm-up demonstrates a decreased bat velocity compared to NW warm-up. Considering the current data is 3D, it may be considered to be a more precise estimate of bat swing velocity, which also supports the 2D linear velocity that has previously been investigated. Further research investigating the time point of maximum bat swing velocity during the swing should be performed to see if the warm-up bat has any influence on the joint mechanics rather than just bat velocity.

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**2268** Board #314 MAY 31 9:00 AM - 10:30 AM

**Influence of Twelve Second Pitching Interval Time on Muscle Damage and Inflammation in Baseball Pitcher**

Sun Chin Yang<sup>1</sup>, Chia-Chi Wang<sup>2</sup>, Yu-Chung Lee<sup>3</sup>, Kuei Hui Chan<sup>4</sup>, Chia-Hua Kuo, FACSM<sup>5</sup>. <sup>1</sup>Shih-Hsin university, Taipei, Taiwan. <sup>2</sup>National Taiwan Sport University, Tao-Yuan county, Taiwan. <sup>3</sup>Vanung University, Tao Yuan County, Taiwan. <sup>4</sup>National Taiwan Sport University, Tao Yuan County, Taiwan. <sup>5</sup>Taipei Physical Education College, Taipei, Taiwan. (Sponsor: Chia-Hua Kuo, FACSM)

(No relationships reported)

**PURPOSE:** To investigate the reaction of 12 sec pitching interval on baseball pitcher's muscle damage and inflammatory cytokine markers in a simulate game.

**METHODS:** Eight baseball pitchers were recruited form an excellent university baseball team. Subjects participated a simulate game that pitching interval time was 12 sec, 15 pitching per inning for 7 innings and the rest time between inning was 5 minutes. Venous blood were drawn on pre-game, post-game and days 1, 2, and 3 after-game to measure the activity of CK, LDH as well as the concentration of IL-1 $\beta$ , IL-6, TNF- $\alpha$  and IL-10. Parametric data were analyzed using repeated-measures ANOVA.

**RESULTS:** Activity of CK was elevated significantly on post-game (205.75±23.05 U/l) ( $p < .05$ ) and peaked value was on day 1 (348.87±83.59) after-game ( $p < .05$ ) and then gradually decreased on days 2 and 3, but day 2 was still significant higher than pre-game. Activity of LDH was elevated significantly on day 1 (185.38±32.74 U/l) and then close to value of pre-game on day 2 and 3. IL-1 $\beta$  reminded steady during post-game period. In contrast, IL-6 was elevated significantly on the end of post-game (3.30±1.61 pg/ml) ( $p < .05$ ) and had no significant difference on day 2 and 3. TNF- $\alpha$  was elevated significantly on day 1 (4.05±0.29 pg/ml) and 2 (3.90±0.26 pg/ml) after-game ( $p < .05$ ) and then close to value of pre-game on day 3. IL-10 was elevated significantly on post-game (6.67±0.88 pg/ml) and days 1 (7.15±1.18 pg/ml) and 2 (6.14±0.99 pg/ml) after-game ( $p < .05$ ).

**CONCLUSION:** Twelve sec pitching interval for 7 innings induced significant muscle damage and inflammation reaction, but returned the baseline on days 3 after-game.

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**2269** Board #315 MAY 31 9:00 AM - 10:30 AM

**Physiological Indexes of Fitness between Aboriginal and non-Aboriginal College Baseball Players**

Yi-Tzu Chen, Li-Lan Fu, Pei-Fan Wang, jung-Tang Kung. *National Taiwan Sport University, Taoyuan, Taiwan.*

(No relationships reported)

**PURPOSE:** The purpose of this study was to compare various physiological indexes of fitness between aboriginal and non-aboriginal college baseball players of a treadmill incremental maximal test.

**METHOD:** Ten aboriginal (Ab) (ht: 180.40 ± 3.13 cm, wt: 81.70 ± 10.85 kg, age: 19.20 ± 1.13 yrs) and 27 non-aboriginal (nAb) (ht: 177.97 ± 4.79 cm, wt: 77.07 ± 10.08 kg, age: 19.69 ± 1.13 yrs) healthy college baseball players participated in this study. Treadmill (COSMED) and indirect calorimetry (SensorMedics, Vmas 29) were used during maximal exercise test and calculation of physiological indexes of fitness. Finger-tip blood samples were collected right before and after exercise, and then analyzed (Biosen C\_Line Analysers). Unpaired t-test and two-way ANOVA were used for significant differences calculation ( $\alpha = 0.05$ ).

**RESULTS:** Ab have significantly lower  $VO_{2Max}$  (Ab: 48.53 ± 5.62 mL·min<sup>-1</sup>·kg<sup>-1</sup>; nAb: 54.21 ± 4.82 mL min<sup>-1</sup>·kg<sup>-1</sup>,  $p = 0.00$ ) and significantly higher post-exercise Lac (Ab: 14.33 ± 3.31 mmol·L<sup>-1</sup>; nAb: 11.35 ± 2.24 mmol·L<sup>-1</sup>,  $p = 0.00$ ) compared to nAb. But total exercise time, HR<sub>Max</sub>, VE, and post-exercise Glu were not significantly different between Ab and nAb.

**CONCLUSION:** Ab group have significantly lower  $VO_{2Max}$  and higher post-exercise Lac than nAb. Possible underlining mechanism could be related to the different performance of anaerobic metabolic pathway, which caused the higher post-exercise Lac after exercise test.

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**2270** Board #316 MAY 31 9:00 AM - 10:30 AM

**Total Touch Height in Football Performance Testing: A Case for Practicality**

Cole M. Thompson, Brian J. Campbell. *University of Louisiana at Lafayette, Lafayette, LA.*

(No relationships reported)

Performance testing in football might suggest how fast a player can run (40-yard dash), the upper/lower body strength (1 rep max), or the agility of a player (pro-agility test). Most coaches would assume that traditional vertical jump (TVJ) testing suggest how high a player can jump. TVJ assesses the relative power of an athlete, but does not measure how high a player can reach. Thus total touch height (TTH) is a more practical test for coaches to assess how high an athlete can jump. If a football is thrown up in the air, it's the player with the highest TTH that has the best chance to catch the ball, not necessarily the player with the best vertical jump.

**PURPOSE:** To determine a more practical test for assessing jumping ability in athletes.

**METHODS:** 58 college level football players (Age= 20.75± 1.13 years) served as subjects. Athletes were tested by an NSCA certified strenght coach and performed TVJ protocol using a Vertec<sup>TM</sup> apparatus. No step was given to the jumpers and the top score out of three trials was used for data collection. TTH data were calculated by adding the TVJ measure to the maximum standing reach measure. Peak anaerobic power (PAP) calculated from the TVJ test was then correlated to the more functional TTH measure.

**RESULTS:** PAP and TTH have a moderate correlation of (Pearson's  $r = .469$ ,  $p < .001$ ).



**CONCLUSIONS:** The 78% unexplained relationship of PAP to TTH confirmed that TVJ does not sufficiently explain how high a player can jump. The lack of a strong correlation confirmed the use of separate tests for either TVJ Power or TTH. TTH does not only prove to be more practical, but also more cost efficient. Measuring how high an athletic can jump can simply be done with a pre-measured wall and chalk on the subjects' finger tips.

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2271 Board #317 MAY 31 9:00 AM - 10:30 AM

**Changes in Body Mass and Absolute and Relative Bench Press, Squat and Leg Press Strength in NCAA Division I Football players**

Jerrold C. Grace<sup>1</sup>, Ali Boolani<sup>2</sup>. <sup>1</sup>Tennessee State University, Nashville, TN. <sup>2</sup>Oklahoma City University, Oklahoma City, OK.

(No relationships reported)

**PURPOSE:** The purpose of this study was to determine whether there were changes in body mass (BM) and absolute and relative bench press (BP), squat (SQ), and leg press (LP) strength over the course of 3 years in NCAA Division I football players. **METHODOLOGY:** Collegiate football players (N=29, age= 18-24) were tested yearly for BW, 1 repetition max (RM) on BP, SQ and LP. Data was collected over 3 years in March, approximately 3 months after the end of the college football season. A Repeated Measures ANOVA was used to analyze results. Post-hoc data was analyzed using paired t-tests.

**RESULTS:** Repeated measures ANOVA indicated significant differences in BW (p<.001), BP (p<.001), BP/BM ratio (p<.001), SQ (p<.003), SQ/BM ratio (p<.017), LP (p<.001), LP/BM ratio (p<.001). Post-hoc analysis yielded a significant increase from year 1 to 2 in BM (p<.001), BP (p<.001), SQ (p<.001), SQ/WT (p<.001), LP (p<.001), LP/WT (p<.001). There was no significant increase in BP/WT from year 1 to 2 (p=.280). There was a significant decrease in BM from year 2 to 3, but there was a significant increase in BP (p<.001), BP/WT (p<.001), SQ (p<.001), SQ/WT (p<.001), LP (p<.001), LP/WT (p<.001).

**CONCLUSION:** Significant increases in BM, absolute BP, SQ and LP and relative in SQ and LP in the first year indicate increased muscle mass and an adaptation to the strength and conditioning program at the university. This may be attributed to a change in diet, increased muscle mass and increased neural adaptation to strength training. Second year decrease in BM and increase in absolute and relative BP, SQ and LP might be attributed to decreased body fat percentages and improved tissue quality.

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2272 Board #318 MAY 31 9:00 AM - 10:30 AM

**Testosterone And Cortisol With Relation To Mood State In Professional Spanish Basketballers**

Xavi Schelling i del Alcázar<sup>1</sup>, Julio Calleja-González<sup>2</sup>, Nicolás Terrados Cepeda<sup>3</sup>, Jeffrey M. Mjaanes<sup>4</sup>, Holly J. Benjamin, FACSM<sup>5</sup>. <sup>1</sup>Basquet Manresa, Barcelone, Spain. <sup>2</sup>Faculty of Physical Activity and Sport Sciences. UPV-EHU, Vitoria, Spain. <sup>3</sup>University of Oviedo, Oviedo, Spain. <sup>4</sup>Rush University Medical Center, Chicago, IL. <sup>5</sup>University of Chicago, Chicago, IL.

(No relationships reported)

**PURPOSE:** To describe the trends in Total Testosterone (TT) and Cortisol (C) and their relation to mood state during a complete season in elite Spanish basketball players.

**METHODS:** We studied eleven male players of a professional basketball team (n=11; 27.4±6.3 years; 92±9.9 kg; 23.9±1.1 BMI). Samples were taken in the morning, in fasting state, every 4-6 weeks, after a 24-36 hour break following the last game played. Seven samples were collected since August to April from each player. Blood samples of preseason's 1<sup>st</sup> day was considered as baseline. POMS (*Profile of Mood States*) test was performed at the laboratory waiting room before every blood extraction.

**RESULTS:** TT concentration showed significant variations between blood samples: September Vs. August (+2.6 nMol/l, p=0.027). In October TT correlated with POMS' s Total Punctuation (PT) (R=0.685; p=0.029), Tension (R=0.634; p=0.049) and Aggressivity (R=0.669; p=0.034). C concentration and TT/C ratio did not show significant variations during the season. In November C correlated with PT (R=-0.846; p=0.001), Tension (R=-0.676; p=0.022), Depression (R=-0.814; p=0.002) and Confusion (R=-0.715; p=0.013). TT/C ratio correlated in October with PT (R=0.765; p=0.010), Tension (R=0.817; p=0.004), Depression (R=0.709; p=0.022) and Aggressivity (R=0.843; p=0.002); and in November with PT (R=0.685; p=0.020), Tension (R=0.611; p=0.046) and Depression (R=0.745; p=0.008).

**CONCLUSIONS:** The physiologic effect of playing professional level basketball is reflected by total testosterone concentrations and mood state. Preseason phase is the one which implies the most significant hormonal and psychological variations, where the total testosterone increases may show an anabolic state. POMS reflects better current stress than fatigue state. Therefore, testosterone could be an indicator of the athlete's physiologic state and may serve as a future clinical marker for preventing overload or overtraining states. POMS, on the other hand, can help to evaluate the psychological stress level of players.

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2273 Board #319 MAY 31 9:00 AM - 10:30 AM

**Comparison of Physical Performance and Muscle Imbalances of First and Second Division Spanish Basketball Teams**

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(No relationships reported)

Many basketball teams coach their young players with the aim that some of them will play on the first league's team. There is little information in the literature that compares muscular imbalances and physical performance between 1<sup>st</sup> and 2<sup>nd</sup> division leagues.

**PURPOSE:** To describe the differences in physical performance and muscular imbalances of male basketball players of 1<sup>st</sup> and 2<sup>nd</sup> division Spanish leagues.

**METHODS:** Twelve 1<sup>st</sup> division and twelve 2<sup>nd</sup> division Spanish professional basketball players (age: 30.2 ± 3.1 and 22.7 ± 5.1 yr, BMI: 24.1 ± 1.3 and 23.3 ± 1.4 m·kg<sup>-2</sup>) carried out muscular imbalance and physical performance tests. Stabilometry (normality <20% error) and Isokinetic knee (high imbalance: H<sub>CON</sub>/Q<sub>CON</sub> and H<sub>ECC</sub>/Q<sub>CON</sub> = mean-1SD, bilateral imbalance = mean+1SD) tests were measured on the first day. Peak power in leg press and jump tests (CMJ, CMJas, 3-CMJ and 5-RJ) were measured on the second day. Results were compared by an equal or unequal variance Student's t-test for unpaired data after a F-test. Statistical significance was set at p<0.05.

**RESULTS:** No differences were observed neither in Stabilometry for both right and left legs nor in the Isokinetic test (concentric and eccentric peak force, H<sub>CON</sub>/Q<sub>CON</sub> and H<sub>ECC</sub>/Q<sub>CON</sub>) within and between teams. A higher H<sub>CON</sub>/Q<sub>CON</sub> (61.8 ± 12.2 vs. 50.8 ± 7.9%, p<0.05) and H<sub>ECC</sub>/Q<sub>CON</sub> (91.0 ± 15.9 vs. 66.0 ± 7.8%, p<0.001) in right leg for 2<sup>nd</sup> vs. 1<sup>st</sup> team was observed. Players' frequency in high levels of imbalance was similar on 1<sup>st</sup> vs. 2<sup>nd</sup> team (H<sub>CON</sub>/Q<sub>CON</sub>, H<sub>ECC</sub>/Q<sub>CON</sub> and bilateral deficit). Force and load to achieve peak power in leg press were higher on 1<sup>st</sup> vs. 2<sup>nd</sup> team (2986 ± 382 vs. 2270 ± 332 N, 276 ± 36 vs. 212 ± 29 kg, p<0.01). There were not significant differences neither in speed nor in power although the latter one was higher for 1<sup>st</sup> team (1235 ± 122 vs. 1046 ± 207 W). There were no differences in height neither CMJ nor CMJas between teams; peak power and force on 1<sup>st</sup> team were higher than on 2<sup>nd</sup> team for both CMJ (4747 ± 130 vs. 4224 ± 582 W, p<0.05; 2538 ± 313 vs. 1897 ± 380 N, p<0.01) and CMJas (8625 ± 786 vs. 5083 ± 1007 W, p<0.001; 2682 ± 342 vs. 2048 ± 464 N, p<0.05), despite no differences in body mass. There were no significant differences in 3-CMJ and 5-RJ between teams.

**CONCLUSION:** Muscular imbalances were similar between both teams. 1<sup>st</sup> team showed higher levels of strength and power than 2<sup>nd</sup> team.

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2274 Board #320 MAY 31 9:00 AM - 10:30 AM

**Seasonal Progression in Fitness Variables in Elite Junior Basketball Players**

Julio Calleja-Gonzalez. Faculty of Sport Sciences. University of the Basque Country, Vitoria, Spain. (Sponsor: Holly Benjamin, FACSM)

(No relationships reported)

**PURPOSE:** Tests of athletic performance are widely used in team sports to assess the progression of various fitness characteristics in players over the course of a season. However, no scientific data exists analyzing these parameters in top level junior players.

The aim of the present study was to evaluate seasonal variation in anthropometric and physiological variables, and identify differences between the first and reserve team in the elite Spanish junior basketball players.

**METHODS:** Fifteen top-level junior male players (Spanish National Junior team) (mean  $\pm$  SD), age ( $17 \pm 0$  years), height ( $197.0 \pm 4.4$  cm), body mass ( $88.9 \pm 8.3$  kg) participated in this study. All the players completed the same training program (5 h per day, four years). The subjects were divided into two different categories: first team player (FT) ( $n=7$ ) and reserve team player (RT) ( $n=8$ ). Four times during the season (Sep., Dec., March and June) each player performed lower-limb power test, course Navette (60 yard shuttle run) test (CN) and explosive arm strength test (SEAT). In addition anthropometrical data were recorded.

**RESULTS:** No significant changes were observed in body composition. At the end of the training program the values were: [ABK:  $49.2 \pm 7.5$  Vs.  $57.7 \pm 6.5$  cm;  $46.3 \pm 10.0$  Vs.  $56.1 \pm 4.4$  cm]; [HJ:  $2.14 \pm 0.3$  Vs.  $2.18 \pm 0.4$  m;  $2.01 \pm 0.3$  Vs.  $2.59 \pm 0.4$  m]; [CN:  $11.9 \pm 1.6$  Vs.  $12.5 \pm 1.4$  ppliers;  $11.6 \pm 1.6$  Vs.  $12.9 \pm 1.4$  ppliers]; [SEAT:  $7.0 \pm 0.7$  Vs.  $7.6 \pm 0.8$  m;  $7.3 \pm 0.7$  Vs.  $7.8 \pm 1.2$  m], FT and RT respectively. Significant pre- and post-training intra-group increases in maximum speed, strength and endurance were noted ( $P<0.05$ ).

**CONCLUSIONS:** The progression of both groups during the season was quite similar, with no significant differences in any anthropometric or physiological variables between them. At the end of the season and close to the international championship all players got the best results. All players obtained the best results towards the end of the season.

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**2275** Board #321 MAY 31 9:00 AM - 10:30 AM  
**Specific Short-sprint Assessment For Beach Volley Defensive Actions**

Bernat Buscà<sup>1</sup>, David Alique<sup>2</sup>, Cristofol Salas<sup>3</sup>, Raül Hileno<sup>3</sup>. <sup>1</sup>Ramon Llull University, Barcelona, Spain. <sup>2</sup>National Institute of Physical Education of Catalonia, Barcelona, Spain. <sup>3</sup>National Institute of Physical Education of Catalonia, Lleida, Spain.  
(No relationships reported)

Defensive actions are one of the most important phases for scoring in beach volleyball. Team tactics and individual decision making are both decisive to get advantage in the rally but these decisions are conditioned for short-sprint ability on the sand. The specificity of these movements in this particular surface requires an appropriated assessment method.

**PURPOSE:** To design and report reliability and validity of a new method for assessing defensive displacements called Short-Sprint Ability Beach Volleyball Test (SSABVT).

**METHODS:** Seventeen sub-elite beach volleyball players ( $29 \pm 6$  yrs;  $1.85 \pm 0.09$  m height;  $78.56 \pm 13.44$  kg weight) were assessed for short-sprint and jump ability on the beach volleyball court (three trials each test). The sprint test consisted in sprinting to the net in diagonal, departing from the center of the court (Velleman PMD10 @ light gates were used to switch on the timing Chronojump Bosco System ®), touch a contact sensor situated at 4 m in diagonal, coming back to the starting point and continue sprinting to the other touch sensor located on the opposite corner, and finally return to the starting point (final test time). The jump test consisted in performing a counter movement jump (CMJ) on a rigid surface. Coefficient of variation (CV) was calculated and Pearson product-moment correlation was used to compare short-sprint ability and jump ability. We also used a t-test to determine the difference of the mean between regional (RP) and national (NP) ranked players.

**RESULTS:** CV was less than 2% in both tests. Significant correlations were found between SSABVT time and CMJ flight time ( $r=-0.81$ ;  $p<0.05$ ). The NR players needed 0.26 sec less ( $p<0.01$ ) than RP in SSABVT and jumped 0.036 sec more ( $p>0.05$ ) than RP.

**CONCLUSION:** SSABVT constitute a reliable and valid test for short-sprint ability assessment on the sand court. NR players perform significantly better the specific sprints on the sand than RP, but not the CMJ.

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**2276** Board #322 MAY 31 9:00 AM - 10:30 AM  
**Load On Lower Extremities During Landing After An Offensive Stroke In Volleyball (case Study).**

David Zahradnik<sup>1</sup>, Dan Jandacka<sup>1</sup>, Jaroslav Uchytíl<sup>1</sup>, Roman Farana<sup>1</sup>, Martin Zvonar<sup>2</sup>. <sup>1</sup>Pedagogická fakulta Univerzita Ostrava, Ostrava, Czech Republic. <sup>2</sup>Fakulta sportovních studií Masarykova univerzita, Brno, Czech Republic.  
(No relationships reported)

**PURPOSE:** The knee joint is the most overloaded joint in volleyball where the number of landings and the magnitude of the reaction force of the pad represent limitary factors in the occurrence of knee injuries. The aim of the study was to compare the reaction force of the pad and the loading rate generated during a bilateral landing after an offensive stroke in relation to the type of the pass.

**METHODS:** One highest-level male volleyball player (aged 38; height 194 cm; weight 94 kg; 20 years experiences of playing highest-level volleyball) from the Czech Republic participated in this study. The experimental positioning was based on a real situation of an offensive stroke in a match. Two dynamometric platforms were built in the floor in the area of the landing and eight infrared cameras for kinematic analysis were installed in a circle around the net. Mean values and standard deviations of selected dynamic and kinematic movement parameters were calculated. Subsequently, the pairing T-test was used. The objective significance was evaluated according to the index of effect of size.

**RESULTS:** Statistically significant differences were found in the length of the last step before the bounce (m) and the horizontal movement of the left leg after the bounce (m), in the maximum values of the anteroposterior reaction force of the pad (BW), in the times for reaching the maximum values of the reaction forces of the pad (s), in the loading rate in the vertical and sagittal direction (BW/s) on the right lower extremity in favor of the landing after a quick pass ( $P \leq 0.05$ ).

**CONCLUSIONS:** The load on lower extremities from the point of the reaction forces of the pad and the loading rate was greater in the quick pass.

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**2277** Board #323 MAY 31 9:00 AM - 10:30 AM  
**Using a Vertical Jump as Monitoring Purpose of Resistance Training Progress for Women's Volleyball**

Chieh-Ying Chiang, Timothy McInnis, Kimitake Sato. East Tennessee State University, Johnson city, TN.  
(No relationships reported)

Strength is the ability to generate muscle force. Athletes who have higher strength generate higher power output. Intensive resistance training can improve strength and power, and monitoring progression is a vital component of the athletes' development. The efficacy of measuring force output as part of a monitoring program during intensive resistance training period needs to be established.

**PURPOSE:** To monitor women's volleyball team's off-season strength training protocol by periodically measuring the peak force output during squat jumps.

**METHODS:** Nine collegiate women's volleyball players participated in the study during their off-season (age:  $21.3 \pm 1.4$  yrs, height:  $179.4 \pm 8.6$  cm, mass:  $67.4 \pm 4.6$  kg). They reported to the laboratory for initial squat jump (SJ) test to measure peak force output prior to their off-season resistance training program. Then they underwent a 4 days/wk resistance training program for 10 weeks. To monitor progress, the athletes performed SJ bi-weekly to measure the peak force (total 5 tests). The statistical analysis was performed to identify whether the peak forces over 6 testing sessions to be similar or not. The peak force output from each player was tracked and analyzed using repeated-measure ANOVA to see if there is any difference ( $p = 0.05$ ).

**RESULTS:** The repeated-measures ANOVA was calculated comparing peak force output over six times: from initial test to the 10th week. A significant difference was found ( $F(5,40)=3.52$ ,  $p < 0.01$ ) with effect size of .301. Follow-up t tests revealed that the peak force output increased significantly from initial test to week 6, week 8, week 10, and from week 2 to week 8.

**CONCLUSION:** The peak force value increased gradually to show some improvement from the resistance training. Monitoring athlete performance is essential to maximize performance and prevent excessive fatigue or overtraining. Peak force output from SJ on a force plate is a quick and seemingly relevant test to monitor athletes' physical status. Although this study was based around off season training, this monitoring program could also be employed during in-season training when fatigue management and performance maintenance is the most important. Monitoring data could also be used by strength and conditioning professionals to design periodized programs.

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**2278** Board #324 MAY 31 9:00 AM - 10:30 AM  
**Evaluating Division I Collegiate Ice Hockey Players Using Preseason Fitness Characteristics and Game Performance**

Christopher P. Connolly, James M. Pivarnik, FACSM, Kimberly Maier, Adam Nightingale, Michael Vorkapich. Michigan State University, East Lansing, MI.  
(No relationships reported)

Preseason fitness testing has been shown to predict game performance in Division I collegiate ice hockey players. Although the plus/minus (+/-) system has been examined previously as a measure of game performance, individualized scoring chance assessments have not been investigated.

**PURPOSE:** To determine whether preseason fitness predicts game performance among collegiate hockey players.

**METHODS:** Testing was performed on members of a Division I collegiate men's ice hockey team over two consecutive seasons (season 1, n=19; season 2, n=20). Overall team performance resulted in 7 wins, 17 losses, and 4 overtime losses for the first season and 14 wins, 8 losses, and 6 overtime losses for the second season. Participants included forwards and defensemen who played at least half (14) the conference games each season. Preseason fitness variables consisted of % body fat, chin-ups, bench press, leg press, off-ice sprinting, and treadmill aerobic capacity. Game performance was assessed for each athlete in the form of +/- score and primary scoring chances, which were determined by a member of the hockey coaching staff. Median split was used to categorize players into high and low performance groups by both +/- score and scoring chances. Differences in preseason values between the performance groups were analyzed using one-way analysis of variance.

**RESULTS:** The median +/- scores for season 1 and season 2 were -9.5 (range -22 to +2) and -1 (range -5 to +11). Median scoring chances for season 1 and season 2 were 10 (range 2 to 28) and 15.5 (range 0 to 41). In season one, chin-up score was significantly higher ( $p=0.01$ ,  $ES=0.26$ ) in the high performance group as determined by scoring chances. In season two, the percentage of maximum blood lactate at the fourth stage of the incremental treadmill test was significantly lower in the low performance group as determined by scoring chances ( $p=0.021$ ,  $ES=0.23$ ). No other significant differences were found in preseason fitness measures between performance groups.

**CONCLUSIONS:** Further testing is needed to determine how overall team performance affects the relationship between preseason exercise and fitness testing and game performance among Division I collegiate hockey players.

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**2279** Board #325 **MAY 31** **9:00 AM - 10:30 AM**  
**Time Motion Analysis of Varsity Ice Hockey**

Gordon J. Bell, Alex Game, Jessie Gill, Ben Davis, Pierre Gervais, Gary Snyder. *University of Alberta, Edmonton, AB, Canada.* (Sponsor: Darren Delorey, FACSM)  
(No relationships reported)

Ice hockey has evolved to become more physically demanding and played at a higher intensity than in the past. However, a time motion analysis (TMA) of various movements performed during a varsity ice hockey game has not been reported.

**PURPOSE:** The purpose of this study was to determine the frequency and time spent performing different movement patterns during an ice hockey game.

**METHODS:** A convenient sample of 18 male varsity ice hockey players belonging to the same team agreed to participate. The mean ( $\pm$ SD) age, height and body mass of the players was:  $22\pm 1$  yrs;  $179.7\pm 6.3$  cm; and,  $84.3\pm 6.7$  kg, respectively. A digital camera (GoPro<sup>®</sup> Hero; 720p, 60fps) was mounted to the arena wall and was used to videotape an in-season game. The video files were downloaded and analyzed using Dartfish computer software. Three categories of movements (forward, backward and other) were separated into 9 different movement activities.

**RESULTS:** Forwards and defensemen had a mean shift time of 53 and 54s, respectively. The mean frequency of movements per shift and mean time per movement (in brackets;  $\pm$ SD) during a complete ice hockey game for centers was: forward gliding = 7.7 (4.9 $\pm$ 3.6s); moderate intensity forward skating = 4.7 (1.6 $\pm$ 1.0s); high intensity forward skating = 0.2 (3.4 $\pm$ 1.5s); backward gliding = 0.6 (1.5 $\pm$ 1.2s); struggling for the puck or position = 1.2 (1.7 $\pm$ 0.8s); and standing occurred 1.9 (1.8 $\pm$ 1.4s) times per shift. Forwards: forward gliding = 7.3 (4.3 $\pm$ 3.3s); moderate intensity forward skating = 4.6 (1.8 $\pm$ 1.0s); high intensity forward skating = 0.2 (3.3 $\pm$ 1.2s); backward gliding = 0.8 (1.9 $\pm$ 1.0s); backward moderate skating = 0.1 (1.9 $\pm$ 0.3s); struggling for the puck or position = 0.6 (1.6 $\pm$ 1.0s); and standing occurred 1.4 (2.1 $\pm$ 1.6s) times per shift. Defense: forward gliding = 6.9 (4.1 $\pm$ 2.9s); moderate intensity forward skating = 2.3 (1.5 $\pm$ 0.6s); high intensity forward skating = 0.1 (3.2 $\pm$ 1.0s); backward gliding = 3.4 (2.8 $\pm$ 1.7s); backward moderate skating = 0.1 (1.8 $\pm$ 0.7s); struggling for the puck or position = 0.5 (1.3 $\pm$ 0.7s); and standing occurred 2.9 (2.2 $\pm$ 2.0s) time per shift.

**CONCLUSION:** Time motion analysis of a varsity ice hockey game revealed that the movement activities performed by players varied in time and depended on player positions. High intensity movements were least frequently performed and for shorter periods of time.

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**2280** Board #326 **MAY 31** **9:00 AM - 10:30 AM**  
**Fitness Level of Professional Hockey Players**

Paul Hafen, Cody Bremner, Jon Garcia, Tedd Girouard, Lawrence A. Golding, FACSM, Stephen Harris, Michael Jarrett, Hanaa Shaheen, Kimberly Trocio, Antonio S. Santo. *University of Nevada, Las Vegas, Las Vegas, NV.*  
(No relationships reported)

**PURPOSE:** The primary purpose of this study was to describe the physiological profile of members of the same professional hockey team.

**METHODS:** 21 professional hockey players (mean age =  $25.15 \pm 1.49$  years) reported to our laboratory in order to test body composition, VO<sub>2</sub>max, and heart rate data.

**RESULTS:** The mean height, weight, body fat percent and lean body mass (LBM) of the hockey players was  $181.85 \pm 5.79$ cm,  $88.99 \pm 6.43$ kg,  $13.19 \pm 4.12\%$ , and  $75.13 \pm 14.98$ kg, respectively. The VO<sub>2</sub>max running test resulted in an observed mean of  $61.55 \pm 6.7$  ml/kg/min. Resting Heart Rate for the group was  $68.28 \pm 9.97$  beats per minute (bpm), with a maximum recorded heart rate during the VO<sub>2</sub>max test of  $188.14 \pm 6.81$ bpm.

**CONCLUSION:** This study provides an interesting view into the profile of an entire, professional hockey team. Because the team is divided drastically based upon position played, it would be valuable insight to those interested in athletic profiles to also seek out possible studies involving positional profiling and perhaps data throughout the different training cycles.

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**2281** Board #327 **MAY 31** **9:00 AM - 10:30 AM**  
**Isokinetic Strength and Anaerobic Capacity in Collegiate Male Lacrosse Players**

Yosuke Tsuchiya, MSc<sup>1</sup>, Keishoku Sakuraba, MD, PhD<sup>2</sup>, Kenta Wakamatsu, MSc<sup>2</sup>, Eisuke Ochi, PhD<sup>3</sup>, Inkwan Hwang, PhD<sup>1</sup>. <sup>1</sup>*Nippon Sport Science University, Tokyo, Japan.* <sup>2</sup>*Graduate School of Medicine, Juntendo University, Tokyo, Japan.* <sup>3</sup>*Meiji Gakuin University, Tokyo, Japan.*  
(No relationships reported)

Although previous studies have shown to investigate physiological characteristics of major sports players such as soccer and football, those of lacrosse players are limited. Since lacrosse includes three playing positions, position-specific characteristics of players need to be explored for their training and conditioning.

**PURPOSE:** The purpose of this study was to investigate isokinetic strength and anaerobic capacity in collegiate male lacrosse players.

**METHODS:** Subjects were 33 male Japanese lacrosse players (age:  $21.5 \pm 1.3$  years, height:  $173.1 \pm 5.1$  cm, body mass:  $65.6 \pm 6.5$  kg). They were divided into three groups on the basis of their positions: attacker (AT; n = 11), defender (DF; n = 10), and midfielder (MF; n = 12). All subjects were measured in body composition (height, body mass, body fat, and lean body mass), isokinetic strength (elbow/knee extension and flexion), and cycling power output (peak power, PP; 30-sec Wingate anaerobic power, WAnP; intermittent power, IP).

**RESULTS:** No significant difference in height, body mass, body fat and lean body mass was found between the three groups. The isokinetic strength of knee flexion was significantly higher in the DF (60 deg/sec:  $1.62 \pm 0.20$  vs.  $1.35 \pm 0.20$  Nm/kg,  $p < 0.05$ ; 180 deg/sec:  $1.31 \pm 0.31$  vs.  $1.10 \pm 0.17$  Nm/kg,  $p < 0.05$ ) and MF groups (300 deg/sec:  $1.18 \pm 0.23$  vs.  $0.96 \pm 0.15$  Nm/kg,  $p < 0.05$ ) than in the AT group. PP was significantly higher in the MF group than in the AT group ( $13.51 \pm 1.31$  vs.  $12.40 \pm 0.76$  watts/kg,  $p < 0.05$ ), and cycling power output was significantly higher in the MF group than in the AT (WAnP:  $9.36 \pm 0.35$  vs.  $8.75 \pm 0.39$  watts/kg,  $p < 0.01$ ; IP:  $102.9 \pm 4.4$  vs.  $97.2 \pm 4.4$  watts/kg,  $p < 0.01$ ) and DF groups (WAnP:  $9.36 \pm 0.35$  vs.  $8.79 \pm 0.52$  watts/kg,  $p < 0.01$ ; IP:  $102.9 \pm 4.4$  vs.  $96.0 \pm 6.6$  watts/kg,  $p < 0.01$ ).

**CONCLUSIONS:** The present results suggest that players at the MF position have better anaerobic capacity than those at the DF and AT positions. In addition, players at the MF and DF positions have better muscle strength than those at the AT position. On the basis of these findings, we conclude that lacrosse players require different physiological abilities depending on their position.

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2282 Board #328 MAY 31 9:00 AM - 10:30 AM

**Physiologic Profile of National Champion Cheerleaders**

Judy R. Wilson, FACSM, Rolando J. Aviles, Angela Dougall. *University of Texas @ Arlington, Arlington, TX.*

*(No relationships reported)*

**INTRODUCTION:** Cheerleading involves the performance of skills requiring a high degree of muscular strength, endurance, flexibility, balance, and determination. Despite the trend of cheerleaders performing increasingly difficult and athletic skills, very little is known about their physiological fitness levels.

**PURPOSE:** The purpose of the study was to create a physiologic profile of the fitness status of male and female collegiate cheerleaders.

**METHODS:** Eight females (age:  $19.4 \pm 1.1$  yrs; ht:  $156.3 \pm 6.9$  cm; wt:  $55.3 \pm 8.6$  kg) and four males (age:  $24.2 \pm 2.6$  yrs; ht:  $182.8 \pm 9.9$  cm; wt:  $83.4 \pm 10.6$  kg) volunteered to participate in this study. Each subject completed a treadmill test to maximal oxygen levels using the Bruce Protocol, Hydrostatic weighing, and a Wingate Anaerobic Test (WAnT) on a cycle ergometer.

**RESULTS:** Maximal oxygen consumption for the males was  $47.9 (\pm 1.1)$  ml/kg/min and  $40.9 (\pm 6.1)$  ml/kg/min for the females. Absolute values were  $4.3 (\pm 0.1)$  L/min for males and  $2.3 (\pm 0.4)$  L/min for the females. The maximal heart rates achieved were  $204.7 (\pm 13.6)$  bpm for the males and  $191.2 (\pm 4.9)$  bpm for females. It was determined that the percent body fat for the males was  $9.2 (\pm 5.8\%)$  and  $16.0 (\pm 4.6\%)$  for the females. The findings for the WAnT indicated a mean power of  $8.625 (\pm 0.8)$  W/kg for the males and  $7.23 (\pm 0.69)$  W/kg for the females with peak power of  $14.9 (\pm 2.57)$  W/kg and  $11.34 (\pm 2.18)$  W/kg, respectively.

**CONCLUSION:** When compared to norms from the ACSM's Guidelines for Exercise Testing and Prescription 8th ed (2010), the relative maximal oxygen consumption was above the 70th percentile for males and above the 65th percentile for females for the 20 to 24 year old. According to norms for 18-25 year old (Nieman, 2007) the results for the WAnT placed 10 of 12 subjects in this group of cheerleaders in the elite category for both peak and mean power/kg. This physiological profile of the fitness level of cheerleaders suggests that the ability to generate power is developed to a greater extent than aerobic fitness.

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2283 Board #329 MAY 31 9:00 AM - 10:30 AM

**The Effects of Vision Training on Softball Performance**

Britany Tallhammer<sup>1</sup>, Michael J. Ryan<sup>1</sup>, Katie Burgess<sup>1</sup>, Paul Reneau<sup>1</sup>, Randy Bryner<sup>2</sup>. <sup>1</sup>*Fairmont State University, Fairmont, WV.* <sup>2</sup>*West Virginia University, Morgantown, WV.* (Sponsor: Stephen Alway, FACSM)

*(No relationships reported)*

While it is consistently agreed upon that superior vision is desirable for sports participation, the efficacy of vision training continues to be debated.

**PURPOSE:** The purpose of this study was to determine if a 5-week program of vision training, designed to train saccades, accommodation, vergence of the eye, hand eye coordination and peripheral vision, enhanced skills related to softball in a group of female collegiate softball players.

**METHODS:** Sixteen healthy softball athlete's age (18-22 years), from a Division II collegiate setting were randomly assigned into treatment or control groups. Treatment consisted of 20 sessions of vision training conducted over five weeks. Eye training was conducted following a specific program using equipment from the Eye Metrix, Inc (Maryland Heights, MO, USA) with exercises changing every session. The subjects from the control group did not participate in any vision training. All subjects maintained their usually softball practice schedule. Study design was a 2 x 2 factorial with group (experimental group and control group), and time (pre- and post- testing). The dependent variables included colored line perception test and background alteration, vertical saccades, horizontal saccades and hand eye coordination/peripheral vision assessment. The testing and training occurred at Fairmont State University in the Feaster Center.

**RESULTS:** There was a significant group by test interaction for all measures involving saccades and accommodation and vergence with the experimental group improving on all visual dependent variables. There were no significant differences between groups in the ability of players to hit balls colored with different lines. Softball players scored significantly higher ( $p \leq 0.05$ ) in their ability to hit balls coming at them with a red background. However, no difference was observed using either a black or green background.

**CONCLUSIONS:** Although eye training significantly improved visual characteristics in a group of collegiate female softball players, this improvement did not appear to translate into enhanced batting capabilities within laboratory conditions.

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2284 Board #330 MAY 31 9:00 AM - 10:30 AM

**Relationship Between Heart Rate Variability And Subjective Feeling Of Fatigue In Elite Badminton Players**

Taro Iizuka<sup>1</sup>, Mariko Nakamura<sup>1</sup>, Michihiro Kon<sup>1</sup>, Yoko Saito<sup>1</sup>, Natsumi Suzuki<sup>1</sup>, Kazumi Eguchi<sup>1</sup>, Joo Bong Park<sup>2</sup>, Kei Nakashima<sup>2</sup>, Rionny Mainaky<sup>2</sup>, Kanako Yonekura<sup>2</sup>, Keita Masuda<sup>2</sup>, Norio Imai<sup>3</sup>, Hideyuki Takahashi<sup>1</sup>. <sup>1</sup>*Japan Institute of Sports Sciences, Tokyo, Japan.* <sup>2</sup>*Nippon Badminton Association, Tokyo, Japan.* <sup>3</sup>*Japanese Olympic Committee, Tokyo, Japan.*

*(No relationships reported)*

Since it has been considered that prolonged fatigue has negative influence on maintaining physical condition, it would be essential for athletes to continuously monitor their state of physical fatigue. Although resting heart rate (HR) has long been recognized as an objective index of physical fatigue, recent studies suggest that heart rate variability (HRV) would be a better tool for monitoring a state of physical fatigue. To date, however, little is known whether measuring HRV would be efficient for elite athletes to monitor their state of physical fatigue.

**PURPOSE:** To examine the relationships between HRV indices and physical fatigue in elite athletes.

**METHODS:** Sixteen Japanese national badminton team players ( $23.2 \pm 2.9$  yrs) volunteered to participate in the study. Measurements were carried out during the national team training camps on two different days, each separated by three months. In each measurement, all data were collected in the morning just after the players' waking time. Beat-to-beat heart rate was recorded for five minutes under the controlled breathing of 15 breaths per minute. Frequency domain heart rate variability indices were obtained using spectral analysis. The spectral power in the low-frequency (LF: 0.04-0.15Hz) and the high-frequency (HF: 0.15-0.40Hz) bands were calculated. In addition, normalized units (LFnu and HFnu) were obtained. Whereas HF is known to represent parasympathetic activity, LFnu and HFnu represent an evaluation of the autonomic nervous system balance. The subjects were also asked to fill in a questionnaire in which they estimated their subjective feeling of fatigue on a visual analog scale.

**RESULTS:** There was a significant difference in subjective feeling of fatigue between the measurements ( $54.7 \pm 4.8$  vs.  $62.6 \pm 3.8$  mm,  $p < 0.05$ ). The changes in subjective feeling of fatigue between the measurements were significantly correlated with the changes in HFnu ( $r = -0.70$ ,  $p < 0.01$ ). In contrast, no significant correlation were observed between the changes in subjective feeling of fatigue and the changes in HR ( $r = 0.06$ ,  $P > 0.05$ ).

**CONCLUSION:** These results suggest that measuring changes in HRV indices such as HFnu might be more efficient than measuring changes in HR for elite athletes to objectively monitor their state of physical fatigue.

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## C-39 Free Communication/Poster - Thirst and Behavior

MAY 31, 2012 7:30 AM - 12:30 PM  
ROOM: Exhibit Hall

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### 2285 Board #331 MAY 31 9:00 AM - 10:30 AM

#### Age-related Changes In Hydration Status During Intermittent Exercise In The Heat

Heather E. Wright<sup>1</sup>, Joanie Larose<sup>1</sup>, Stephen G. Hardcastle<sup>2</sup>, Ronald J. Sigal<sup>3</sup>, Pierre Boulay<sup>4</sup>, Glen P. Kenny<sup>1</sup>. <sup>1</sup>University of Ottawa, Ottawa, ON, Canada. <sup>2</sup>CANMET Natural Resources Canada, Sudbury, ON, Canada. <sup>3</sup>University of Calgary, Calgary, AB, Canada. <sup>4</sup>Champlain Diabetes Regional Coordination Centre, Ottawa, ON, Canada.

(No relationships reported)

Ageing is associated with a progressive decrease in thermoregulatory and cardiovascular function. When combined, these age-related changes are thought to decrease the body's ability to maintain core temperature at safe levels, during heat exposure. This can be exacerbated by reductions in hydration. However, the differences in hydration between young and older individuals during exercise in the heat and how this may affect core temperature are unclear.

**PURPOSE:** To examine the effects of intermittent exercise in a hot/dry environment on the changes in hydration status in healthy young, middle-aged, and older males.

**METHODS:** Five young (Mean±SD; Y: 27.6±4.4 yrs), five middle-aged (M: 45.2±3.0 yrs), and five older (O: 61.2±4.3 yrs) healthy males, matched for weight and body composition, performed four successive bouts of 15-min cycling at a constant rate of metabolic heat production (400 W) in dry heat (35°C, 20% relative humidity). Each exercise bout was separated by 15 minutes of rest with a final rest period of 60 minutes. Rectal temperature (T<sub>re</sub>) was measured continuously. Blood and urine samples were obtained prior to exercise (PRE) and following the final recovery for the analysis of hematological parameters (e.g., hemoglobin, hematocrit) and osmolality, and urine specific gravity (USG), respectively.

**RESULTS:** The change in T<sub>re</sub> from PRE to the end of exercise (Y: 0.36±0.15, M: 0.55±0.21, O: 0.58±0.23°C) and final recovery was similar between age groups. Similar hydration status measures, including changes in weight (Y: -1.2±0.1, M: -1.2±0.2, O: -1.2±0.1 kg), plasma (Y: -6.1±2.8, M: -7.8±2.5, O: -7.1±4.0%) and blood volumes (Y: -2.8±2.4, M: -3.8±1.5, O: -4.0±1.8%), plasma osmolality (Y: +4.5±5.7, M: +3.7±2.6, O: +3.8±2.5 mOsm/kgH<sub>2</sub>O), and USG (Y: +0.006±0.007, M: +0.007±0.005, O: +0.005±0.007), were observed between groups.

**CONCLUSION:** Preliminary data indicate that young, middle-aged, and older male adults show similar changes in hydration status following intermittent exercise in the heat. Support: Workplace Safety and Insurance Board of Ontario and Canada Foundation for Innovation-Leaders Opportunity Fund (held by G.P. Kenny).

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### 2286 Board #332 MAY 31 9:00 AM - 10:30 AM

#### Predetermined Drinking Plans Impact Blood Sodium Concentration And Body Weight During A Half Marathon

Nicole Mitchell<sup>1</sup>, James Winger<sup>1</sup>, Jonathan Dugas<sup>2</sup>, Amy Luke<sup>1</sup>, Lara Dugas<sup>1</sup>. <sup>1</sup>Loyola University Chicago, Maywood, IL. <sup>2</sup>The Vitality Group, Chicago, IL.

(No relationships reported)

**PURPOSE:** Exercise-associated hyponatremia (EAH) is caused by ingesting fluids beyond thirst, resulting in dilution of blood sodium concentrations ([Na<sup>+</sup>]). Runners can decrease the likelihood of EAH by following their bodies' natural drive to drink, commonly known as drinking to thirst<sup>®</sup>. ACSM recommends that runners lose no more than 2% of their starting body mass, to protect them from dehydration and poor performance. We sought to investigate the relationships between predetermined drinking plans, body mass changes and changes in blood sodium levels during a half marathon race.

**METHODS:** 94 runners completed a pre-race drinking plan survey, 67 runners completed both pre and post-race body mass and blood sample measurements. Blood samples were used to determine serum [Na<sup>+</sup>].

**RESULTS:** No runners finished the race hyponatremic. The majority of runners (52%) indicated that they planned to drink according to a predetermined schedule (SCHED), 37% of runners planned to drink only when thirsty (DTT), with 11% of runners planning to drink as much as possible (AMAP). The DTT group was significantly younger (p<0.001), predominantly female (58%) and had the least running experience (5.5 yrs vs. 12.5 yrs, p<0.05). Runners in these three groups differed in their [Na<sup>+</sup>] change during the race (DTT; 2.7±2.7 mmol/L, SCHED; 1.4±2.0 mmol/L, AMAP; 0.8±4.5 mmol/L; p = 0.08) but did not exhibit statistical difference in their race times (DTT; 121.3±22.2 min, SCHED; 124.8±20.2 min, AMAP; 139.4±22.6 min; p = 0.14). However the running time for the DTT group represents almost 11 min faster than the combined mean race time of the other 2 groups. Alternatively runners losing ≥2% of starting body mass on average ran 10 min faster (p = 0.06) compared to runners with a more modest body mass loss and experienced greater differences in their [Na<sup>+</sup>] (3.2 mEq/L in [Na<sup>+</sup>] vs. 1.1 mEq/L for group losing <2% body mass, p = 0.002).

**CONCLUSIONS:** Pre-race hydration plan has a measurable effect on post-race parameters of fluid and electrolyte balance. Drinking to thirst or losing ≥2% of starting body mass may protect runners from EAH through favorable [Na<sup>+</sup>] changes and may have favorable outcomes on running performance. These findings bring into question current drinking recommendations and advice given to recreational runners. No external funding.

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### 2287 Board #333 MAY 31 9:00 AM - 10:30 AM

#### Hydration Status, Perceived Thirst and RPE of South-East Asian Soccer Players during Consecutive Days Training

John O'Reilly, Stephen H. Wong, FACSM, Feng Hua Sun. The Chinese University of Hong Kong, Shatin, NT, Hong Kong.

(No relationships reported)

There is little, if any, data published in the literature on the hydration status and sweat rate of South-East Asian soccer players during consecutive days of regular season training. Furthermore, the relationship between heart-rate and self-perception measures for exercise and thirst has not been well established in soccer players.

**PURPOSE:** (1) To assess the sweat rate (SR) and hydration status of South-East Asian professional soccer players during consecutive days of in-season training. (2) To investigate the relationship between rate of perceived exertion (RPE), heart-rate (HR) & perceived thirst (PT) amongst South-East Asian soccer players.

**METHODS:** 14 healthy, male professional soccer players from the Hong Kong football league (mean ± SD: age 24.1 ± 3.5 years, height 1.78 ± 0.07 m, body mass (BM) 72.6 ± 12.1 kg) took part in two soccer-specific, in-season training sessions of similar intensity on consecutive days (T1 & T2). Environmental conditions (Temp: 27 °C, RH: 85%, Wind speed: 1.03 - 1.20 m/sec) were similar on both occasions. Ad libitum drinking was permitted at all times. Each participant was individually assessed to establish their pre- and post-training hydration status by urine specific gravity (USG), as well as their fluid consumption (FC) and SR for each training session. RPE and PT were measured periodically during both training sessions.

**RESULTS:** Although the mean percentage BM losses were within recommended ranges (i.e. < 2%) on both days, 5 players began T1 in a dehydrated condition (USG > 1.020), while 7 players commenced T2 dehydrated. The relationship between SR and FC was significant in T1 (SR vs. FC: 1.39 ± 0.54 L/h vs. 0.85 ± 0.20 L/h, p<0.01), but not in T2 (SR vs. FC: 1.54 ± 0.46 L/h vs. 1.02 ± 0.23 L/h, p>0.05). There were no significant differences observed in USG either between or within training sessions (p<0.05). A positive correlation was observed between PT and RPE during both training sessions (T1: r = 0.986, T2: r = 0.988, p<0.01).

**CONCLUSIONS:** RPE provides an accurate estimate of PT and work intensity during soccer specific exercise. Not all South-East Asian soccer players commence training in a euhydrated condition. Training on consecutive days in a hot and humid environment does not significantly alter USG in South-East Asian professional soccer players.

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2288 Board #334 MAY 31 9:00 AM - 10:30 AM

**Male and Female Runners Underestimate Sweat Losses during 1 h Summer Run**

Eric K. O'Neal<sup>1</sup>, Brett A. Davis<sup>1</sup>, Lauren K. Thigpen<sup>1</sup>, Christina R. Caufield<sup>1</sup>, Joyce R. McIntosh<sup>1</sup>, Anthony D. Horton<sup>1</sup>, Rebecca L. Keating<sup>1</sup>, Jared H. Hornsby<sup>2</sup>, James M. Green, FACSM<sup>1</sup>. <sup>1</sup>University of North Alabama, Florence, AL. <sup>2</sup>University of Alabama, Tuscaloosa, AL.  
(No relationships reported)

A key tenant in adherence to ACSM fluid intake guidelines is accurate assessment of fluid volume lost during exercise.

**PURPOSE:** To determine how accurately runners estimate their sweat losses.

**METHODS:** Twenty heat-acclimated female (age = 41 ± 9 y, VO<sub>2</sub>max = 52 ± 8 ml/kg/min, body fat = 23 ± 4%) and 19 male (41 ± 12 y, VO<sub>2</sub>max = 61 ± 9 ml/kg/min, body fat = 14 ± 5%) runners from the southeastern US completed a challenging outdoor road run between August and early September (WBGT = 24.1 ± 1.5 °C) that allowed a finishing time of approximately 1 h. Runs began at approximately 06:45 or 18:45. Runners filled 8 oz race aid station paper cups with a volume of fluid they felt would be equivalent to their sweat losses before and after running.

**RESULTS:** Total sweat losses and losses by percent body were significantly greater ( $p < 0.01$ ) for men (1797 ± 449 mL, 2.3 ± 0.6%) than women (1155 ± 258 mL, 1.9 ± 0.4%), but post-run sweat loss estimation accuracy did not differ between males (underestimation = 46.9 ± 27.3%; 95% CI = 33.8-60.0%) and females (underestimation = 52.1 ± 18.4%; CI = 43.5-60.7%). Collectively, runners' predictions (738 ± 470 mL) were less than half of actual sweat losses (1468 ± 484;  $p < 0.001$ ). Pre- and post-run sweat loss estimations did not differ and were strongly correlated ( $r = 0.88$ ). Nine runners (5 female and 4 male) reported they had assessed their pre- and post-run body weights in the previous month. However, there was no difference ( $p = 0.55$ ) in the accuracy of runners who had assessed body weight change before and after a run (underestimations = 53.6 ± 18.2%) and those who had not (underestimations = 48.3 ± 24.4%).

**CONCLUSIONS:** These results suggest inadequate fluid intake during runs or between runs may stem from underestimations of sweat losses. Further, runners who attempt to assess sweat losses through changes in body weight may be making sweat loss calculation errors or do not accurately translate changes in body weight on a scale to physical volumes of water in race aid station cups.

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2289 Board #335 MAY 31 9:00 AM - 10:30 AM

**Drinking According to Thirst does not Prevent Dehydration in Sub-optimally Hydrated Young Soccer Players**

Giannis Arnaoutis, Stavros A. Kavouras, FACSM, Yiannis P. Kotsis, Costas N. Bardis. Harokopio University, Athens, Greece.  
(No relationships reported)

Maintenance of fluid balance is essential for health, athletic performance and thermoregulation. Although there are a lot of studies evaluating hydration status in adults, limited data concerning hydration levels in athletic youth exists.

**PURPOSE:** To assess hydration status in male young soccer players during a summer sports camp and to investigate if ad libitum water intake will prevent further dehydration in the hypohydrated children.

**METHODS:** Initial hydration status was assessed in 107 young soccer players (age: 13±2 y, weight: 52.2±8.5 kg, height: 1.58±0.08 m). Seventy-two out of the 107 children agreed to undergo additional testing for two more separate training days, in order to calculate dehydration via changes in body weight, while water drinking was allowed ad libitum. Hydration status of the participants was assessed in the morning and after the training session, via urine specific gravity (USG), urine color and changes in total body weight. Mean environmental temperature and humidity was 27.2±2°C and 57±9% respectively.

**RESULTS:** According to USG values ( $\geq 1.020$ ), 95 out of 107 of the children (88.7%) were dehydrated prior to practice. Likewise, according to the urine color chart, 93.7% (100 out of 107) were also classified as dehydrated. The prevalence of dehydration was maintained in both training days, with 95.8% and 97.2% of the children being dehydrated (USG  $\geq 1.020$ ) after the end of the 1st and the 2nd training session respectively. Remarkably, despite fluid availability, mean weight loss of -0.35±0.04 kg after the 1st practice and -0.22±0.03 kg after the 2nd practice was observed among the subjects. Specifically, 54 out of the 66 children (81.8%) with pre-exercise USG > 1.020 reduced their body weight after 1st training session, while similarly, 47 out of the 63 dehydrated children (74.6%) also further reduced their body weight after the end of the 2nd training session. Correlation between pre-exercise USG values and changes in body weight failed to reveal any relationship ( $p > 0.05$ ).

**CONCLUSION:** Approximately 80% of the dehydrated soccer players dehydrated more during soccer practice, regardless of fluid availability. These findings indicate that drinking according to thirst during practice, did not prevent further dehydration in sub-optimally hydrated young soccer players.

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2290 Board #336 MAY 31 9:00 AM - 10:30 AM

**Are All Milks Equal? Comparing The Rehydration Potential Of Popular Milk Based Beverages.**

Sarah Jansen, Christopher Irwin, Michael Leveritt, Ben Desbrow. Griffith University, Gold Coast, Australia. (Sponsor: Louise Burke, FACSM)  
(No relationships reported)

**PURPOSE:** To examine several varieties of milk regarding their ability to rehydrate following exercise-induced fluid losses.

**METHODS:** Six male participants (age 25.7 ± 5.9y, height 178.9cm ± 6.3cm, body mass 75.2kg ± 5.5kg (mean±SD)) lost 2.1 ± 0.3% body weight through intermittent cycle exercise before consuming a different beverage on four separate occasions. Drinks included Cow's milk (0.6cal·mL<sup>-1</sup>), Soy milk (0.6cal·mL<sup>-1</sup>), a milk based liquid meal replacement - Sustagen - (1.1cal·mL<sup>-1</sup>) and a Sports Drink (0.3cal·mL<sup>-1</sup>). Beverages were consumed over 1h in total volumes equivalent to 150% of body weight loss during exercise. Body weight, blood and urine samples and measures of gastrointestinal tolerance were obtained before and for 4h after beverage consumption.

**RESULTS:** Net fluid balance at conclusion of the trial was significantly enhanced on the Sustagen trial compared to the Sports Drink (Sustagen = -0.59±0.36 kg vs Sports Drink = -1.25±0.44kg,  $p=0.039$ ), which was largely a result of significant differences in total urine output ( $p < 0.01$ ) between treatments. There was a tendency for improved fluid retention with the Soy (-0.83±0.39kg) and Cow's (-0.85±0.41kg) milk treatments relative to the Sports Drink trial however this was not statistically significant. Overall measures of gastrointestinal tolerance and haematological markers exhibited no difference between milk-based trials.

**CONCLUSION:** Milk-based drinks are more effective rehydration options compared to traditional sports drinks. The consumption of a high calorie milk-based liquid meal replacement maximises the recovery of fluid losses following exercise and should be recommended to individuals requiring rapid fluid restoration.

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2291 Board #337 MAY 31 9:00 AM - 10:30 AM

**Voluntary Fluid Intake With Milk Or Chocolate Milk In Boys Exercising In The Heat**

Alheli MateosRoman<sup>1</sup>, Luis F. Aragon-Vargas, FACSM<sup>2</sup>. <sup>1</sup>Club Deportivo Saprissa, San José, Costa Rica. <sup>2</sup>UNIVERSIDAD DE COSTA RICA, San José, Costa Rica.  
(No relationships reported)

**PURPOSE:** To compare fluid balance (FB) and voluntary intake (VI) in 10-to-14-year-old boys, when they combine milk or chocolate milk with water during exercise in the heat. In addition, palatability and gastrointestinal (GI) symptoms were assessed.

**METHODS:** Thirty-one boys from a junior soccer team (12.6±1.4 y.o., 42.69±2.09 kg and 147.8±10.0 cm) (Mean ± S.D.), exercised in a controlled environment chamber (31.6±0.36°C dry bulb and 47.3±2% relative humidity), at 67.4±4.1% HRmax, using a cycle ergometer and a treadmill. They alternated 20 min of exercise with 10 min of rest on four consecutive times, for a total of 2h in the chamber. Ad libitum fluid intake was monitored from the simultaneous presentation of water and partially skimmed milk (session A), or water and partially skimmed chocolate milk (session B); the drinks had a temperature of 15.9±0.12°C. Fluid balance was calculated from differences in nude body weight. Palatability and GI symptoms were reported upon arrival, and before, during, and at the end of the exercise session.

**RESULTS:** Initial conditions were the same for sessions A and B ( $p > 0.05$ ). No significant difference was found between sweat rates during session A (460.8±217.4 mL·h<sup>-1</sup>) and session B (459.8±229.4 mL·h<sup>-1</sup>) ( $p=0.98$ ). FB was the same for both sessions (0.76±0.80%BW vs. 0.77±0.76%BW,  $p=0.94$ ). A significant difference was found for time: a positive FB was observed during the first hour of exercise, but not during the second hour. VI was the same for both sessions ( $p = 0.87$ ), but different over time: boys drank more fluid during the first hour (573±213 mL and 526±203 mL for sessions A and B, respectively) than during the second hour (307±137 mL and 343±138 mL for A and B, respectively) ( $p < 0.001$ ). Chocolate milk showed the highest

palatability scores and water showed the lowest. GI symptoms were low (session A= 0.8±1.4, 1.5±1.7, 0.7±1.3; session B=0.8±1.9, 1.6±1.9, 0.8±1.4 for abdominal pain, fullness, and side stitch, respectively).

**CONCLUSION:** When presented simultaneously with water, both partially skimmed milk and chocolate milk were effective in preventing voluntary dehydration in boys exercising in the heat. Palatability scores were favorable and GI symptoms presented were not clinically relevant.

Supported by Cooperativa de Productores de Leche Dos Pinos R.L<sup>®</sup> and UCR-VI-245-B0-315.

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**2292** Board #338 **MAY 31 9:00 AM - 10:30 AM**  
**Hydration Status Influenced by Gender but not Environment**

Namrita K. O'Dea, Deborah M. Wendland, Tracy Norman, Michael L. Jones, Jochen Kressler, Maxime E. Buyckx, Mindy Millard-Stafford, FACSM. *Georgia Institute of Technology, Atlanta, GA.*

(No relationships reported)

Optimal hydration is important for health in daily living, including for individuals who are not engaging in exercise.

**PURPOSE:** To compare the impact of gender and environment (hot vs. temperate) on hydration status during free-living (FL) and 24 hr fluid restriction (FR) conditions.

**METHODS:** Female and male subjects (n=46, 24 ± 6 yrs) participated in morning (AM) and afternoon (PM) laboratory visits while otherwise maintaining activities of daily living without exercise over three days. After the first day of FL, 24 hr of euhydration was followed by 24 hr dehydration via FR. Mean ± SD peak outdoor temperature was 32 ± 4°C and 18 ± 13.5°C during hot and temperate conditions, respectively. Body mass (BM), perceived thirst, urine osmolality (UOsm), urine color (UC), urine specific gravity (USG), and plasma osmolality (POsm) were measured.

**RESULTS:** The frequency distribution for FL subjects with UOsm >700 mOsm/kg during hot weather was 55%, 59% (for AM, PM) and 75%, 63% (for AM, PM) during temperate conditions. Mean ± SD UOsm was not different in hot vs. temperate (783 ± 119 vs. 805 ± 119 mOsm/kg) and no differences were observed in other hydration status biomarkers during FL and FR. Males had significantly higher UOsm (818 ± 117 vs. 733 ± 117 mOsm/kg in females, p < .02) and POsm (291 ± 4 vs. 287 ± 4 mOsm/kg in females, p < .001) across all time points and environmental conditions. During 24 hr FR, males lost a greater %BM compared to females (-2.3 ± 0.6 vs. -1.9 ± 0.7 %, p < 0.05) but thirst, UC, and USG were not different by gender. From 16 to 24 hr of FR, thirst rating, UOsm, POsm, and %BM loss increased significantly (p < 0.001) in all subjects while UC and USG did not change.

**CONCLUSIONS:** Hydration status in young adults suggests no greater incidence of dehydration during daily living when weather conditions are hot vs. temperate. However, men exhibit greater hypertonicity of urine and plasma compared to women.

Funded by a grant from The Coca-Cola Company, Atlanta, GA

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**2293** Board #339 **MAY 31 9:00 AM - 10:30 AM**  
**Effect Of Milk Intake On Electrolyte Balance In Children After Exercise In The Heat**

Kim Volterman, Joyce Obeid, Boguslaw Wilk, FACSM, Brian W. Timmons. *McMaster University, Hamilton, ON, Canada.*

(No relationships reported)

The use of low-fat milk as a safe and effective post-exercise rehydration beverage has been recently investigated in the adult population; however, there is a paucity of information on milk's rehydration ability in children after exercising in the heat.

**PURPOSE:** This study tested the hypothesis that due to higher electrolyte content, milk will be more effective than both water and a carbohydrate/electrolyte solution (CES) in replacing electrolyte losses in children following exercise in the heat.

**METHODS:** Fourteen 8- to 10-year old heat-acclimated children (8 girls, 6 boys) performed three exercise trials in a warm environment (35°C, 50% relative humidity) consisting of two 20-min cycling bouts at 60% VO<sub>2peak</sub> followed by consumption of either water (W), CES, or skim milk (SM). Each beverage was consumed in a volume equal to 100% of their body weight losses and beginning immediately after exercise. Urine samples were collected before, during, and after exercise, as well as during the 120 min following drink consumption.

**RESULTS:** Participants ingested 399 ± 97 mL of fluid. Children remained in a net negative balance for Na<sup>+</sup> and Cl<sup>-</sup> at the end of the 120 min recovery period for all beverages. No difference was found between beverages for Na<sup>+</sup> balance; however, children maintained a more positive Cl<sup>-</sup> following the consumption of SM (-1059 ± 575 mg) compared with both W (-1530 ± 561 mg; p < 0.01) and CES (-1412 ± 484 mg; p < 0.05). Similarly, K<sup>+</sup> balance was significantly greater in the SM trial compared with both the W (p < 0.001) and CES (p < 0.001) trials; no significant difference between the W and CES trials. Children were able to return to a net positive K<sup>+</sup> balance following the consumption of SM (182 ± 170 mg), whereas they remained in a net negative K<sup>+</sup> balance during the CES (-270 ± 179 mg) and W (-399 ± 228 mg) trials.

**CONCLUSIONS:** SM was effective at maintaining a more positive electrolyte balance for both K<sup>+</sup> and Cl<sup>-</sup> in comparison to W and a C.

Supported by a Grant from the Agri-Science Cluster Initiative\*

\*This initiative includes: Dairy Farmers of Canada, Agriculture and Agri-Food Canada and the Canadian Dairy Commission.

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**C-40** Free Communication/Poster - **Vascular Function and Arterial Stiffness**

MAY 31, 2012 7:30 AM - 12:30 PM

ROOM: Exhibit Hall

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**2294** Board #340 **MAY 31 8:00 AM - 9:30 AM**  
**Lack of an Effect of Venous Occlusion on Reactive Hyperemia During Three Different Types of Contractions**

Morgan Bauman, Hannah Stone, Maurie J. Luetkemeier, John E. Davis. *Alma College, Alma, MI.*

(No relationships reported)

Previous studies have examined handgrip strength and brachial artery dilation as a result of venous occlusion while strength training with solely a concentric contraction. However, few studies have looked at the vascular response as a result of different types of muscular contractions with and without venous restriction.

**PURPOSE:** The purpose of this study was to investigate the effects of different types of muscular contractions, with and without venous restriction, on reactive hyperemia.

**METHODS:** Nine participants (mean ± 1 SD: age 19 ± 8.5 years, males = 4, females = 5) performed 15 repetitions of three types of forearm muscular contractions: concentric (CON), eccentric (ECC), and isometric (ISO) on an isokinetic dynamometer (Cybex Norm) using right wrist flexion. Each type of contraction was performed once with venous restriction induced by a pneumatic cuff inflated to 80 mmHg on the upper arm and once without venous occlusion for a total of six trials on six different days. All trials were randomized. Reactive hyperemia was measured before and after each exercise condition using venous-occlusion plethysmography following a 250mmHg occlusion in the same arm as the exercise. From the reactive hyperemia data, area under the curve, time to return to baseline, and peak blood flow were determined. An analysis of variance was used to compare the previously mentioned variables following exercise with and without venous restriction and also to compare them during the CON, ECC, and ISO contractions.

**RESULTS:** While area under the curve was significantly greater after each type of exercise (Pre-CON = 62.1 ± 23, Post-CON = 114.2 ± 27.7; Pre-ECC = 45.9 ± 23.3, Post-ECC = 112.5 ± 47.9; Pre-ISO = 45.2 ± 19.3, Post-ISO = 95.7 ± 46.3), there were no significant differences either between contraction types or with or without occlusion (P > 0.05).

**CONCLUSION:** These data suggest that the active hyperemia induced by exercise is so great that it masks any reactive hyperemia differences that may be present due to contraction type or venous occlusion.

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2295 Board #341 MAY 31 8:00 AM - 9:30 AM

**The Effect of Eccentric Exercise-Induced Muscle Injury on Vascular Function**

Mitchel R. Stacy, Jennifer L. Lawrence, Sarah A. McGlinchy, Barry W. Scheuermann. *The University of Toledo, Toledo, OH.*

(No relationships reported)

Pro-inflammatory conditions associated with aging, poor dietary habits, obesity and increased levels of oxidative stress have been linked to endothelial dysfunction. While the long-term benefits of exercise on vascular function are well known, muscle injury is often a consequence of performing exercise. Post-injury inflammatory responses may contribute to vascular dysfunction, as markers of inflammation have been shown to increase arterial stiffness, impair endothelial-dependent vasodilatation, and decrease the expression of endothelial nitric oxide synthase.

**PURPOSE:** To examine the effect of eccentric exercise-induced injury on endothelial dependent and independent vascular responses.

**METHODS:** Ten healthy male subjects ( $26.6 \pm 1.2$  yrs,  $\pm$  SD) performed 50 maximal eccentric contractions to induce injury to the biceps brachii. Subsequent changes in maximal isometric strength and vascular responses were assessed at 1, 24, 48, and 96 hrs post injury. Endothelial-dependent and -independent vasodilatation were measured in the brachial artery using the flow-mediated dilation (FMD) approach and sublingual NTG (0.4 mg) administration, respectively. Mean blood velocity was measured by Doppler ultrasound and subsequently used to calculate muscle blood flow and shear stress (expressed as the area under the curve,  $SS_{AUC}$ ).

**RESULTS:** Eccentric exercise resulted in impaired maximal isometric strength for up to 96 hours ( $p < 0.05$ ). Compared to pre-injury values, FMD decreased within 1 hr of injury (Pre;  $8.4 \pm 0.9$ ; 1 hr post;  $5.12 \pm 0.7$  %FMD,  $p < 0.05$ ) and remained lower ( $p < 0.05$ ) for up to 96 hrs. Similarly, the vasodilatory response to NTG was also impaired for 96 hours following eccentric-induced muscle injury (Pre;  $26.3 \pm 2.1$ ; 1 hr post;  $20.7 \pm 1.5$  %,  $p < 0.05$ ). Injury resulted in a decrease ( $p < 0.05$ ) in  $SS_{AUC}$  immediately following exercise which remained impaired for 48 hrs. Resting blood pressure and muscle blood flow remained similar throughout the duration of the study.

**CONCLUSIONS:** These results suggest that muscle injury leads to impaired local endothelial and vascular smooth muscle function. The lower shear stress following injury may contribute to the reduced FMD response but the mechanism responsible for the attenuated endothelial-independent vasodilatation requires further investigation.

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2296 Board #342 MAY 31 8:00 AM - 9:30 AM

**Influence of Self-reported Physical Activity on Arterial Stiffness in Adolescents**

Megumi Sugino, Hajime Miura, Saori Maruoka, Yukimi Maki. *Univ. of Tokushima, Tokushima, Japan.*

(No relationships reported)

Insufficient physical activity may play a pathophysiological role in the development of atherosclerosis in middle-aged to older men. However, few attempts have so far been made to identify the role of physical activity on arterial function in adolescents.

**PURPOSE:** The aim of this study was to explore the effect of current life style of physical activity on arterial stiffness in adolescents.

**METHODS:** 183 healthy male high school students were divided into two groups: 83 were in the active group who participated in sports or athletic clubs in addition to physical education class and 100 were in the control group who took only physical education class. The brachial systolic and diastolic blood pressure (SBP, DBP), heart rate (HR) and brachial to ankle pulse wave velocity (baPWV) were measured using a volume-plethysmographic apparatus while the subjects were in the supine position. In order to estimate the energy expenditure of physical activity (PA), the International Physical Activity Questionnaire with the short format was adopted.

**RESULTS:** In the active group, both baPWV and PA significantly differed from those in the control group ( $p < 0.001$ ). However, no significant differences in age, height, weight, body mass index (BMI), %fat, SBP, DBP, or HR were found between two groups. The 9 independent variables that had correlations with selected variables (age, height, weight, BMI, %fat, SBP, DBP, HR, and PA) were examined by regression modeling to determine their relative influence on the baPWV. In the final model, SBP, PA, weight, and age accounted for 43.5% of the variation in baPWV. The standardized beta estimates were  $\beta = 0.544$  ( $p < 0.0001$ ) for SBP,  $\beta = -0.371$  ( $p < 0.0001$ ) for PA,  $\beta = -0.145$  ( $p < 0.05$ ) for weight, and  $\beta = 0.129$  ( $p < 0.05$ ) for age.

**CONCLUSIONS:** These results suggested that spending more time engaging in physical activity has a favorable effect on arterial stiffness in adolescents as well as middle-aged to older men.

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2297 Board #343 MAY 31 8:00 AM - 9:30 AM

**Acute Effect of Moderate and High Intensity Resistance Exercise on Arterial Stiffness**

Thomas Black. *Springfield College, Springfield, MA.*

(No relationships reported)

**INTRODUCTION:** Cardiovascular disease is the leading cause of death in the western world. The stiffness of large arteries has been identified as a major independent risk factor for cardiovascular disease. Resistance exercise (RE) is included in a well-rounded exercise prescription for the general public and for persons with a variety of diseases in accordance with ACSM guidelines. However, researchers have found evidence indicating that RE may increase arterial stiffness.

**PURPOSE:** The current study was designed to determine the effect on moderate and high intensity RE on arterial stiffness (AS).

**METHODS:** Twelve young healthy males, age ( $21.5$  yr  $\pm$  1.5), training age ( $6$  yr  $\pm$  1.8), weight ( $88.5$  kg  $\pm$  7.9), height ( $177.2$  cm  $\pm$  3.3), and % body fat ( $15.9$  %  $\pm$  5.3), who regularly resistance trained were recruited for the study. Each subject completed both the moderate and high intensity bout on two separate occasions in a randomized order. Pulse wave velocity (PWV) was used to estimate AS and was measured at baseline, 10 min post, 20 min post, and 30 min post. Heart rate was measured during each bout and was used as a marker of sympathetic nervous system activity. A total body RE workout was completed during each bout and consisted of four free weight exercises.

**RESULTS:** Significant increases ( $p < .05$ ) in PWV were observed up to 30 min following RE, however, no significant differences ( $p < .05$ ) were found between the two intensities. The differences in PWV observed are as follows: BL ( $M = 5.66$ ,  $SD = .82$ ), 10 min post ( $p = .00$ ;  $M = 6.17$ ,  $SD = .94$ ), 20 min post ( $p = .04$ ;  $M = 5.95$ ,  $SD = .89$ ) and 30 min post ( $p = .04$ ;  $M = 5.93$ ,  $SD = 1.01$ ). The moderate intensity RE ( $M = 156.65$  bpm,  $SD = 12.08$ ) produced a significantly higher ( $p < .05$ ) HR as compared to the high intensity RE ( $M = 143.17$  bpm,  $SD = 11.53$ ).

**CONCLUSION:** AS was elevated for up to 30 min following a bout of RE and is not dependent on intensity. Whether or not the AS elevation is pathologic and identifying the mechanisms involved warrants further investigation.

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2298 Board #344 MAY 31 8:00 AM - 9:30 AM

**Effects of School-Based Exercise Training on Endothelial Function and Pulse Wave Velocity in Obese Adolescents**

Soo-Hyun Park, Eun-Sun Yoon, Yong Jin Lee, Ki Won Lee, Yong Hee Lee, Sae Young Jae. *University of Seoul, Seoul, Korea, Republic of.*

(No relationships reported)

Vascular endothelial dysfunction and increased arterial stiffness are associated with early atherosclerosis in obese adolescents.

**PURPOSE:** The purpose of the study was to assess the effects of school-based exercise training on endothelial function and pulse wave velocity in obese adolescents.

**METHODS:** Twenty one obese adolescents ( $13 \pm 1$ yr) were randomly assigned to a school based exercise training (ET)(12weeks, 50 minutes, 5day/week) group ( $n=11$ ) and a non exercise control (CON) group ( $n=10$ ). Cardiorespiratory fitness was measured using maximal oxygen uptake with metabolic gas analysis and body composition was determined by bioelectrical impedance. We measured carotid-femoral pulse wave velocity and reactive hyperemia index as indices of vascular function.

**RESULTS:** Waist girth was significantly decreased in ET group than CON group (ET  $94.41 \pm 6.17$  to  $92.62 \pm 6.13$  vs. CON  $92.62 \pm 7.80$  to  $94.27 \pm 9.23$ cm,  $p < 0.05$ ). Cardiorespiratory fitness was significantly increased in ET group than CON group (ET  $32.35 \pm 6.49$  to  $39.24 \pm 6.63$  vs. CON  $34.59 \pm 5.47$  to  $38.36 \pm 6.54$ ml/kg/min,  $p < 0.05$ ). Body mass index and selected CVD risk factors were not improved in ET group. Reactive hyperemia index was significantly increased in ET group (ET  $1.60 \pm 0.45$  to  $1.87 \pm 0.58$  vs. CON  $1.73 \pm 0.39$  to  $1.43 \pm 0.26$ %,  $p < 0.05$ ) but carotid-femoral pulse wave velocity did not significantly decrease in ET group (ET  $5.77 \pm 5.40$  to  $5.40 \pm 0.53$  vs. CON  $5.12 \pm 0.53$  to  $5.05 \pm 0.54$ m/s, NS). Change in cardiorespiratory fitness was associated with change in reactive hyperemia index after adjusted for changes in waist ( $r=0.469$ ,  $p < 0.05$ ).

**CONCLUSIONS:** These results show that school-based exercise training improved endothelial function, and this was associated with improved cardiorespiratory fitness in obese adolescents.

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2299 Board #345 MAY 31 8:00 AM - 9:30 AM

**Physical Activity, Age, And Arterial Compliance**

A. Maleah Holland, Joel M. Stager, David A. Tanner, Colleen M. McCracken, Hao Guo, Peter R. Finn. *Indiana University, Bloomington, IN.*  
(No relationships reported)

A reduction in large arterial compliance has been shown to occur with age and physical inactivity and is considered an independent risk factor of cardiovascular disease. Low compliance is associated with various pathological states such as hypertension, left ventricular hypertrophy, and congestive heart failure. The relationship between sex, aging, and physical activity remains unclear.

**PURPOSE:** The purpose of this study is to determine if high levels of physical activity influence arterial compliance similarly in men and women.

**METHODS:** Thirty-six subjects, 16 men (M), 20 women (W), were categorized as younger (Y, 40-59yrs old) or older (O, 60-79yrs old). Nineteen subjects (6 YM, age= 46.8±2.6yrs, 2 OM, age= 61±1.4yrs; 9 YW, age= 48 ± 4.1yrs, 3 OW, age= 67.3±8.4) were considered highly active based on self-reported vigorous physical activity > 200 min/wk and 17 subjects (4 YM, age=50.5 ± 4yrs, 4 OM, age= 70.5±7.4yrs; 4 YW, age 54.3±5.6, 5 OW, age=65.6±5.9yrs) were considered sedentary to moderately active- with activity confirmed by an activity monitor worn for 7 days. Resting cardiovascular measurements including large arterial compliance, blood pressure, and heart rate were recorded. Statistical analysis included a 2x2x2 Analysis of Variance with p<0.05.

**RESULTS:** Compliance was greater in highly active subjects compared to the sedentary or moderately active subjects (18.2 ± 4.2 vs. 13.5 ± 3.8 mL/mmHg<sup>10</sup>) and it was greater in men when compared to women (17.9 ± 4.4 vs. 14.6 ± 4.3 mL/mmHg<sup>10</sup>). There was no difference in compliance between age groups though power was low due to a small n. There were no significant interactions between activity, sex, and age on compliance. There was a significant simple effect for sex by activity in women, as compliance was greater in active women compared to inactive women (16.9 ± 3.9 vs. 11.6 ± 2.6 mL/mmHg<sup>10</sup>).

**CONCLUSIONS:** Arterial compliance differs as a function of physical activity in an aging population demonstrating the highly active to be at a reduced risk of cardiovascular disease. Oddly, women, particularly the inactive women show the greatest risk for cardiovascular disease as compared with other groups. Thus, the converse, habitually high levels of physical activity may pose a greater benefit for women than for men.

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2300 Board #346 MAY 31 8:00 AM - 9:30 AM

**Effects of Group Training on Arterial Stiffness in Elderly Hypertensive Women**

Hajime Miura<sup>1</sup>, Yoshinori Takahashi<sup>2</sup>, Yukimi Maki<sup>1</sup>, Megumi Sugino<sup>1</sup>. <sup>1</sup>University of Tokushima, Tokushima, Japan. <sup>2</sup>Institute of Tohigi Health & Wellness Foundation, Tohigi, Japan.  
(No relationships reported)

Regular physical exercise is recommended for the prevention and treatment of cardiovascular diseases. However, few attempts have so far been made to identify the role of exercise training in arterial function in elderly hypertensive people.

**PURPOSE:** The aim of this study was to evaluate the effects of group training on arterial stiffness in elderly hypertensive women.

**METHODS:** According to their systolic blood pressure (SBP) and diastolic blood pressure (DBP), 153 elderly women were assigned to 4 groups; hypertensive training (HT) group (n=35), normal BP training (NT) group (n=42), hypertensive control (HC) group (n=37), and normal BP control (NC) group (n=39). In the training group, subjects participated in 90-min group training twice a week for 12 weeks. Each training program included recreational activities, six to eight resistance exercise for circuit training, leg exercises for chair-based exercise. Before and after training, SBP, DBP and brachial to ankle pulse wave velocity (baPWV) were obtained in the supine position using an automatic pulse wave form analyzer.

**RESULTS:** Changes ratio ( $\Delta$ ) of baPWV, SBP and DBP between before and after training were -4.3±3.3%, -4.6±4.3%, -4.4±5.5% for HT, -4.1±6.9%, -3.5±6.9%, -8.1±5.9% for NT, -0.6±3.4%, -0.3±3.9%, 0.5±4.4% for HC, and 0.8±5.5%, 0.4±5.9%, 0.2±5.7% for NC, respectively. Compared with control (HC and NC) groups, a greater reduction in  $\Delta$ PWV,  $\Delta$ SBP and  $\Delta$ DBP were observed in training (HT and NT) groups (p<0.05). The difference of  $\Delta$ PWV between HT and NT was also significant (p<0.05).

**CONCLUSIONS:** These data indicate that short term group training

produces less improvement of arterial stiffness in elderly hypertensive women compared with healthy elderly. Different training effect of arterial stiffness might be explained by the structural changes such as increased fragmentation, collagen content, or cross-linking of collagen molecules in hypertensive elderly.

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2301 Board #347 MAY 31 8:00 AM - 9:30 AM

**The Effect Of Acute Aerobic Exercise On Arterial Stiffness Of Overweight Males**

David Chandrakumar, Stephen H. Boutcher, FACSM, Yati N. Boutcher. *University of New South Wales, Sydney, Australia.*  
(No relationships reported)

Overweight and obese individuals have been shown to possess early stiffening of the arteries and abnormal lipid profiles. To date, no studies have examined the effect of one single bout of aerobic exercise on arterial stiffness in young overweight males.

**PURPOSE:** To determine the acute effect of a single bout of exercise on arterial stiffness assessed by an augmentation index (AIx) and pulse wave velocity (PWV) in young overweight males.

**METHODS:** Twenty young healthy males aged 18-30 yrs with a body mass index (BMI) of between 18-35 kg.m<sup>2</sup> were recruited. They comprised of normal weight (n=12; BMI=18-25 kg.m<sup>2</sup>) and overweight (n=8; BMI>25 kg.m<sup>2</sup>) males. All subjects underwent one single bout of cycle exercise at 65% of their maximal oxygen uptake. Cardiovascular function such as resting heart rate, blood pressure, AIx, and PWV were assessed pre and post acute exercise. Lipid profiles and body composition were also recorded. AIx, a measure of wave reflection and a surrogate measure of arterial stiffness, was assessed using applanation tonometry, and was calculated as the ratio of augmented pressure and pulse pressure. Carotid-radial PWV (PWV<sub>cr</sub>) and carotid-femoral PWV (PWV<sub>cf</sub>) were also measured using applanation tonometry. PWV velocity is determined from the time taken for the arterial pulse to propagate from the carotid to the femoral/radial artery. AIx was assessed at pre, 10, 20, 30, and 60 min post acute exercise, whereas PWV was assessed at pre and 60 min post acute exercise.

**RESULTS:** There was no significant change in PWV<sub>cr</sub> and PWV<sub>cf</sub> following acute exercise, however, AIx at pre and throughout post acute exercise was significantly higher (P<0.05) in overweight compared to normal weight males. Resting blood pressure and total cholesterol levels (P<0.05) were also higher in overweight than that of normal weight males.

**CONCLUSION:** The high AIx levels after acute exercise of the overweight males is possibly associated with their high resting blood pressure and abnormal lipid levels.

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2302 Board #348 MAY 31 8:00 AM - 9:30 AM

**Endothelial Dysfunction In Polycystic Ovarian Syndrome Is Not Explained By Poor Fitness Or Increased Fatness**

Victoria S. Sprung<sup>1</sup>, Daniel J. Cuthbertson<sup>2</sup>, Christopher JA Pugh<sup>1</sup>, Nabil Aziz<sup>3</sup>, Graham J. Kemp<sup>2</sup>, Daniel J. Green<sup>4</sup>, Greg Atkinson<sup>1</sup>, Tim Cable<sup>1</sup>, Helen Jones<sup>1</sup>. <sup>1</sup>Liverpool John Moores University, Liverpool, United Kingdom. <sup>2</sup>University of Liverpool, Liverpool, United Kingdom. <sup>3</sup>Liverpool Women's Hospital, Liverpool, United Kingdom. <sup>4</sup>University of Western Australia, Crawley, Australia. (Sponsor: Professor Keith Geroge, FACSM)  
(No relationships reported)

**PURPOSE:** Polycystic ovarian syndrome (PCOS) has an adverse cardiovascular disease (CVD) risk profile which infers a ~2 fold increased risk of coronary artery disease. It remains unclear as to whether endothelial dysfunction is evident in PCOS independently, or if co-existing morbidities are independent risk factors for endothelial function in this population. The aim of this study was to investigate the relationship between endothelial function, adiposity and fitness in PCOS patients compared with matched control women.

**METHODS:** PCOS (n=35, age 27±1 yrs, BMI 32±1 kg/m<sup>2</sup>) and control women (n=15, age 31±1 yrs, BMI 29±2 kg/m<sup>2</sup>) were matched for age and BMI. Brachial artery endothelial function was assessed using flow mediated dilation (FMD). Visceral (VAT) and subcutaneous fat (SAT) was quantified using whole body magnetic resonance imaging. Cardiorespiratory fitness was also determined by a VO<sub>2peak</sub> test. Differences between PCOS and control women were analysed using independent t-tests and analysis of covariance. Data are presented as mean±SE.

**RESULTS:** FMD was impaired in PCOS when compared to matched control women ( $6.2 \pm 0.4$  vs.  $10.5 \pm 1.0\%$ ;  $P < 0.0005$ ). When FMD was adjusted for individual differences in BMI, VAT, SAT and cardiorespiratory fitness, the difference in FMD between groups remained ( $6.4 \pm 0.5$  vs.  $9.4 \pm 1.0\%$ ;  $P = 0.01$ ).

**CONCLUSION:** These findings indicate that FMD is impaired in PCOS women independent of global adiposity, specific fat deposition or volume, or cardiorespiratory fitness. Endothelial dysfunction is likely directly mediated by PCOS and further exploration of potential moderators of endothelial function associated with the PCOS is warranted.

**2303 Board #349 MAY 31 8:00 AM - 9:30 AM**

**Exercise Training Reduces Peripheral Pulse Wave Velocity in Young Prehypertensives**

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(No relationships reported)

**PURPOSE:** To determine the separate effects of resistance and endurance exercise training on arterial function in young prehypertensives.

**METHODS:** Forty-three prehypertensive subjects were recruited and randomly assigned to either a resistance training (n=15), endurance training (n=13), or control group (n=15). Additionally, fifteen sedentary matched normotensive time controls were studied. Training groups completed an eight week exercise training regimen. Carotid to Femoral (C-F), Carotid to Radial (C-R), and Femoral to Dorsalis Pedis (F-D) pulse wave velocity (PWV) were measured via electrocardiogram gated applanation tonometry before and after exercise training or time matched control.

**RESULTS:** Pulse wave velocity before and after exercise training and time control

|           | PHRT (N=15) |            | PHET (N=13) |            | PHTC (N=15) |             | NMTC (N=15) |           |
|-----------|-------------|------------|-------------|------------|-------------|-------------|-------------|-----------|
|           | Before      | After      | Before      | After      | Before      | After       | Before      | After     |
| C-F, msec | 6.94±0.18   | 6.81±0.18  | 6.92±0.20   | 6.86±0.20  | 7.02±0.17   | 7.04±0.17   | 6.55±0.18   | 6.59±0.18 |
| C-R, msec | 8.81±0.30*  | 7.81±0.30† | 8.63±0.36*  | 7.71±0.35† | 8.78±0.28*  | 8.75±0.27*  | 7.92±0.31   | 7.90±0.31 |
| F-D, msec | 10.41±0.25* | 9.39±0.36† | 10.27±0.27* | 8.93±0.39  | 10.43±0.23* | 10.19±0.33* | 8.60±0.25   | 8.62±0.36 |

Values are mean±SEM. Significance values are reported from between group and between timepoint repeated measures ANOVA and Tukey post hoc analysis. \* $P < 0.05$  baseline versus normotensive control values; † $P < 0.05$  versus pretreatment values.

**CONCLUSIONS**

Young prehypertensives increased peripheral pulse wave velocity when compared to matched normotensives. Additionally, both resistance and endurance exercise training reduced peripheral pulse wave velocity in young prehypertensives.

**2304 Board #350 MAY 31 8:00 AM - 9:30 AM**

**Effect of Resistance Training and/or a Hypocaloric Diet on Endothelial Function in Hypercholesterolemic Obese Women**

Javier Ibáñez Santos<sup>1</sup>, Irene Madariaga<sup>2</sup>, Ana Grijalba<sup>3</sup>, Marisol García-Unciti<sup>4</sup>, Mikel Izquierdo<sup>1</sup>, Esteban Gorostiaga<sup>1</sup>. <sup>1</sup>CEIMD, Pamplona, Spain. <sup>2</sup>Hospital of Navarra, Pamplona, Spain. <sup>3</sup>Hospital of Navarra., Pamplona, Spain. <sup>4</sup>Universidad de Navarra., Pamplona, Spain.

(No relationships reported)

The pathogenesis of endothelial dysfunction in obesity remains uncertain; the relative roles of insulin resistance, circulating NEFA, or adipocyte-associated cytokines are being delineated. In this context, the effects of resistance training (RT) and/or a hypocaloric diet on the relationship between those metabolic variables and the endothelial function of obese women with hypercholesterolemia remain to be elucidated.

**PURPOSE:** To evaluate the effect of a twice-weekly RT program and/or a hypocaloric diet on the endothelial function in hypercholesterolemic obese women.

**METHODS:** The design was a 16 week randomized controlled trial. Thirty three participants were assigned to 3 groups: Control group (C, n= 8); Diet group (D, n= 12) with a caloric restriction of 500 Kcal/day; and Diet + RT group (D+RT, n= 13) with a caloric restriction as diet group and a 16- week supervised RT program of 2 sessions/ week. Endothelial function (measured by high-frequency ultrasonography), and basal circulating levels of insulin, glucose, NEFA, leptin, adiponectin and IL- 1Ra were measured baseline and at week 16.

**RESULTS:** Body weight reduction was similar in both D and D+RT groups (6.3 vs. 7.1 Kg). No significant change was observed in plasma NEFA levels. Insulin sensitivity (HOMA index) improved ( $P < .01$ ) and plasma leptin decreased ( $P < .001$ ) in both D and D+RT groups. In contrast, while no significant change was observed in plasma adiponectin levels in women of diet group, in the trained group adiponectin levels decreased significantly (from  $13.8 \pm 4.3$  to  $12.4 \pm 3.5$ ;  $P < .05$ ). As to the endothelial function, an amelioration in the endothelium-independent vasodilatation was observed only in D+RT group (from  $0.41 \pm 0.05$  to  $0.48 \pm 0.04$ ;  $P < .001$ ). IL- 1Ra also increased only in D+RT group ( $P < .05$ ), and in all the three groups a significant correlation was observed between the evolution of the endothelium-independent vasodilatation and the percentage variation of IL- 1Ra ( $r = .348$ ;  $P < .05$ ).

**CONCLUSIONS:** Two sessions/ week of RT, with a concomitant weight loss diet, improves endothelium-independent vasodilatation associated to IL- 1Ra.

Supported in part by grants of Spanish Ministry of Health, Institute Carlos III, Dept. of Health of the Government of Navarra and Government of Spain (CSD) RD06/013/1003 and 87/2010 and 008/EPB10/11, respectively.

**2305 Board #351 MAY 31 8:00 AM - 9:30 AM**

**Exercise Training and Skeletal Muscle Blood Flow: Functional Role of Neuronal Nitric Oxide Synthase (nNOS)**

Daniel M. Hirai, Steven W. Copp, Scott K. Ferguson, Clark T. Holdsworth, David C. Poole, FACSM, Timothy I. Musch, FACSM. Kansas State University, Manhattan, KS.

(No relationships reported)

Exercise training induces multiple adaptations within skeletal muscle which enhance hemodynamic control. Increased nitric oxide (NO) bioavailability via upregulation of endothelial NO synthase (eNOS) function is intrinsic in this process. However, it is also possible that training-induced upregulation of nNOS function contributes importantly to the NO-mediated training response.

**PURPOSE:** To test the hypothesis that selective nNOS inhibition would reduce blood flow and vascular conductance (VC) in hindlimb skeletal muscle of exercise trained rats during submaximal treadmill running.

**METHODS:** Male Sprague-Dawley rats (4-5 mo;  $456 \pm 5$  g) were assigned randomly to either sedentary (S; n=8) or exercise trained (ET; n=8) groups. ET rats performed treadmill exercise 60 min/day, 5 days/wk for 6-8 wks at a speed of up to 35 m/min. Blood flow and VC were determined during submaximal treadmill running at 20 m/min via radiolabeled microspheres before and after administration of the selective nNOS inhibitor S-methyl-L-thiocitrulline (SMTC,  $2.1 \mu\text{mol/kg}$  i.a.).

**RESULTS:** ET rats had greater  $\text{VO}_2$  peak ( $82.4 \pm 2.3$  ml/kg/min) than S rats ( $76.9 \pm 1.3$  ml/kg/min;  $p < 0.05$ ). During submaximal whole-body exercise, ET rats had lower blood lactate concentration during control (S:  $4.4 \pm 0.4$ ; ET:  $1.4 \pm 0.2$  mM;  $p < 0.05$ ) and SMTC (S:  $5.7 \pm 0.5$ ; ET:  $2.0 \pm 0.3$  mM;  $p < 0.05$ ) conditions. Consistent with previous reports, SMTC had no effects on total hindlimb muscle blood flow (control:  $104 \pm 12$ ; SMTC:  $102 \pm 13$  ml/min/100g;  $p > 0.05$ ) and VC (control:  $0.74 \pm 0.07$ ; SMTC:  $0.72 \pm 0.09$  ml/min/100g/mmHg;  $p > 0.05$ ) in S rats. Contrary to our hypothesis, no changes in total hindlimb muscle blood flow (control:  $98 \pm 6$ ; SMTC:  $95 \pm 6$  ml/min/100g;  $p > 0.05$ ) and VC (control:  $0.72 \pm 0.03$ ; SMTC:  $0.66 \pm 0.02$  ml/min/100g/mmHg;  $p > 0.05$ ) were observed in ET rats. Individual hindlimb muscle blood flow and VC were not significantly different following SMTC in S rats. Similarly, the great majority of the individual hindlimb muscles from ET rats exhibited no significant differences in blood flow (27 out of 28) and VC (25 out of 28) between control and SMTC.

**CONCLUSIONS:** Upregulation of nNOS function does not appear to play an obligatory role in muscle hyperemia during submaximal treadmill running in exercise trained rats.

*Support: ACSM Doctoral Grant, AHA Midwest Affiliate, NIH HL-108328*

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**2306** Board #352 MAY 31 8:00 AM - 9:30 AM

**Effect of Aging and Indomethacin on Forearm Reactive Hyperemia in Healthy Adults.**

Jill N. Barnes, Jennifer L. Taylor, Casey N. Hines, Michael J. Joyner, FACSM. *Mayo Clinic, Rochester, MN.*

*(No relationships reported)*

Prostaglandins contribute to peripheral vasodilatory responses and this contribution may vary with age. There are conflicting reports on the extent to which post-ischemic hyperemic flow is influenced by the cyclooxygenase inhibitor indomethacin in young adults, with both increased and decreased flow reported. Despite these discrepancies in young adults, the effect of indomethacin on reactive hyperemia in older adults has not been evaluated.

**PURPOSE:** To evaluate the effect of cyclooxygenase inhibition on forearm reactive hyperemia, in young and old adults. Because aging is associated with a shift from vasodilating to vasoconstricting prostaglandins, we hypothesized that indomethacin would augment forearm vascular conductance during reactive hyperemia in older adults.

**METHODS:** Forearm blood flow (FBF) responses to 5 minutes of forearm ischemia were measured in 20 healthy subjects, including 10 young (26±5 yr) and 10 older (65±6 yr) adults using venous occlusion plethysmography before (CON) and after cyclooxygenase inhibition with oral indomethacin (INDO).

**RESULTS:** Baseline MAP, FBF, and forearm vascular conductance (FVC) were not different between young and old adults during either trial. During the INDO trial, MAP increased during reactive hyperemia in the old (+7±7 mmHg) but not young adults (-1±3 mmHg). Peak FVC was similar between young and old adults during the CON trial (p=0.59), but tended to be lower in older adults during INDO (26±5 AU vs. 37±5 AU; p=0.06). The magnitude of change in FVC peak between the CON and INDO trials was significantly different between groups with increased FVC peak in young (+9±4 AU) and decreased FVC peak in old (-5±6 AU). Similarly, the change in FVC area under the curve (AUC) between CON and INDO trials was increased in young (+1±1 AU) and decreased in old (-2±2 AU). **CONCLUSIONS:** There were no age-related differences in post-ischemic vascular conductance prior to cyclooxygenase inhibition. Contrary to our hypothesis, peak vascular conductance after indomethacin was lower in older adults compared with younger adults. These results suggest that aging alters the effect of cyclooxygenase inhibition on forearm vasodilator responses to reactive hyperemia. Supported by NIH: RR024150 (CTSA); AR056950 (JNB); AG38067 (JNB); AG16574-11PP2 (MJJ); HL46493 (MJJ)

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**2307** Board #353 MAY 31 8:00 AM - 9:30 AM

**Independent Relationship Between Flexibility And Arterial Stiffness In Patients With Stroke**

Yong-Hee Lee, Soo-Hyun Park, Eun-Sun Yoon, Ki Won Lee, Sae Young Jae. *University of Seoul, Seoul, Korea, Republic of.*

*(No relationships reported)*

Increased arterial stiffness is a strong predictor of future cardiovascular events and mortality. Flexibility is associated with arterial stiffness in healthy populations, but it is unclear if this is also the case in patients with stroke.

**PURPOSE:** We investigate the relationship between flexibility and arterial stiffness in patients with stroke.

**METHODS:** Ninety four patients with stroke (male n=68, female n=26, 61±9 years) were recruited in the study. We measured a modified sit and reach test on chair as an index of flexibility. Arterial stiffness was assessed by carotid-femoral pulse wave velocity using applanation tonometry.

**RESULTS:** There was a significant inversely association between flexibility and pulse wave velocity (r=-0.48, p<0.001). In multivariable linear regression models that adjusted for age, gender, body mass index, duration of stroke, systolic blood pressure, heart rate, medication, an cardiorespiratory fitness, flexibility was an independent associated with pulse wave velocity (β=-0.19, p<0.05). Patients with high flexibility had significantly lower pulse wave velocity than patients with low flexibility (8.9m/s vs. 11.8m/s, p<0.001).

**CONCLUSIONS:** These findings demonstrate that high flexibility was associated with low arterial stiffness independent of risk factors and cardiorespiratory fitness in patients with stroke.

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**2308** Board #354 MAY 31 8:00 AM - 9:30 AM

**Aerobic Exercise Training Improves Arterial Stiffness in Relation to the Reduction of Visceral Adiposity in Middle-Aged Men with Abdominal Obesity**

Yoshikazu Takanami<sup>1</sup>, Yukari Kawai<sup>2</sup>, Wataru Aoi<sup>3</sup>, Yuko Tanimura<sup>2</sup>, Hiroshi Ichikawa<sup>4</sup>, Yukari Furukawa<sup>1</sup>, Toshikazu Yoshikawa<sup>3</sup>. <sup>1</sup>*Otsu Women's University, Tokyo, Japan.* <sup>2</sup>*Kyoto Prefectural University of Medicine, Kyoto, Japan.* <sup>3</sup>*Kyoto Prefectural University, Kyoto, Japan.* <sup>4</sup>*Doshisha University, Kyoto, Japan.*

*(No relationships reported)*

**PURPOSE:** To elucidate whether regular aerobic exercise reduces visceral adiposity and arterial stiffness in middle-aged men with abdominal obesity.

**METHODS:** We assigned forty-six sedentary subjects (51.0±0.9 y; mean±SE) to two groups: one that engaged in 30-60 minutes of aerobic exercise/day at least 2 times/week for 16 weeks (Ex, n=36), and one age-matched sedentary control group (C, n=10). Body fat indices and brachial-ankle pulse wave velocity (baPWV) were measured at baseline and after 16 weeks. Visceral fat area (VFA) and subcutaneous fat area (SFA) at the umbilical level was determined by computed tomographic scanning (CT).

**RESULTS:** According to the baseline CT examination, there were 16 subjects with abdominal obesity (VFA≤100cm<sup>2</sup>; Ob) in Ex (Ex-Ob), and 5 in C (C-Ob). Twenty subjects were not abdominally obese in Ex (Ex-N). Exercise training reduced VFA in Ex-Ob (139.6±7.3cm<sup>2</sup> to 113.4±7.9cm<sup>2</sup>; p<0.001) and also in Ex-N (58.0±3.9cm<sup>2</sup> to 48.6±3.7cm<sup>2</sup>; p<0.001). baPWV of Ex-Ob decreased from 1340.9±39.3cm/sec to 1281.6±39.1cm/sec (p<0.05) through exercise training. However, no significant change of baPWV was detected in Ex-N and in C-Ob after 16 weeks period. There was a significant correlation between the changes in VFA and the changes in baPWV in Ex (r=0.338, p<0.05).

**CONCLUSIONS:** Regular aerobic exercise reduced visceral adiposity and arterial stiffness in abdominal obesity. This reduction of arterial stiffness through aerobic exercise training may be partially caused by the reduction of visceral fat.

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**2309** Board #355 MAY 31 8:00 AM - 9:30 AM

**Measurement Of Peak-flow To Rest-flow Ratio In Children After Aerobic Exercise Using Laser Doppler Fluximetry**

Goutham Ganesan, Diana Vigil, Scott Graf, Shlomit Aizik, Dan Cooper, Pietro Galassetti. *UC Irvine, Irvine, CA.*

*(No relationships reported)*

**PURPOSE:** The non-invasive assessment of endothelial function has become a key part of the study of the progression of dysmetabolic states (obesity, diabetes). Reliable measurements have however proven challenging during metabolic perturbations (i.e. physical exercise, invoked in these conditions both as a therapeutic and as a testing tool), and in vulnerable populations such as obese and diabetic children. We sought to optimize the use of an established technique measuring skin microcirculation reactivity, Laser Doppler Fluximetry (LDF), in the post-exercise state in healthy and obese children, and to determine a reproducible method for analyzing and reporting measurements of reactive hyperemia.

**METHODS:** Ten children (13.3±1.1 years, 3 f; 5 obese, 5 healthy weight) completed standard incremental maximal exercise tests. Post-Occlusive Reactive Hyperemia (PORH) testing (1 min occlusion, >280 mm Hg at wrist, probe placed over middle phalanx of third digit, recumbent position) was conducted 5 min before, and 5 and 15 min post-exercise (Periflux 5000, Perimed, Sweden). Perfusion index (PI) and temperature were continuously measured. Data taken one minute before and two minutes after occlusion was analyzed with PSW software, provided by manufacturer, yielding calculations of time to maximum PI (TM), rest, or baseline pre-occlusion PI (RF), peak post-occlusion PI (PF), and biological zero (BZ).

**RESULTS:** We observed that the ratio of peak flow to rest flow (PF/RF) was very consistent within and across subjects, showing a clear post-exercise vasodilatory effect (pre-exercise: 1.59±.08; 5 min post, 1.75±.18; 15 min post 1.85±.18). As a relative index, PF/RF prevented imprecision due to varying baseline values, changes in probe positioning, and inaccuracies in determination of PI absolute values, and could therefore be used as reliable index of maximal hyperemic response in our study group.

**CONCLUSIONS:** Our data suggests that post-occlusive PF/RF ratio may be a reproducible index of both resting vascular function, and of post-exercise vasodilation in children with a wide range of BMI values. Broader application of this variable may help standardize prior non-homogeneous findings of altered post-occlusive hyperemic response in pediatric obese populations, often reported in arbitrary perfusion units.

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2310 Board #356 MAY 31 8:00 AM - 9:30 AM

**Brachial Artery Low Flow-Mediated Constriction in Individuals with Increased Cardiovascular Risk**

Kunihiko Aizawa, Salim Elyas, Damilola D. Adingupu, Angela C. Shore, W David Strain, Phillip E. Gates. *Peninsula Medical School, Exeter, United Kingdom.*  
(No relationships reported)

Low flow-mediated constriction (LFMC) is a recently introduced technique that has been proposed to provide additional and complementary information to "traditional" flow-mediated dilation (FMD). However, whether LFMC occurs when the test is performed in the brachial artery remains controversial and LFMC has not been well studied in older individuals with increased cardiovascular (CV) risk.

**PURPOSE:** The purpose of this study was 1) to determine whether LFMC would differ between older individuals with increased CV risk and healthy older individuals, and 2) to examine relationships between LFMC and estimated shear rate (SR).

**METHODS:** Data from 2 groups [56 individuals with increased CV risk (history of recent stroke or transient ischemic attack, presence of hypertension and/or type2 diabetes, 67.5±9.2yrs, 12F), and 20 individuals with no clinically manifest CV disease (65.8±4.3yrs, 16F)] were compared. FMD and LFMC were assessed using a 5-min forearm cuff occlusion technique. Diameter and blood velocity data obtained by a Doppler ultrasound machine were used for the calculation of FMD, LFMC, and SR indices using a semi-automated edge detection software. Two indices of SR were calculated: SR during LFMC (SRlow) and the differences in SR between baseline and LFMC (SRdiff).

**RESULTS:** The prevalence of LFMC was 60.7% in the increased CV risk group and 45.0% in the healthy group. LFMC tended to be greater in the increased CV risk group (-0.63±1.64%) than the healthy group (0.24±2.04%, p=0.058). In the healthy group, LFMC was significantly correlated with FMD (r=0.55, p<0.05), whereas no association was observed in the increased CV risk group. Neither SRlow nor SRdiff was correlated with LFMC.

**CONCLUSION:** These results suggest that LFMC is independent of SR during cuff occlusion in our populations. Whereas greater LFMC may lead to a lower FMD in healthy older individuals, the FMD response may be independent of LFMC in older individuals with increased CV risk. The trend for a difference in LFMC between the groups requires further investigation. Supported in part by Peninsula NIHR Clinical Research Facility.

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2311 Board #357 MAY 31 8:00 AM - 9:30 AM

**Responsiveness of the Popliteal Artery in Older Trained and Untrained Women**

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(No relationships reported)

Age and sex are two major determinants of the flow-mediated dilation (FMD) response. Advancing age is associated with endothelial dysfunction, with older women displaying a more prominent decline. The role of aerobic fitness on preserving endothelial function in post-menopausal women is not well understood. Further, the response of the popliteal artery among older women is not well documented.

**PURPOSE:** To determine whether there are differences between the FMD response of the popliteal artery between older women (ages 60-85 years) who are endurance trained compared to older women who are not endurance trained.

**METHODS:** Ultrasound-derived arterial diameter and Doppler mean blood velocity (MBV) of the popliteal artery were measured in 10 trained (age: 62.6 ± 3.3 yrs, VO2max : 39.5 ± 8.7 ml·kg<sup>-1</sup>·min<sup>-1</sup>) and 11 untrained (age: 68.7 ± 6.0 yrs, VO2max: 24.0 ± 2.6 ml·kg<sup>-1</sup>·min<sup>-1</sup>) healthy post-menopausal women at rest and after 5 min of distal cuff occlusion. Blood flow (BF) and shear rate (SR) were calculated as 60×MBV×3.14r<sup>2</sup> and MBV/diameter respectively. Multivariate analysis of variance was conducted to determine between group differences and linear regression analyses were conducted with FMD, MBV, BF and SR as outcomes.

**RESULTS:** No significant differences between peak diameter, MBV, BF and SR were noted between groups. The percent change in diameter following cuff release was 5.6% in the trained group and 4.8% in the untrained group. Age was a significant predictor of MBV, BF and SR such that older women were more likely to have higher MBV and SR.

**CONCLUSIONS:** A greater MBV, BF and SR are required to induce the same change in diameter of the popliteal artery as post-menopausal women age, regardless of their aerobic fitness level. This has implications for the utility of FMD as a measure of exercise training related endothelial function improvements.

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2312 Board #358 MAY 31 8:00 AM - 9:30 AM

**The Effect of High-Dose Atorvastatin Therapy on Peripheral Arterial Stiffness in Healthy Adults**

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(No relationships reported)

**PURPOSE:** Statin therapy has been shown to improve peripheral arterial stiffness in clinical populations. The purpose of this study was to examine the effect of high dose atorvastatin therapy on peripheral arterial stiffness in healthy adults.

**METHODS:** Healthy, statin naïve adults (20-76 years old) were randomized to either 80mg atorvastatin (ATOR: n=17) or placebo (PL: n=22) for 6 months. Peripheral (femoral-tibial) pulse wave velocity (PWV) was measured before and after drug treatment. Change in PWV ( $\Delta$  PWV) was calculated as the difference between baseline and post treatment values. Repeated measures ANCOVA tested differences in PWV over 6 months by drug treatment group, investigating potential covariates such as baseline age, fitness (VO2max), body mass index, blood pressure, blood lipids and physical activity (Actical accelerometer) as well as changes in these parameters over the trial.

**RESULTS:** Baseline characteristics were similar between statin and placebo groups including PWV (p=0.62). Low density lipoprotein (LDL) cholesterol decreased significantly (-49.8 ± 16.6%; p<0.01) in the ATOR group with no change in LDL for the PL group (0.3 ± 14.6% ; p=0.92). There was no difference in  $\Delta$  PWV between ATOR and PL groups (p=0.52). However, there was a significant interaction between time spent in moderate and vigorous physical activity at baseline and drug treatment (both p < 0.05) such that in the ATOR group only,  $\Delta$  PWV with statin treatment (0.12 ± 1.95 m/s) was directly related to baseline levels of moderate activity (Pearson coefficient = 0.55; p = 0.02) and inversely related to baseline levels of vigorous activity (Pearson coefficient = -0.56; p = 0.02).

**CONCLUSIONS:** Healthy adults with high levels of moderate physical activity and low levels of vigorous physical activity at the beginning of the trial exhibited reduced peripheral arterial stiffness with statin therapy. The interaction between atorvastatin and baseline physical activity level suggests that direct effects of statin therapy on the peripheral vasculature may be influenced by exposure to chronic physical activity. Resultantly, physical activity levels should be monitored in clinical trials assessing vascular effects of statins.

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2313 Board #359 MAY 31 8:00 AM - 9:30 AM

**The Effect Of An Acute Bout Of Exercise On Endothelial Function Following Ischemic-reperfusion Injury**

Jennifer L. Lawrence, Mitchell R. Stacy, Sarah A. McGlinchey, Erin C. Garmyn, Barry W. Scheuermann. *The University of Toledo, Toledo, OH.*  
(No relationships reported)

Previous studies have shown that ischemic-reperfusion injury (IRI) leads to endothelial dysfunction, a hallmark of poor vascular health. It has been established that endothelial dysfunction is one of the first markers of atherosclerosis and thus, identifying conditions that lead to endothelial dysfunction have important clinical implications. Participation in regular physical activity can provide some protection against IRI through a preconditioning mechanism as well as improve endothelial function. However, it is not currently known if an acute bout of exercise performed prior to IRI can lead to a protective condition whereby endothelial dysfunction is prevented or reduced.

**PURPOSE:** To determine if an acute bout of moderate intensity exercise can provide an alternative method of preconditioning to either prevent or attenuate the effects of IRI on endothelial function.

**METHODS:** Nine healthy subjects (6 males; 3 females, 21.7 ± 3.2 yrs, ± SD) participated in three protocols including, ischemic-reperfusion injury (IRI), exercise only (EXER), and preconditioning (COND). IRI was induced by inflating a cuff placed around the upper arm to 200 mm Hg for 20 minutes. The COND protocol involved running on a treadmill at a moderate intensity (60% APMHR) for 45 min prior to application of IRI. Endothelial function in the brachial artery was assessed using flow-mediated dilation (FMD) before and at 120, 140 and 160 min after the initial FMD measurement.

**RESULTS:** Compared to pre-injury FMD, both IRI (Pre;  $7.56 \pm 1.04$ ; Post  $2.57 \pm 1.07$  %FMD,  $p < 0.05$ ) and COND (Pre;  $7.23 \pm 0.94$ ; Post  $2.34 \pm 1.05$  %FMD,  $p < 0.05$ ) resulted in a decrease in vascular response at 120 min. The FMD at 140 min remained blunted ( $p < 0.05$ ) for IRI but returned to pre-injury values by 160 min. The FMD for COND returned to pre-injury values by 140 min with no further change at 160 min. The EXER only intervention did not result in a significant change in %FMD at any time points.

**CONCLUSIONS:** Ischemic-reperfusion resulted in a significant decrease in endothelial function during the IRI and COND protocols but %FMD returned to pre-injury values by 140 for COND and not until 160 min for IRI. An acute bout of moderate intensity exercise performed prior to IRI may not attenuate the magnitude of endothelial dysfunction but recovery from IRI may be speeded by exercise.

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**2314** Board #360 MAY 31 8:00 AM - 9:30 AM  
**50%vo2max-Arm-Crank Exercise May Not Improve Arterial Stiffness**

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(No relationships reported)

The endurance exercise such as cycling, walking, or running is useful for improving arterial stiffness. Subjects suffering from partial paralysis or arthritis, however, are not able to conduct these kinds of lower-limb exercise. Previous research suggested that 60-70%VO<sub>2</sub>max-arm-crank exercise increased arterial stiffness. Therefore, in order to improve arterial stiffness by arm-exercise, lower exercise intensity might be needed.

**PURPOSE:** We tried to identify the acute effect of 50%VO<sub>2</sub>max-arm-crank exercise on arterial stiffness determined by pulse wave velocity.

**METHODS:** Six healthy recreationally active adult men were studied under two experimental trials on 2 separate days. The order of experiments was randomized among 30min-arm-crank exercises at 50%VO<sub>2</sub>max (50%-Arm) and control (C; seated rest while reading). Before and for 45min at 15min intervals after each trial, brachial to ankle pulse wave velocity (baPWV), brachial systolic and diastolic blood pressure (SBP, DBP) and heart rate (HR) were obtained while in the supine position.

**RESULTS:** Baseline hemodynamic values were not different among two trials. In 50%-Arm trials, SBP, DBP, and HR returned to baseline at 15-min recovery. Compared with rest value ( $999.5 \pm 26.4 \text{ cm} \cdot \text{sec}^{-1}$ ), baPWV was significantly elevated after 15-min recovery ( $1083.0 \pm 38.8 \text{ cm} \cdot \text{sec}^{-1}$ ), 30-min recovery ( $1047.7 \pm 34.3 \text{ cm} \cdot \text{sec}^{-1}$ ), 45-min recovery ( $1016.0 \pm 64.6 \text{ cm} \cdot \text{sec}^{-1}$ ). In C trial, however, there were no changes in SBP, DBP, HR, and baPWV through the trial.

**CONCLUSIONS:** These results indicate that acute 50%VO<sub>2</sub>max-arm-crank exercise increased baPWV, which was the opposite reaction of lower-limb exercise. Therefore, in order to improve arterial stiffness by arm-crank exercise, less than 50%VO<sub>2</sub>max should be recommended.

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**2315** Board #361 MAY 31 8:00 AM - 9:30 AM  
**Systemic Vascular Resistance Response to Exercise in Morbidly Obese College-Aged Mexican-American Females**

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(No relationships reported)

Systemic vascular resistance response (SVRR) to exercise provides insight into potential cardiovascular disease. However, one potential risk factor that may contribute to reduction of the SVRR may be the over accumulation of adipose tissue. Research in obesity-related reduction of SVRR in Mexican-American females is lacking.

**PURPOSE:** The purpose of this study was to examine the SVRR to exercise of morbidly obese Mexican-American college-aged females compared to non-morbidly obese females.

**METHODS:** Subjects (N=79) were limited to Mexican-American females of college age (mean =  $23.59 \pm 5.85$  yrs) recruited across campus. Body fat percent (BF%) was recorded by air plethysmography. Radial pulse wave contour tonometry was used to determine large artery elasticity index (LAEI) and small artery elasticity index (SAEI) and systemic vascular resistance (SVR). Pulse wave contour analysis was recorded prior to a multistage submaximal treadmill exercise test and within 5 minutes after completing the submaximal test. Predicted VO<sub>2</sub> was calculated from the submaximal test. Subjects were categorized by BF% and VO<sub>2</sub>. The SVRR was calculated as the difference between the exercise pretest SVR and posttest SVR.

**RESULTS:** The non-morbidly obese group had significantly greater predicted VO<sub>2</sub> ( $35.05 \pm 5.9 \text{ ml/kg/min}^{-1}$ ) than the morbidly obese group ( $28.25 \pm 5.9 \text{ ml/kg/min}^{-1}$ ,  $p < 0.05$ ). The mean SVRR for non-morbidly obese fit subjects ( $120.72 \pm 205.17 \text{ dynes/sec/cm}^2$ ) was significantly greater than for the morbidly obese unfit subjects ( $37.21 \pm 133.83 \text{ dynes/sec/cm}^2$ ,  $p < 0.05$ ). To determine if fitness was a factor for SVRR a one-way ANOVA was conducted that excluded the independent variable of obesity. The results of the ANOVA indicated no significant differences for SVRR between the fitness groups. No significant differences between the LAEI and the SAEI were observed between the groups.

**CONCLUSIONS:** The mediation of morbid obesity attributes to the loss of SVRR in this sample of Mexican-American females; placing them at greater risk for CVD. One possible explanation is that obese individuals typically have less circulating adiponectin. Other research indicates that Mexican-American populations have reduced levels of adiponectin than other population groups.

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**2316** Board #362 MAY 31 8:00 AM - 9:30 AM  
**Acute Effects of Stretching Exercise on Arterial Stiffness**

Yuko Gando<sup>1</sup>, Kenta Yamamoto<sup>2</sup>, Hiroshi Kawano<sup>1</sup>, Isao Muraoka<sup>1</sup>. <sup>1</sup>Waseda University, Saitama, Japan. <sup>2</sup>University of North Texas Health Science Center, Fort Worth, TX. (Sponsor: Mitsuru Higuchi, FACSM)  
(No relationships reported)

Increased arterial stiffness is a risk factor for cardiovascular diseases. Poor flexibility is associated with arterial stiffening. Currently, it is unknown whether stretching exercise induces favorable changes in the arterial stiffness.

**PURPOSE:** To determine the acute effects of stretching exercise on arterial stiffness.

**METHODS:** Seven healthy adults (2 men and 5 women, age  $24 \pm 1$  yrs) were studied separately under parallel experimental trials on two days. The order of experiments was performed randomly between stretching exercise (40 stretching exercises for whole body at maximum range of motion) and sham control (seated rest in the exercise room). Arterial stiffness (baPWV; brachial-ankle pulse wave velocity) was measured before and immediately after the stretching exercise as well as 15, 30, 45, 60 minutes after the stretching exercise.

**RESULTS:** Baseline baPWV was not different between the two experimental trials (Stretching;  $1011 \pm 55$  vs. Control;  $992 \pm 55 \text{ cm/s}$ ,  $P > 0.05$ ). The baPWV significantly decreased 45 and 60 minutes after stretching exercise (45 min;  $958 \pm 46$ , 60 min;  $951 \pm 42 \text{ cm/s}$ ,  $P < 0.05$  respectively). In contrast, during the sham control trial, no significant changes in baPWV were observed. Systolic blood pressure, mean arterial pressure, and diastolic blood pressure were not significantly different from baseline values at any time point in both experimental trials.

**CONCLUSIONS:** These results indicated that stretching exercise decreases acutely arterial stiffness, suggesting that to improve flexibility induced by stretching exercise may be capable of modifying arterial stiffening. This study was supported by a Grant-in-Aid for Research Activity Start-up (#23800060, Y.Gando).

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**2317** Board #363 MAY 31 8:00 AM - 9:30 AM  
**Vitamin C Prevents Attenuation of Flow-mediated Dilation Following Exercise with Augmented Oscillatory and Retrograde Shear**

Blair D. Johnson<sup>1</sup>, Kieren J. Mather<sup>2</sup>, Sean C. Newcomer<sup>3</sup>, Timothy D. Mickleborough<sup>1</sup>, Janet P. Wallace, FACSM<sup>1</sup>. <sup>1</sup>Indiana University, Bloomington, IN. <sup>2</sup>Indiana University, Indianapolis, IN. <sup>3</sup>Purdue University, West Lafayette, IN.  
(No relationships reported)

Elevated oscillatory and retrograde shear rate (SR) reduces flow-mediated dilation (FMD) possibly due to oxidative stress.

**PURPOSE:** We tested the hypothesis that the antioxidant vitamin C would prevent the attenuation of FMD following exercise with elevated oscillatory and retrograde SR.

**METHODS:** Twelve lean healthy men ( $26.3 \pm 0.9$  years) ingested 1 g of vitamin C or placebo (1 g sucrose) before undergoing two supine cycle ergometer exercise trials (20 min at 90 W). A forearm blood pressure cuff was inflated to 60 mm Hg during exercise to increase oscillatory and retrograde SR in one arm. The contralateral arm served as the control. Brachial artery FMD was assessed in both arms before and promptly after exercise. SR profiles were assessed at baseline and during exercise. The oscillatory shear index (OSI) was determined as:  $(\text{retrograde} / (\text{retrograde} + \text{lantegrade}))$ .

**RESULTS:** Baseline FMD was not different between arms or trials ( $P > 0.52$  for both) (placebo: cuffed  $4.9 \pm 2.4\%$ , control  $4.4 \pm 1.5\%$ ; vitamin C: cuffed  $4.9 \pm 3.0\%$ , control  $4.5 \pm 2.4\%$ ). Antegrade SR increased during exercise ( $P < 0.01$ ), was not different between trials ( $P = 0.37$ ) but was greater in the cuffed arm ( $P = 0.01$ ) (placebo: cuffed  $52.8 \pm 13.0 \text{ s}^{-1}$ , control  $49.6 \pm 12.5 \text{ s}^{-1}$ ; vitamin C: cuffed  $53.2 \pm 13.0 \text{ s}^{-1}$ , control  $45.4 \pm 9.0 \text{ s}^{-1}$ ). Retrograde SR increased in both arms during exercise ( $P < 0.01$ ) and was greater in the cuffed arm in both trials ( $P < 0.01$ ) (placebo: cuffed  $36.7 \pm 10.8 \text{ s}^{-1}$ , control  $27.9 \pm 9.7 \text{ s}^{-1}$ ; vitamin C: cuffed  $35.6 \pm 10.3 \text{ s}^{-1}$ , control  $26.1 \pm 6.7 \text{ s}^{-1}$ ). Mean SR was not different between arms or trials ( $P > 0.10$  for both) (placebo: cuffed  $16.1 \pm 14.7 \text{ s}^{-1}$ , control  $21.7 \pm 15.9 \text{ s}^{-1}$ ; vitamin C: cuffed  $17.6 \pm 11.9 \text{ s}^{-1}$ , control  $19.2 \pm 9.5 \text{ s}^{-1}$ ). The OSI was greater in the cuffed arm vs. control ( $P = 0.02$ ) and was not different between trials ( $P = 0.88$ ) (placebo: cuffed  $0.40 \pm 0.1$ , control  $0.36 \pm 0.1$ ; vitamin C: cuffed  $0.40 \pm 0.1$ , control  $0.37 \pm 0.1$ ). Postexercise FMD in the control arms increased ( $P < 0.01$ ) but were not different between trials ( $P > 0.05$ ) (placebo  $7.7 \pm 2.8\%$  vs. vitamin C  $7.1 \pm 3.5\%$ ). FMD in the cuffed arm was unchanged in the placebo trial ( $5.4 \pm 2.4\%$ ,  $P = 0.52$ ). FMD increased in the vitamin C trial ( $6.6 \pm 3.3\%$ ,  $P = 0.03$ ).

**CONCLUSIONS:** Vitamin C prevents the attenuation of FMD after exercise with elevated oscillatory and retrograde SR through an apparent reduction of oxidative stress.

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**2318** Board #364 MAY 31 8:00 AM - 9:30 AM

**Effects of Cigarette Smoking on Endothelial Function in Chronic Smokers Compared with Healthy Young Adults**

Marvin T. Dang<sup>1</sup>, Deborah L. Fearheller<sup>1</sup>, Ryan A. Harris<sup>2</sup>, Christian K. Roberts, FACSM<sup>1</sup>. <sup>1</sup>University of California, Los Angeles, Los Angeles, CA. <sup>2</sup>Georgia Health Sciences University, Augusta, GA.  
(No relationships reported)

**PURPOSE:** Previous studies have suggested endothelial dysfunction as a predictor of adverse cardiovascular events, and cigarette smoking impairs endothelial function. To examine the degree to which smoking cigarettes affects endothelial function in individuals, we compared brachial artery flow-mediated dilation (FMD) between young adult smokers (100 cigarette lifetime minimum, and 15 per month) and non-smoking recreationally-active young adults.

**METHODS:** The FMD test was performed on 30 young adult smokers (26 M, 4 F, age  $25.2 \pm 4.6$  yrs) and 28 non-smokers (19 M, 9 F age  $24.2 \pm 3.7$  yrs). Parameters of the FMD test include, baseline and peak diameter, FMD (% and absolute change), shear rate area under the curve ( $\text{s}^{-1}$ , AUC), normalized FMD response (FMD (%)/Shear rate ( $\text{s}^{-1}$ , AUC). Smoking status was verified via breath carbon monoxide (CO) concentration.

**RESULTS:** FMD ( $5.6 \pm 3.8\%$  vs.  $7.6 \pm 3.1\%$ ,  $p = 0.05$ ) and the normalized FMD response ( $0.41 \pm 0.35$  vs.  $0.73 \pm 0.52$ ,  $p = 0.01$ ) were both lower in smokers compared to non-smokers. There were sex differences in baseline diameter ( $0.35 \pm 0.03$  cm vs.  $0.41 \pm 0.06$  cm;  $p = 0.001$ ) and peak diameter ( $0.37 \pm 0.01$  cm vs.  $0.43 \pm 0.06$  cm  $p = 0.001$ ), with men exhibiting higher for both measures. No differences ( $p > 0.05$ ) between smokers and non-smokers were observed for baseline diameter ( $0.38 \pm 0.06$  cm vs.  $0.41 \pm 0.06$  cm), peak diameter ( $0.41 \pm 0.06$  cm vs.  $0.43 \pm 0.06$  cm), absolute change in diameter ( $0.03 \pm 0.01$  cm vs.  $0.02 \pm 0.02$  cm), and shear rate ( $14011.98 \pm 10.456.17 \text{ s}^{-1}$ , AUC vs.  $16714.42 \pm 8128.99 \text{ s}^{-1}$ , AUC). Further, there was no correlation with breath CO concentration and any FMD variable in smokers.

**CONCLUSION:** These data support previous studies which indicate that chronic smoking results in endothelial dysfunction. Our ongoing randomized-controlled trial will determine if resistance training can improve endothelial function in chronic smokers and whether the levels after training will be similar to those in non-smokers before training.

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**2319** Board #365 MAY 31 8:00 AM - 9:30 AM

**Cross-Sectional Analysis of Arterial Stiffness in Chronic Smokers Compared with Physically-Active Young Adults**

Michelle L. LaFranchi, Sang Moon, Christian K. Roberts, FACSM. UCLA, Los Angeles, CA.  
(No relationships reported)

**PURPOSE:** Previous studies have demonstrated the beneficial effect of exercise on arterial stiffness, an independent predictor of cardiovascular disease risk, in healthy, young adults. However, the effects of exercise on chronic smokers are not known. The present study compared baseline arterial stiffness measurements between smoking and non-smoking, recreationally-active, young adults as part of a randomized-controlled trial (RCT) to investigate the effects of resistance training (RT) and smoking cessation on vascular function in young adult, chronic smokers.

**METHODS:** Brachial blood pressure and arterial tonometry measurements were performed on 30 young adult smokers (26 men, 4 women, age  $25 \pm 4.6$  yr) and 28 non-smokers (19 men, 9 women, age  $24 \pm 3.7$  yr). Smokers reported the number of cigarettes smoked/day over the past 30 days. Arterial stiffness was assessed in duplicate via measurements of cPWV and radial artery pulse wave analysis (PWA) using applanation tonometry (Sphygmocor) to derive augmentation index (AIx), sub-endocardial viability ratio (SEVR, an index of cardiac perfusion), pulse pressure amplification (PPA), and mean aortic pressure (aMAP). Results are reported as mean  $\pm$  standard deviation.

**RESULTS:** Despite no significant differences in brachial blood pressures, compared with healthy, recreationally-active control subjects, smokers exhibited higher cPWV ( $6.6 \pm 1.1 \text{ m/s}$  vs.  $5.9 \pm 0.8 \text{ m/s}$ ,  $p < 0.01$ ) and AIx ( $-2.6 \pm 12.4\%$  vs.  $-11.2 \pm 12.4\%$ ,  $p < 0.05$ ). Additionally, SEVR ( $189.4 \pm 32.8$  vs.  $212.9 \pm 42.7$ ,  $p < 0.05$ ) and PPA ( $1.6 \pm 0.1$  vs.  $1.5 \pm 0.1$ ,  $p < 0.005$ ) were lower in smokers. No difference in aMAP was noted ( $93.8 \pm 9.5 \text{ mmHg}$  vs.  $93.6 \pm 9.6 \text{ mmHg}$ ). In smokers, there was a significant difference in cPWV between less frequent (6 cigarettes/day) ( $6.0 \pm 0.9 \text{ m/s}$  vs.  $6.9 \pm 1.1 \text{ m/s}$ ,  $p < 0.05$ ).

**CONCLUSIONS:** Chronic smokers exhibit higher arterial stiffness and lower cardiac perfusion, even at a young age. Furthermore, individuals who smoke more cigarettes per day present higher cPWV. These results agree with prior studies that cigarette smoking increases arterial stiffness. Our ongoing RCT will determine if RT can improve arterial stiffness and induce smoking cessation in chronic smokers.

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**2320** Board #366 MAY 31 8:00 AM - 9:30 AM

**Blood Flow Regulation is Blunted during Exercise in Patients with Cystic Fibrosis**

Ryan A. Harris<sup>1</sup>, Breana Berry<sup>1</sup>, Spencer Poore<sup>1</sup>, Dabney Eidson<sup>1</sup>, Gareth W. Davison, FACSM<sup>2</sup>, Katie T. McKie<sup>1</sup>. <sup>1</sup>Georgia Health Sciences University, Augusta, GA. <sup>2</sup>University of Ulster, Jordanstown, Ireland.  
(No relationships reported)

Cystic fibrosis (CF) is an autosomal recessive genetic disorder that affects multiple organ systems. The non-functional CFTR protein channel characteristic in patients with CF has recently been discovered in skeletal muscle and vascular endothelium and may be linked to observed exercise intolerance in these patients.

**PURPOSE:** To examine the peripheral hemodynamic response during exercise in children with CF compared to matched controls.

**METHODS:** 14 patients with CF and 14 demographically matched controls underwent pulmonary function tests and a maximal cycle exercise test. Brachial artery diameter and blood flow were measured at baseline and during progressive submaximal exercise; 20%, 40% and 60% of maximal work load. Blood samples were taken at baseline and during 60% of maximal workload for the detection of ascorbyl free radicals.

**RESULTS:** All subject characteristics were similar between CF and control groups (all  $p > 0.05$ ) except for lung function ( $\text{FEV}_1/\text{FVC}$ ,  $\text{FEV}_1\%$  of predicted, and  $\text{FEF}_{25-75}$ ; all  $p < 0.05$ ). Although not significant, exercise capacity was lower in patients with CF compared to controls ( $\text{VO}_2 = 34.5 \pm 6.7$  vs.  $37.8 \pm 9.2 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ ;  $p = 0.287$ ). During submaximal exercise, all subjects exhibited an increase in blood flow and blood velocity ( $p < 0.001$ ) with increased exertion. However, patients with CF exhibited a blunted retrograde blood velocity ( $3.1 \pm 0.9$  vs.  $5.9 \pm 0.8 \text{ cm/s}$ ;  $p = 0.013$ ) and retrograde blood flow ( $14.3 \pm 7.7$  vs.  $23.6 \pm 4.6 \text{ l/min}$ ;  $p = 0.095$ ) during 60% exercise compared to the controls, indicating an impaired blood flow regulation during exercise. No differences ( $p = 0.894$ ) in ascorbyl free radical concentration was observed between patients ( $5.23 \times 10^5 \text{ A.U}$ ) and controls ( $6.01 \times 10^5 \text{ A.U}$ ) at baseline, however, patients with CF appear to have an exaggerated ( $p = 0.179$ ) free radical response to exercise compared to controls ( $\Delta 1.47 \times 10^6$  vs.  $4.25 \times 10^5 \text{ A.U.}$ , respectively).

**CONCLUSION:** These data are the first to identify an impaired blood flow regulation during exercise in patients with CF compared to controls, which may, in part, be explained by the greater free radical response to exercise in these patients compared to controls. This work was supported in part by grants from the American Heart Association (R.A.H) and Child Health Discovery Institute (R.A.H).

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2321 Board #367 MAY 31 8:00 AM - 9:30 AM

**Effect of Maximal Exercise on Carotid Artery Stiffness in African-American and Caucasian Men and Women**

Bo Fernhall, FACSM<sup>1</sup>, Sushant Randive<sup>2</sup>, Huimin Yan<sup>2</sup>, Abbi Lane<sup>1</sup>, Rebecca Kappus<sup>1</sup>, Marc Cook<sup>2</sup>, Peng Sun<sup>2</sup>, Shevon Harvey<sup>2</sup>, Kenneth Wilund<sup>2</sup>, Jeffrey Woods, FACSM<sup>2</sup>. <sup>1</sup>University of Illinois at Chicago, Chicago, IL. <sup>2</sup>University of Illinois at Urbana-Champaign, Urbana, IL.  
(No relationships reported)

**PURPOSE:** Arterial stiffness is higher in young African-Americans (AA) vs Caucasians (CA). It has also been suggested that peripheral, but not central arterial stiffness changes differentially after maximal exercise in AA, but only in a select small sample of AA men. The purpose of this study was to compare the arterial response to maximal exercise in AA and CA men and women.

**METHODS:** 36 AA (17 men and 19 women) and 34 CA (18 men and 16 women) between the ages of 18-35 volunteered for the study. Women were tested during menses. Carotid, brachial and femoral artery stiffness were assessed using high resolution ultrasonography. Subjects completed a maximal exercise test with maximal oxygen uptake (VO<sub>2</sub>max) measurements. All arterial measures were conducted in a supine position, at rest and then at 15 and 30 minutes after the maximal exercise.

**RESULTS:** AA exhibited lower VO<sub>2</sub>max (31.8 ± 7.5 vs 37.1 ± 7.8 ml/kg/min) but slightly higher body mass index (27.1 ± 5.2 vs 24.6 ± 3.6) than CA (p<.05). Consequently, all arterial and blood pressure exercise responses were adjusted for VO<sub>2</sub>max and BMI, and the adjusted means are presented. CA increased carotid beta stiffness more following exercise than AA (5.4 ± 0.2 to 6.6 ± 0.3 to 5.9 ± 0.3 vs 5.7 ± 0.2 to 5.9 ± 0.2 to 5.5 ± 0.2; p<.01 for interaction). There was no significant change in brachial or femoral artery stiffness following maximal exercise for either group (data not shown; p>.05). However, aortic SBP significantly decreased in CA but did not change in AA following exercise (105 to 102 to 100 mmHg vs 103 to 105 to 105 mmHg; p<.001 for interaction) and carotid SBP showed a similar response, and approached significance (117 to 117 to 113 vs 113 to 121 to 116 for CA vs AA respectively; p=.07 for interaction).

**CONCLUSION:** These data show that AA exhibited lower changes in carotid artery stiffness following maximal exercise compared to CA despite maintaining higher BP, suggesting an uncoupling of changes in stiffness and blood pressure following exercise. Future work is needed to determine if the differential responses between AA and CA translates to differences in CVD risk.

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2322 Board #368 MAY 31 8:00 AM - 9:30 AM

**The Associations Between Aerobic Capacity and Arterial Stiffness in People with Chronic Spinal Cord Injury**

Masae Miyatani<sup>1</sup>, Cameron Moore<sup>1</sup>, Kei Masani<sup>1</sup>, Paul I. Oh<sup>1</sup>, Milos R. Popovic<sup>2</sup>, B Cathy Craven<sup>1</sup>. <sup>1</sup>Toronto Rehabilitation Institute, Toronto, ON, Canada. <sup>2</sup>University of Toronto, Toronto, ON, Canada. (Sponsor: Mitsuru Higuchi, FACSM)  
(No relationships reported)

People living with spinal cord injury (SCI) are a vulnerable population prone to coronary artery disease (CAD) resulting in high morbidity and mortality. Arterial stiffness assessed by pulse wave velocity measured between the common carotid and femoral arteries (cfPWV) is an established independent predictor of CAD morbidity and mortality in the able-bodied population. The European Society of Hypertension and the European Society of Cardiology have defined cfPWV values ≥1200 cm/s as a diagnostic threshold for subclinical vascular end-organ damage. We have previously reported that average cfPWV values among people with chronic SCI above this diagnostic threshold. Prior studies have demonstrated that aerobic capacity is inversely associated with arterial stiffness in able-bodied people. However, the relationship between arterial stiffness, particularly elevated cfPWV values (≥1200 cm/s), and aerobic capacity in people with SCI has not been described.

**PURPOSE:** To explore the associations between aerobic capacity (VO<sub>2</sub>peak) and elevated cfPWV values (≥1200 cm/s) among adults with chronic SCI.

**METHODS:** Thirty men and women with chronic SCI (C2-T12; AIS A-D; 11 paraplegics and 19 tetraplegics; time post injury: 14.3±11.7 yrs; Age: 50.6±11.8 yrs; Height: 175.9 ± 9.4cm; and Weight: 85.7 ± 19.1 kg) participated in the study. cfPWV was measured using two Doppler flowmeters and VO<sub>2</sub>peak was measured by arm ergometry. Subjects were stratified into two groups according to cfPWV values (<1200 cm/sec: low cfPWV, ≥1200 cm/sec: high cfPWV). Logistic regression analysis was used to determine the contribution of aerobic capacity after adjustment for confounders (age, level of injury, and gender) to high cfPWV.

**RESULTS:** Aerobic capacity was significantly and negatively associated with cfPWV (r=-0.459, p<0.045). After correction for other confounding parameters, low aerobic capacity was an independent predictor for high cfPWV (odds ratio = 2.04, 95% CI=1.07- 3.87, p<0.029).

**CONCLUSIONS:** Aerobic capacity is an independent predictor of high cfPWV values (≥1200 cm/sec) among people with chronic SCI. Further research is needed to explore whether improvements in aerobic capacity will reduce arterial stiffness and adverse cardiac outcomes among people with chronic SCI.

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2323 Board #369 MAY 31 8:00 AM - 9:30 AM

**Six Weeks of Sprint Interval Training Speeds Flow-Mediated Dilation in Women**

Stephanie M. Reid<sup>1</sup>, Alan R. Smith<sup>1</sup>, T. Dylan Olver<sup>1</sup>, J. Kevin Shoemaker<sup>2</sup>, Peter W.R. Lemon, FACSM<sup>3</sup>. <sup>1</sup>The University of Western Ontario, London, N6A 3K7, ON, Canada. <sup>2</sup>(The Neurovascular Research Laboratory) The University of Western Ontario, London, ON, Canada. <sup>3</sup>(The Exercise and Nutrition Laboratory) The University of Western Ontario, London, ON, Canada.  
(No relationships reported)

The effects of sprint interval training (SIT; 4-7 x 30-45 s all out exercise efforts separated by 4 min of recovery, repeated 3-4 times/wk over 4-6 wk) on endothelial function in the superficial femoral artery (SFA) remains to be elucidated fully.

**PURPOSE:** To assess the effects of 18 sessions of SIT (3 sessions/wk X 6 wk) on flow mediated SFA dilation (FMD) in young women.

**METHODS:** Five women (lean mass=64.7±3.7 kg, fat mass=17.6±3.9 kg, height=163±4 cm, age=24±4 y; mean±SD) arrived at the laboratory after a 12 h overnight fast. SFA diameter and blood velocity (BV) were assessed with ultrasound imaging (4 MHz Doppler ultrasound, 10 MHz Doppler ultrasound imaging, GE Vivid 7) before and after 5 min of suprasystolic cuff inflation of the lower leg. Blood pressure was measured using a Finometer on the right hand. Normalized FMD was analyzed as the maximal Δ in SFA diameter (%) ÷ shear rate (mean BV x 8 ÷ diameter: s-1) measured every 30 s for 5 min following cuff release. This was assessed pre- and 6 weeks post SIT.

**RESULTS:** After training, no changes in baseline SFA diameter (Pre- = 0.61±0.04 vs Post = 0.61±0.04 cm; P=0.80), mean arterial pressure (Pre- = 86.5±8.3 vs Post = 84.9± 4.3 mmHg; P=0.64), peak shear rate (30 s average) after cuff release (Pre- = 390±124 vs Post = 418±125 s-1; P=0.64) or peak flow after cuff release (Pre- = 559±211 vs Post = 666±277 ml-min-1; P=0.41) or normalized FMD (Pre- = 0.014±0.010 vs Post = 0.017±0.006 s-1; P=0.54), were observed. However, time to peak dilation decreased significantly (Pre- = 150±60 vs Post = 54±25 s; P=0.03).

**CONCLUSION:** Six weeks of SIT reduces SFA response time to peak dilation despite a similar shear stimulus suggesting an alteration in shear-induced vasodilation.

Supported by NSERC

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2324 Board #370 MAY 31 8:00 AM - 9:30 AM

**Effects of Diet and/or Low-intensity Resistance Training on Arterial Stiffness and Body Composition in Women**

Arturo Figueroa, Bruce Daggy, Florence Vicil, Alexei Wong, Marcos A. Sanchez-Gonzalez, Bahram H. Arjmandi. Florida State University, Tallahassee, FL.  
(Sponsor: Bo Fernhall, FACSM)  
(No relationships reported)

Arterial stiffness (pulse wave velocity, PWV) is inversely related to muscle strength and mass. High-intensity resistance exercise training (RET) preserves lean soft tissue mass (LSTM) during weight loss, but it may increase PWV. Although low-intensity RET with slow movement (LIRET) may improve LSTM and PWV, its effects on PWV and LSTM during weight loss are unknown.

**PURPOSE:** To determine the effect of diet-induced weight loss and/or LIRET on arterial function and body composition in obese women.

**METHODS:** Forty five postmenopausal obese women (54.3±0.9 years; 33.7±0.9 kg/m<sup>2</sup>) were randomized to LIRET (n=12), diet (n=14) or diet+LIRET (n=14) for 12 weeks. The data of 40

women who have completed the study are shown. LIRET consisted of four leg exercises at 40% of maximal strength (1RM). Brachial-ankle PWV (baPWV), aortic systolic blood pressure (aSBP), leg strength, body weight, and DEXA-measured body fat mass (FM), trunk FM, and leg LSTM were collected before and after the interventions.

**RESULTS:** BaPWV, a marker of systemic arterial stiffness, was significantly decreased after diet ( $-1.2 \pm 0.7$  m/s,  $p < 0.05$ ) compared with after LIRET ( $0.2 \pm 0.5$  m/s,  $p > 0.05$ ) but not after diet+LIRET ( $-0.5 \pm 0.5$  m/s,  $p > 0.05$ ). ASBP significantly ( $p < 0.05$ ) decreased after LIRET ( $-7 \pm 4$  mmHg), diet ( $-5 \pm 3$  mmHg), and diet+LIRET ( $-9 \pm 3$  mmHg). Leg strength increased after LIRET ( $27 \pm 8\%$ ,  $p < 0.05$ ) and diet+LIRET ( $28 \pm 7\%$ ,  $p < 0.05$ ) compared to diet ( $-4 \pm 5\%$ ,  $p > 0.05$ ). Leg LSTM was significantly decreased after diet ( $-0.7 \pm 0.0$  kg,  $p < 0.05$ ) compared to after LIRET ( $0.4 \pm 0.0$  kg,  $p > 0.05$ ) but not after diet+LIRET ( $-0.3 \pm 0.2$  kg,  $p > 0.05$ ). Weight and body FM decreased after diet ( $-7 \pm 1$  and  $-5 \pm 4$  kg,  $p < 0.01$ ) and diet+LIRET ( $-5 \pm 1$  and  $4 \pm 1$  kg,  $p < 0.01$ ) compared to LIRET ( $-1 \pm 1$  and  $-3 \pm 3$  kg,  $p > 0.05$ ). Trunk FM significantly ( $p < 0.05$ ) decreased after LIRET ( $-2.6 \pm 2.6$  kg), diet ( $-3.2 \pm 3.4$  kg), and diet+LIRET ( $-2.1 \pm 1.5$  kg).

**CONCLUSIONS:** A weight loss diet improved arterial stiffness, blood pressure, and FM but resulted in leg LSTM loss. LIRET and diet+LIRET improved trunk FM, muscle strength, and blood pressure independently of baPWV; however, LIRET did not affect body weight and body FM. Our findings suggest that addition of LIRET to a weight loss program would be recommended to improve aortic blood pressure and body composition since prevents the loss of leg LSTM induced by hypocaloric diet.

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**2325** Board #371 **MAY 31** **8:00 AM - 9:30 AM**

**Distensibility But Not Compliance Is Augmented In Spinal Cord Injury When Matched For Physical Activity**

Aaron A. Phillips, Anita T. Cote, Shannon S.D. Bredin, Andrei Krassioukov, Darren E.R. Warburton, FACSM. *University of British Columbia, Vancouver, BC, Canada.*

(No relationships reported)

**PURPOSE:** To compare arterial stiffness between those with spinal cord injury (SCI) and able bodied (AB) individuals when matched for habitual level of physical activity.

**METHODS:** A total of 17 SCI and 17 AB were matched for gender, age, weight, blood pressure and levels of self reported habitual physical activity (Godin-Shephard). Measures included central (cfPWV) and lower limb (flPWV) pulse wave velocity and large and small arterial compliance.

**RESULTS:** The cfPWV was significantly elevated ( $726 \pm 206$  vs.  $570 \pm 135$  cm/s, respectively) in the SCI in comparison to AB. No other measures of arterial stiffness were different between groups. Moderate to vigorous physical activity was significantly correlated with both large ( $r = 0.48$ ) and small ( $r = 0.65$ ) artery compliance, but not cfPWV or flPWV.

**CONCLUSIONS:** Both large and small artery compliance appear to be affected highly by habitual physical activity in active individuals with SCI. However, physical activity does not appear to influence PWV in physically active individuals with SCI. These findings suggest that factors other than physical inactivity may mediate the increase in central arterial stiffness seen in the SCI population.

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**D-16** Free Communication/Poster - **Carbohydrate Metabolism**

MAY 31, 2012 1:00 PM - 6:00 PM

ROOM: Exhibit Hall

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**2326** Board #1 **MAY 31** **2:00 PM - 3:30 PM**

**Inflammation, Glucose and Insulin Changes with a High Carbohydrate Diet After Downhill Running in Normal and Overweight Women**

Colleen P. Miller, Katherine A.M. McNulty, Gregory N. Ruegsegger, Peter Stordahl, Mary P. Miles, FACSM. *Montana State University, Bozeman, MT.*

(No relationships reported)

Hyperglycemia amplifies inflammation and insulin resistance in obese women. Thus, a high carbohydrate intake following muscle damaging exercise may increase the magnitude of inflammation and insulin resistance.

**PURPOSE:** To determine whether the magnitude of the inflammatory response and related changes in glucose and insulin differ between normal and overweight women after downhill running with a high carbohydrate recovery diet.

**METHODS:** Normal (BMI  $< 25$  kg/m<sup>2</sup>, n=8) and overweight (BMI  $> 25$  kg/m<sup>2</sup>, n=7) women (age 20-37 y) performed an aerobically based eccentric, downhill, running exercise to induce an inflammation. The exercise was followed by a controlled diet for the first 24 hours post-exercise consisting of 71% carbohydrate, 11% protein, and 18% fat with kilocalories proportional to body mass (31 kcal/kg). Blood collected under fasting conditions pre-exercise, 0, 24, and 48 hours post-exercise and analyzed for tumor necrosis factors- $\alpha$  (TNF- $\alpha$ ), interleukin (IL)-6, IL-18, C-reactive protein (CRP), glucose, insulin, and creatine kinase (CK) activity.

**RESULTS:** Pre-exercise values were similar between groups for TNF- $\alpha$ , IL-18, glucose, insulin, and CK; higher in the overweight group for IL-6 (2.5-fold) and CRP (3.8-fold). Average downhill run distances ( $3.4 \pm 0.5$  and  $3.1 \pm 0.5$  miles), exercise HR ( $152.9 \pm 8.1$  and  $152.4 \pm 15.1$  bpm), and post-exercise increases in CK activity were similar between normal and overweight groups, suggesting that the exercise stress and muscle damage responses were similar. There were no changes over time or differences between groups for TNF- $\alpha$ , IL-18, CRP, and insulin. IL-6 was lower 0 h ( $0.94 \pm 0.36$  vs  $2.32 \pm 1.45$  pg/ml) and 24 h ( $0.39 \pm 0.20$  vs  $0.78 \pm 0.42$  pg/ml) post-exercise in the normal compared to overweight group. Glucose increased 0 h post-exercise and decreased 48 h post-exercise, but was similar between groups. Insulin was lower 0 h ( $7.12 \pm 2.87$  vs  $11.36 \pm 3.60$   $\mu$ U/ml) and 24 h ( $5.28 \pm 1.82$  vs  $9.68 \pm 4.83$   $\mu$ U/ml) post-exercise in the normal compared to overweight group.

**CONCLUSION:** Compared to normal weight women, overweight women have a greater inflammation (IL-6) and insulin increase following downhill running with a high carbohydrate recovery diet.

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**2327** Board #2 **MAY 31** **2:00 PM - 3:30 PM**

**Under Insulin-Mediated Conditions, Resveratrol Restores Glucose Uptake but not Fatty Acid Oxidation in Skeletal Muscle Cells made Insulin Resistant by Treatment with Protease Inhibitors**

Lorraine P. Turcotte, FACSM, Lindsey D. Bogachus. *University of Southern California, Los Angeles, CA.*

(No relationships reported)

Protease inhibitors (PI) such as atazanavir (A) and ritonavir (R) used in antiretroviral therapy (HAART) for HIV patients are known to induce insulin resistance possibly via activation of the pro-inflammatory signaling intermediate JNK1/2. Resveratrol has been shown to improve insulin action in some insulin-resistant states.

**PURPOSE:** To determine the efficiency of resveratrol to blunt PI-induced insulin resistance in skeletal muscle cells.

**METHODS:** L6 muscle cells were treated with A (100 $\mu$ M) and R (25 $\mu$ M)  $\pm$  resveratrol (100 $\mu$ M) or  $\pm$  the JNK inhibitor SP600125 (5 $\mu$ M) and incubated  $\pm$  insulin (100nM). After treatment(s), glucose uptake (GU) and fatty acid uptake (FAU) and oxidation (FAO) as well as JNK1/2 and AKT2 phosphorylation were measured. Treatment effects were statistically assessed with ANOVA.

**RESULTS:** A/R led to the development of insulin resistance as seen by the absence of an insulin-mediated increase in GU and FAU and of an insulin-mediated decrease in FAO. A/R was also accompanied by a rise ( $P < 0.05$ ) in pJNK1/2 that was accompanied by a decrease ( $P < 0.05$ ) in insulin-induced pAKT. In A/R-treated cells, resveratrol and JNK inhibition decreased ( $P < 0.05$ ) basal GU (51-55%) and restored the insulin-sensitive increase (31-62%) in GU ( $P < 0.05$ ). Resveratrol and JNK inhibition decreased ( $P < 0.05$ ) basal FAU (44-55%) but only JNK inhibition reduced ( $P < 0.05$ ) FAO (28%). In contrast to their effects on insulin-mediated GU, neither resveratrol nor JNK inhibition restored the effects of insulin on FAU and FAO in PI-treated cells ( $P > 0.05$ ). In line with the GU data, resveratrol and JNK inhibition reduced ( $P < 0.05$ ) pJNK1/2 (67-86%) but only resveratrol restored the insulin-mediated increase ( $P < 0.05$ ) in pAKT (461%) measured in control cells.

**CONCLUSION:** In L6 myotubes made insulin-resistant by treatment with protease inhibitors, the effects of resveratrol and JNK inhibition on insulin-sensitive muscle metabolism are selective and with resveratrol may occur in part via a restoration of insulin-induced AKT phosphorylation.



2328 Board #3 MAY 31 2:00 PM - 3:30 PM

**Pre-exercise Ingestion of Amylo maize Decreases Hypoglycemia Risk During High Intensity Cycling**

Rachel Bell, Douglas S. King, Mike E. Spurlock, Rick L. Sharp, FACSM. *Iowa State University, Ames, IA.*

(No relationships reported)

Modified amylo maize-7 was previously shown to be 92% digestible but is digested slowly enough that hyperinsulinemia is avoided (Zhou et al. *J Nutr*, 127:1997).

**PURPOSE:** To assess the effect of a carbohydrate pre-load on performance of a brief high-intensity cycling trial, and to compare the metabolic response when amylo maize-7 versus dextrose was consumed in the hour before exercise.

**METHODS:** Ten trained cyclists ( $\text{VO}_{2\text{max}} 64.6 \pm 1.8 \text{ mL}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ ) were given 1 g $\cdot\text{kg}^{-1}$  body mass of either dextrose (DEX) or amylo maize-7 (AMY-7) or a flavored water placebo (PL) 45 min prior to exercise on a cycle ergometer. A 15 min ride at 60%  $\text{W}_{\text{max}}$  was immediately followed by a self-paced time trial (TT) equivalent to 15 min at 80%  $\text{W}_{\text{max}}$  ( $264 \pm 12 \text{ KJ}$ ). Blood samples were taken at baseline, pre-exercise, pre-TT, post-TT and 30 min post-exercise.

**RESULTS:** When cyclists consumed the DEX preload, mean serum glucose concentration increased by  $3.3 \text{ mM} \pm 2.1$  before exercise, compared to AMY-7 or PL ( $0.2 \pm 0.5$ ,  $0.1 \pm 0.8$ , respectively,  $p < 0.001$ ). Glucose concentrations returned to baseline by pre-TT in all treatments. However, the mean post-TT glucose concentration of  $5.5 \pm 0.4 \text{ mM}$  in the DEX group was significantly lower than baseline, AMY-7 or PL ( $5.8 \pm 0.4$ ,  $6.8 \pm 0.8$ ,  $6.8 \pm 1.5$ , respectively,  $p < 0.05$ ). Serum insulin concentration increased nine-fold from baseline to pre-exercise in the DEX trial ( $1.3 \pm 0.1$  to  $11.7 \pm 10.1$ ), whereas PL or AMY-7 remained unchanged ( $p < 0.05$ ). Time (s) required to complete the performance trial was not significantly different between DEX, AMY-7 or PL ( $1091 \pm 71$ ,  $1054 \pm 66$ ,  $1078 \pm 59$ , respectively,  $p = 0.209$ ).

**CONCLUSIONS:** Pre-exercise ingestion of amylo maize-7 compared to dextrose resulted in a more stable serum glucose concentration, but did not offer an additional performance advantage in a high-intensity cycling time trial.

2329 Board #4 MAY 31 2:00 PM - 3:30 PM

**Insulin, Glucose, and Blood Lipid Responses with a High Glycemic Index Diet Following Downhill Running in Normal and Overweight Women**

Katherine A.M. McNulty, Colleen P. Miller, Gregory N. Rueggsegger, Peter Stordahl, Mary P. Miles, FACSM. *Montana State University, Bozeman, MT.*

(No relationships reported)

A chronic, low-grade level of inflammation occurs with increases in adiposity. This inflammation is implicated in development of insulin resistance (IR) and cardiovascular disease (CVD). Hyperglycemia intensifies both IR and inflammation.

**PURPOSE:** To determine if insulin, glucose, homeostatic model assessments (HOMA) of IR (HOMA-IR),  $\beta$ -cell function (HOMA-B), insulin sensitivity (HOMA-S), cholesterol, triglycerides (TG), HDL, and LDL responses differ in normal vs. overweight women consuming a high glycemic index (GI) diet following downhill running.

**METHODS:** Normal weight (BMI  $< 25 \text{ kg}/\text{m}^2$ ,  $n = 7$ ) and overweight (BMI  $> 25 \text{ kg}/\text{m}^2$ ,  $n = 7$ ) women (20-37 y) performed 30 minutes of downhill running with their heart rate (HR) at 65% of predicted maximal oxygen consumption ( $\text{VO}_{2\text{max}}$ ). Participants ate a high GI diet consisting of a carbohydrate/protein/fat ratio of 71%/11%/18%, with kilocalories relative to participant's body mass (31 kcal/kg) for 24 hours post-exercise. Blood was drawn from participants in fasting conditions immediately prior to downhill running, and at 0 h, 24 h, and 48 h following exercise.

**RESULTS:** There were no significant differences between groups at baseline. HOMA-S was higher in normal compared to overweight women and increased from  $109.7 \pm 51.4$  pre-exercise to  $127.0 \pm 57.6$  24 h post-exercise in both groups. HOMA-B and IR responses did not differ between groups. Cholesterol decreased from  $183.0 \pm 27.5$  at pre-exercise to  $177.8 \pm 25.1 \text{ mg}/\text{dl}$  24 h post-exercise. There was a trend ( $P = 0.06$ ) towards higher TG in the overweight group vs. normal weight group ( $110 \pm 69$  vs.  $55 \pm 28 \text{ mg}/\text{dl}$ ), and TG increased from pre-exercise ( $82.2 \pm 58.1 \text{ mg}/\text{dl}$ ) to 0 h ( $91.3 \pm 55.8 \text{ mg}/\text{dl}$ ), while there was a trend ( $P = 0.08$ ) to decrease 24 h post-exercise ( $63.2 \pm 36.7 \text{ mg}/\text{dl}$ ). HDL decreased ( $P < 0.05$ ) from pre-exercise ( $61.4 \pm 12.3$ ) to 24 h post-exercise ( $58.4 \pm 10.7 \text{ mg}/\text{dl}$ ). Magnitude of change ( $\Delta$ ) associated with BMI for  $\Delta$  insulin at 24 h,  $\Delta$ HOMA-B at 24 h ( $r = 0.55$ ) and  $\Delta$ TG at 48 h ( $r = -0.625$ ).

**CONCLUSION:** The combination of inflammation and high GI diet elicited changes in insulin (+), HOMA-B (+), and TG (-) that associated with BMI. While both groups had decreased cholesterol at 24 h, the overweight group had greater decreases in TG after consuming a high GI diet for 24 h after 30 minutes of downhill running.

2330 Board #5 MAY 31 2:00 PM - 3:30 PM

**Effects of Impaired Glucose Metabolism-induced Inflammation on the Joint Function in Current and Retired Athletes**

Ching-Hung Lin<sup>1</sup>, Li-Yuan Tsao<sup>2</sup>, Chu-Chun Fang<sup>2</sup>, Chi-Chang Huang<sup>3</sup>, Mei-Chich Hsu<sup>3</sup>. <sup>1</sup>*Yuan Ze University, Chung-Li, Taiwan.* <sup>2</sup>*National Taipei College of Business, Taipei, Taiwan.* <sup>3</sup>*National Taiwan Sport University, Taoyuan, Taiwan.* (Sponsor: Chia-Hua Kuo, FACSM)

(No relationships reported)

**PURPOSE:** This study aims to investigate the differences of metabolic fitness, inflammatory response and joint condition between current and retired female athletes, as well as the correlation between inflammation and joint function.

**METHODS:** The subjects of this study are all female basketball players. They are divided into two groups based on their status: (1) current group ( $n = 12$ ,  $18.2 \pm 0.9$  yr, height  $166 \pm 0$  cm, weight  $59.6 \pm 2.7$  kg) and (2) retired group ( $n = 19$ ,  $56.1 \pm 1.0$  yr, height  $171 \pm 0$  cm and weight  $73.1 \pm 2.7$  kg). Analysis of a representative sample of all subjects for whom data on body mass index (BMI), waist circumference (WR), Western Ontario and McMaster Universities (WOMAC) index of osteoarthritis, and fasting glucose (FG), hemoglobin A1c (HbA1c), C-reactive protein (CRP), and 2-h plasma glucose during an OGTT and blood glucose area under the curve (GAUC) were determined after a 12-hour period of fasting.

**RESULTS:** The current group had significantly lower BMI, WR, GAUC, FG, HbA1c and WOMAC scores than the retired group ( $P < 0.05$ ). The score of functional evaluation in WOMAC for current group was significantly lower than retired group ( $6.9 \pm 2.8$  vs  $19.4 \pm 3.2$ ,  $P < 0.05$ ). There was a significantly positive correlation between CRP and FG ( $r = 0.504$ ), and CRP and HbA1c ( $r = 0.498$ ), respectively ( $P < 0.05$ ). However, there was no difference in the CRP levels between the two groups and no significant correlation existed between age and CRP.

**CONCLUSION:** The main finding of this study is that the metabolic fitness, the function of knee and HbA1c were impaired in the retired female athletes. Although impaired metabolic fitness-induced inflammatory status in the retired athletes, the deterioration of joint function in the retired subject group was not induced by inflammation.

2331 Board #6 MAY 31 2:00 PM - 3:30 PM

**A Single Exercise Bout Does Not Improve Glycemic Control In Individuals With Type 2 Diabetes**

Douglas J. Oberlin, Catherine R. Mikus, Monica L. Kearney, Justin A. Fletcher, Pam S. Hinton, Jill A. Kanaley, FACSM, Randy Scott Rector, Heather J. Leidy, John P. Thyfault. *University of Missouri, Columbia, MO.*

(No relationships reported)

Type 2 diabetes (T2D) and the associated impaired glycemic control greatly increases the risk of cardiovascular disease mortality.

**PURPOSE:** Our lab previously has shown that seven consecutive days of aerobic exercise can effectively reduce the amplitude of postprandial glycemic excursions ( $\Delta\text{PPG}$ ; = post meal glucose - pre meal glucose) in previously sedentary individuals with T2D measured by continuous glucose monitors (CGMS). It is unknown if or for how long a single bout of exercise will reduce  $\Delta\text{PPG}$  in individuals with T2D.

**METHODS:** We recruited 7 individuals with T2D (BMI:  $38 \pm 1 \text{ kg}/\text{m}^2$ ; age  $59 \pm 2$  years; HbA1c:  $6.49 \pm 0.34$  %) who were not using exogenous insulin and sedentary ( $< 30$  minutes/week of exercise). The subjects consumed a eucaloric diet (51% carbohydrate, 31% fat, 18% protein) containing identical food components at each meal during two separate 3 day trials while wearing CGMS monitors to continually monitor blood glucose. During one 3 day trial the subjects performed one 60 minute, supervised exercise bout (EX; 60-75% of heart rate reserve) prior to breakfast on the morning of the first day. During the second 3 day trial, the subjects maintained their sedentary lifestyle (SED). The order of the SED and EX trials was randomly assigned.

**RESULTS:** A comparison of the 2 trials revealed that one bout of exercise did not significantly change  $\Delta\text{PPG}$  averaged across all meals (EX:  $1.6 \pm 0.1$  vs. SED  $1.1 \pm 0.1 \text{ mmol}/\text{l}$ ), percent of time spent within normal glucose ranges (EX:  $86.1 \pm 2.0$  vs. SED:  $92.7 \pm 0.4$ %), or mean blood glucose (EX:  $6.3 \pm 0.1$  vs. SED:  $6.4 \pm 0.2 \text{ mmol}/\text{l}$ ) throughout the day.

**CONCLUSION:** These preliminary results suggest that more than one moderate-intensity bout of aerobic exercise is needed to significantly improve glycemic control in subjects with T2D.

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2332 Board #7 MAY 31 2:00 PM - 3:30 PM

**Immediate Energy Signaling During Physical Activity**

Nicholas Gant, Clare E. Turner, Cathy M. Stinear, Winston D. Byblow. *The University of Auckland, Auckland, New Zealand.*

(No relationships reported)

The presence of carbohydrate in the mouth has been associated with immediate improvements in human performance and the facilitation of neural drive to muscle. Oral energy receptors may be involved in a novel form of sensorimotor integration, capable of regulating motor output during exercise.

**PURPOSE:** This study used neuroimaging to examine central influences of oral carbohydrate during a motor task, identifying areas of the brain involved in immediate energy signalling.

**Method:** Carbohydrate (CHO) and Placebo (PLA) solutions with identical perceptual qualities but variable energy content were infused and recovered from the mouth in a double-blind, counterbalanced fashion. Functional Magnetic Resonance Imaging was used to measure blood oxygen level-dependent contrast in the brain whilst participants generated isometric force during a handgrip task.

**RESULTS:** The main finding of this study was an increase in the motor cortex activation network with CHO compared to PLA during the handgrip task. Additional areas of activation with CHO were seen in left insular cortex and left central operculum (primary taste areas), and regions of the frontal cortex associated with rewarding sensory stimuli.

**CONCLUSION:** This is the first demonstration of oral CHO exposure enhancing the extent of a neural activation network during a motor task. The increased activity within motor cortex and regions involved in reward processing provides a neural basis for enhancements in force production and motor output observed with oral exposure to carbohydrate.

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2333 Board #8 MAY 31 2:00 PM - 3:30 PM

**Short-Term Aerobic Exercise Training Beneficially Alters PYY and GLP-1 in Impaired Glucose Tolerant Individuals**

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(No relationships reported)

**PURPOSE:** PYY and GLP-1 are potent inducers of satiety, and GLP-1 is also an important mediator of insulin secretion. The purpose of this investigation was to investigate the effect of short-term aerobic exercise training on basal and glucose stimulated PYY and GLP-1 release among overweight and obese individuals with varying glucose tolerance.

**METHODS:** Seven impaired glucose tolerant (IGT; BMI=33), and five normal glucose tolerant (NGT; BMI=31) subjects performed a 3-h oral glucose tolerance test (OGTT) before and one day after a 7-day aerobic exercise program. Subjects performed 60 min. of supervised aerobic exercise training at 80-85% of HRmax for seven consecutive days. Blood was collected before (0 min.) and at 30, 60, 90, 120 and 180 min. during the OGTT. Plasma was analyzed for PYYTotal, active GLP-1, and insulin, at each time point.

**RESULTS:** Before exercise training, IGT tended to have higher basal GLP-1 ( $p=0.09$ ) than NGT. In response to glucose ingestion, IGT tended to have a higher insulin response (AUC120;  $p=0.06$ ) compared to NGT, and only NGT showed a trend ( $p=0.07$ ) for increased PYY in response to glucose ingestion. After exercise training, IGT decreased basal and OGTT GLP-1 ( $p<0.05$ ), decreased the insulin response to glucose (AUC120;  $p<0.01$ ), and significantly increased the PYY response to glucose ( $p<0.01$ ) from pre-exercise training. NGT maintained the trend ( $p=0.08$ ) for a glucose-induced increase in PYY. Furthermore, in the IGT group, basal PYY tended to be elevated ( $p=0.08$ ) relative to NGT, and was significantly higher than that of NGT following glucose ingestion ( $p<0.05$ ).

**CONCLUSIONS:** Short-term moderate- to high-intensity aerobic exercise was effective at beneficially altering gut peptides and the insulin response to glucose in IGT individuals. Increased basal and glucose-induced PYY indicates that exercise may be effective at lowering appetite and increasing satiety in response to food intake, leading to improved weight control. Additionally, decreased basal and OGTT GLP-1 indicates a mechanism of improved insulin regulation following exercise training in IGT individuals. Supported by NIH grants R01 AG12834 and T32DK007319.

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2334 Board #9 MAY 31 2:00 PM - 3:30 PM

**Hepatic Glycogen And Serum Triglycerides Of Diabetic Rats Submitted To Aerobic Training**

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(No relationships reported)

Diabetes mellitus type 1 is an autoimmune disease characterized by chronic hyperglycemia resulting of impaired insulin secretion. Characteristic symptoms are thirst, polyuria, etc. Metabolic alterations include hepatic impairment of glycogen storage and hypertriglyceridemia, a risk factor of cardiovascular diseases. By the other hand, physical activity is prescribed to improve the metabolic control in diabetic subjects.

**PURPOSE:** To evaluate the effects of aerobic training on serum triglycerides and hepatic glycogen content in diabetic rats.

**METHODS:** Forty-five Wistar male rats were randomly allocated into four different groups: sedentary control (SC), trained control (TC), sedentary diabetic (SD) and trained diabetic (TD). Experimental diabetes was induced by an intravenous single dose injection of alloxan monohydrate (32 mg/kg bw dissolved in citrate buffer 0.01M, pH 4.5). For diabetic status checking, a fasting blood glucose test was performed seven days after the induction. Only rats exhibiting glycemia higher than 250mg/dL were considered diabetic. After group allocation, the animals were submitted to water adaptation for 5 days. The training was set at 90% of the maximum lactate steady state. There were seven weeks of swimming training constituted by five sessions/week lasting one hour each. The animals were killed 48 hours after the last training session. Liver samples were collected for glycogen content determination by phenol sulfuric method and blood samples were used for serum triglycerides dosage by commercial kit. One-way ANOVA followed by Bonferroni post test were applied for statistical analysis, the significance level was preset to  $p<0.05$ , data are presented as mean  $\pm$  standard deviation.

**RESULTS:** Liver glycogen content were diminished in the diabetic groups compared to SC, but TD was not different from TC (SC:  $73.4 \pm 20.6$ ; TC:  $72.0 \pm 24.9$ ; SD:  $37.2 \pm 9.2$ ; TD:  $46.1 \pm 14.3$  mg/100mg). Regarding the serum triglycerides concentration an increase related to diabetes was observed in SD group, however TD showed no difference compared to the control groups (SC:  $253.7 \pm 98.9$ ; TC:  $199.1 \pm 54.6$ ; SD:  $459.6 \pm 187.0$ ; TD:  $358.1 \pm 244.4$  mg/dL).

**CONCLUSIONS:** Endurance training improves the serum triglycerides profile but elicits no changes in hepatic glycogen content of diabetic rats.

Supported by CAPES

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2335 Board #10 MAY 31 2:00 PM - 3:30 PM

**Physical Activity And Metabolic Characteristics For Politicians In Taiwan**

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(No relationships reported)

**PURPOSE:** Taiwan politician is having unique social lifestyle aimed to recruit voters, characterized by greater walking activity but high frequency in alcohol drinking. Thus, purpose of the study was to determine metabolic characteristic for Taiwan politician in contrast to their first order adult relatives.

**METHODS:** Oral glucose tolerance test (OGTT), insulin, triglyceride, cholesterol, and inflammatory markers (C-reactive protein and interleukin-6) were measured among 8 parliamentary politician (age  $50.9 \pm 2.2$ ) in Taiwan and their first order descendants (age  $25.5 \pm 3.5$ ) as genetic controls.

**RESULTS:** Politicians had more alcohol consumption and restaurant dining than controls. All politicians were substantially insulin resistant compared with their young descendants, evidenced by exaggerated high glucose and insulin levels ( $>100\%$  greater in area under curve) under oral glucose challenged condition. Although none of the politicians was clinically diabetic, their waist circumference, diastolic blood pressure, and cholesterol levels were significantly greater than controls. Furthermore, C-reactive protein (CRP) of the politicians was approximately 2.3 folds of the control value.

**CONCLUSIONS:** This study presents a potential metabolic risk for the politicians, despite more weekly walking distance was performed during their voter visit. The insulin resistance state of this group appears to be associated with substantially greater baseline inflammation level.

**2336** Board #11 MAY 31 2:00 PM - 3:30 PM

**The Characteristic Of Metabolism In Young Boxing Athletes**

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(No relationships reported)

Previous study has shown that the former elite power sports (boxing, wrestling, weight lifting) athletes exhibited higher relative risk in insulin resistance and hypertension than elite endurance (long-distance running) athletes in elder age.

**PURPOSE:** To investigate that whether this metabolic deterioration already occurred in the young boxing athletes.

**METHODS:** A total of 563 college students were divided into two groups: physical active control (n=538, aged 21.58±.07) and boxing athletes (n=25, aged 20.96±.25). The boxing athlete regularly participated in boxing training program and competition. Physical active control attended to routine physical education (PE) courses and work out more than 160 min/wk. The resting blood pressure included the systolic blood pressure (SBP) and diastolic blood pressure (DBP) was determined. All plasma samples were collected for measuring the glucose, insulin and cholesterol after an overnight fasting.

**RESULTS:** The BMI value of boxing athlete was significantly higher than those of control group. Boxing athlete presented significantly greater systolic blood pressure (SBP) and diastolic blood pressure (DBP) than in control group. No significant difference was observed in the levels of fasting glucose, insulin and cholesterol between in control and boxing athlete.

**CONCLUSIONS:** Our study showed significantly greater value of BMI, SBP and DBP in boxing athlete than in control group. The higher SBP and DBP in boxing athlete were appeared to relate to greater BMI value rather than increased the insulin and glucose level; suggest that well weight management needs to be more concerned in these young power sports athletes.

**2337** Board #12 MAY 31 2:00 PM - 3:30 PM

**Interactive Effect Of Igf-1 And Exercise Training On Muscle Glut4 Protein Expression**

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(No relationships reported)

Exercise transiently elevates the IGF-I (insulin-like growth factor 1) level, but whether exogenous IGF-I administration can reproduce exercise training benefit in glycemic control is currently unknown.

**PURPOSE:** This study compared the effect of IGF-1 administration and exercise training on glycogen storage, glucose tolerance, and muscle GLUT4 protein expression in normal rats.

**METHODS:** Forty rats were weight matched and evenly assigned to the following 4 groups: control (C), exercise trained (E), IGF-1 treated (I), and exercise-trained + IGF-1 (EI). Same volume of saline or IGF-1 (2 µg/kg BW) was injected daily to rats. Exercise training consisted of 90 min swimming for the first week and gradually increased to 180 min twice for the third week. Oral glucose tolerance test (OGTT) was performed in all rats under fasted condition. Muscle tissues were removed at the end of the 3-week treatments (3 days after OGTT). The levels of GLUT4 protein and mRNA were determined in red and white portions of the quadriceps muscle (RQ and WQ).

**RESULTS:** Both exercise training and chronic IGF-1 administration increased GLUT4 expression and improved glucose tolerance without an observed additive effect. Exercise training increased glycogen level in RQ and WQ above control level. Despite chronic IGF-1 administration increased muscle GLUT4 expression above control level, glycogen increase was not observed.

**CONCLUSIONS:** Our data suggests that IGF-1 can partially reproduce exercise training effect on improving glycemic control.

**2338** Board #13 MAY 31 2:00 PM - 3:30 PM

**Effect of Glycemic Index of Snack Bars on Substrate Utilization during Subsequent Moderate Intensity Exercise**

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(No relationships reported)

**PURPOSE:** To investigate whether the glycemic index (GI) of pre-exercise snack bars will affect substrate utilization during subsequent moderate intensity exercise.

**METHODS:** Seven young physically active male subjects (age: 21.0 ± 0.7 yr, BMI: 22.7 ± 2.1 kg·m<sup>-2</sup>, VO<sub>2max</sub>: 51.2 ± 4.6 mL·kg<sup>-1</sup>·min<sup>-1</sup>) volunteered to participate in the study. All subjects completed two main trials in a counterbalanced crossover design with seven days interval. In the main trials, all subjects reported to the lab after an overnight fast. Then they ate one of two snack bars: a low-GI snack bar (LGI) and a moderate-GI snack bar (MGI). The estimated GI values for the two snack bars were 28 and 68, respectively. All snack bars provided similar energy and carbohydrate (CHO) content (1 g CHO/kg body mass). However, the energy percentages of fat and protein were different (LGI vs. MGI: fat, 30% vs. 24%; protein, 9% vs. 16%). After 90-min resting, all subjects completed 45-min cycling at 60% VO<sub>2max</sub>. Substrate utilization was measured using indirect respiratory calorimetry every 30 minutes during the postprandial period and every 15 minutes during exercise. Blood glucose and lactate concentrations were measured every 15 minutes.

**RESULTS:** Blood glucose concentrations peaked at 30 min and returned to baseline level at the end of postprandial period in both trials. During exercise, blood glucose concentrations were suppressed in the MGI trial than those at the onset of exercise, but not in the LGI trial. During the postprandial period, blood glucose was higher at 60 min in the MGI trial compared with that in the LGI trial (5.74 ± 0.83 vs. 4.67 ± 4.06 mmol·L<sup>-1</sup>, P<0.05). The incremental area under the blood response curve of glucose (IAUC) value was also higher in the MGI trial than that in the LGI trial (MGI vs LGI: 206 ± 39 vs 136 ± 28 mmol·min·L<sup>-1</sup>; P<0.05). No differences were observed in blood lactate concentrations, fat and CHO oxidation amounts between the two trials both during the postprandial and exercise periods.

**CONCLUSIONS:** The results suggest that substrate utilization during the 45-min moderate intensity exercise was not affected by the pre-exercise LGI or MGI snack bars consumption.

**2339** Board #14 MAY 31 2:00 PM - 3:30 PM

**Subcellular Localization-dependent Skeletal Muscle Glycogen Content in the Recovery Period After a High-level Soccer Match**

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(No relationships reported)

**PURPOSE:** Whole muscle glycogen levels are deteriorated for a prolonged period following a soccer match. The present study was conducted to investigate how this relates to glycogen content in distinct subcellular localizations. Thus, subcellular localizations of glycogen may be regulated differently and be of distinct importance for muscle performance and recovery.

**METHODS:** Seven high-level male soccer players had a vastus lateralis muscle biopsy collected immediately after and 24, 48, 72 and 120 h after a competitive soccer match. Transmission electron microscopy was used to estimate the glycogen volume in subsarcolemmal (SS), intermyofibrillar (IMF) and intramyofibrillar (Intra) localizations. Two-way interactions or main effects were tested using linear mixed-effect model with subject, time and fibre as random effects and with time and localization as fixed effects. Values were log-transformed before analysis and presented as geometric means and 95% confidence intervals.

**RESULTS:** During the first day of recovery, glycogen content increased by ~60% in all defined subcellular localizations (SS, 0.029 (0.024-0.035) vs 0.046 (0.038-0.057) µm<sup>3</sup> µm<sup>-2</sup>; IMF, 0.014 (0.012-0.017) vs 0.022 (0.020-0.025) µm<sup>3</sup> µm<sup>-3</sup>; Intra, 0.0016 (0.0012-0.0020) vs 0.0026 (0.0022-0.0032) µm<sup>3</sup> µm<sup>-3</sup>), but during the subsequent second day of recovery Intra glycogen content did not increase further (48 h, 0.0025 (0.0020-0.0030) µm<sup>3</sup> µm<sup>-3</sup>) compared with an increase of 25% in subsarcolemmal glycogen (48 h, 0.058 (0.048-0.069) µm<sup>3</sup> µm<sup>-2</sup>) (P = 0.047). Conversely, from the second to the fifth day of recovery, Intra glycogen content exclusively increased (53%) (120 h, 0.0037 (0.0029-0.0048) µm<sup>3</sup> µm<sup>-3</sup>) compared to no change in subsarcolemmal (120 h, 0.048 (0.037-0.063) µm<sup>3</sup> µm<sup>-2</sup>) or intermyofibrillar glycogen (120 h, 0.027 (0.023-0.031) µm<sup>3</sup> µm<sup>-3</sup>) (P < 0.005).

**CONCLUSION:** In the recovery period after a soccer match, the increase in glycogen content is dependent on its subcellular localization. These results indicate that spatial distinct depositions of glycogen may have differential regulatory mechanisms, which might be influenced by the type of prior exercise.:

**2340** Board #15 MAY 31 2:00 PM - 3:30 PM

**Intake of Dammarane Oligo-Saponins Improves Glycogen Resynthesis in Human Skeletal Muscle after Exercise**

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(No relationships reported)

**PURPOSE:** Glycogen is the major energy source in the skeletal muscle for physical activities. Ginseng extracts shown to enhance the exercise performance, but no study demonstrated the effect of purified ginseng extracts and their dose response on glycogen metabolism in human skeletal muscle after exercise. The present study was aimed to investigate the impact of different doses of Dammarane Oligo-Saponins (DS), a purified ginseng extract on glycogen re-synthesis in exercised human skeletal muscle.

**METHODS:** Twelve physically active male college students were considered as placebo and DS trials. DS trials received three different doses of DS substance (low-240, medium-480, high-960 mg/day) for one-month, and all subjects performed an acute bout of cycling exercise for 1-h at 75%  $\dot{V}O_{2max}$ . Muscle samples from vastus lateralis were collected by needle biopsy immediately and 3-h after exercise. Blood glucose, insulin and lactate levels were estimated before exercise, immediately and 3-h after exercise. Crossover trials were performed ones after every dose with 4-week washout interval.

**RESULTS:** We found glycogen resynthesis rate was significantly higher in DS-240 trial ( $2.15 \pm 0.66 \mu\text{moles/mg tissue/h}$ ) than that in placebo trial. The protein levels of glycogen synthase (GS) were significantly ( $P < 0.05$ ) elevated immediately after exercise, and continued until 3-h after exercise in all DS trials. Phospho-GS levels were also increased immediately after exercise in low to high dose of DS. However, lower pGS/GS ratio was found in DS240 trial 3-h after exercise compared to placebo trial. Estimated Akt protein levels in muscle samples were not significantly altered. Nevertheless, phospho-Akt was significantly increased immediately after exercise in all 3 trials, while, DS-240 trial showed 3-h after exercise. Blood lactate levels with medium and high DS dose was higher 3-h after exercise, while blood glucose levels were lower with low dose (DS-240) 3-h after exercise. No significant change in insulin levels were noticed among groups after exercise.

**CONCLUSIONS:** Our findings clearly demonstrating that one-month Dammarane oligosaponins supplementation improved the glycogen resynthesis in skeletal muscle, and this was more prominent with moderate dose of DS.

**2341** Board #16 MAY 31 2:00 PM - 3:30 PM

**Exercise Training Improves Glucose Tolerance In Type 2 Diabetic Rats Regardless Elevation Of Body Temperature**

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(No relationships reported)

Exercise has been shown to improve impaired glucose tolerance and type 2 diabetes. Exercise elevates body temperature, resulting in increased heat shock protein (HSP) expressions in skeletal muscle. This increase of HSP expression has been suggested to contribute to the improvement of glucose tolerance. However, it is unclear whether exercise alone without raising body temperature can improve glucose tolerance.

**PURPOSE:** To examine the effects of exercise training with and without elevation of body temperature on glucose tolerance in type 2 diabetic rats.

**METHODS:** Otsuka Long-Evans Tokushima Fatty (OLETF) rats, which are type 2 diabetes models, were randomly divided into a sedentary (Sed-OLETF; n=9), trained under cold environment (CTr-OLETF; n=9), or trained under ordinary environment group (OTr-OLETF; n=9). OTr- and CTr-OLETF were trained five days a week for 10 weeks on a treadmill under ordinary (25°C) and cold (4°C) temperatures, respectively. The rectum temperature was measured to verify the rise of body temperature during exercise. An intraperitoneal glucose tolerance test (IPGTT) was performed for each group before and after the training period. Soleus and plantaris muscles were sampled under anesthesia 48 hours after the last exercise session. HSP72 expressions were measured using western blot analysis.

**RESULTS:** Body temperature significantly increased in OTr-OLETF ( $40.65 \pm 0.41^\circ\text{C}$ ), whereas body temperature in CTr-OLETF ( $38.01 \pm 0.35^\circ\text{C}$ ) remained similar after exercise. No significant differences in HSP72 expressions were observed among the three OLETF groups in soleus muscle. In plantaris however both CTr- and OTr-OLETF induced higher HSP72 expressions than Sed-OLETF, with the increase in HSP72 expression being greater for OTr-OLETF. The area under the curve of IPGTT was smaller for CTr- and OTr-OLETF than Sed-OLETF, indicating improved glucose tolerance after training. The values were however similar between CTr- and OTr-OLETF.

**CONCLUSION:** Preventing the rise in body temperature during exercise did not preclude the increase of HSP expression. Regardless of different expression levels of HSP72 induced by exercise training, exercise training with and without elevation of body temperature improved glucose tolerance in type 2 diabetic rats by similar degrees.

**2342** Board #17 MAY 31 2:00 PM - 3:30 PM

**High Physical Activity Attenuates The Hyperlipidemic Effect Of A Fructose-rich Meal**

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(No relationships reported)

The hyperlipidemic effect of a chronic high fructose diet has been well documented, however, whether increased physical activity (PA) may confer protection against these effects is yet to be determined.

**PURPOSE:** The purpose of this study was to determine the interaction between chronic high fructose consumption and PA levels on post-prandial lipemia in normal weight, recreationally active individuals.

**METHODS:** Twenty-two normal weight men and women (age:  $21.18 \pm .61$ , BMI =  $22.54 \pm .60 \text{ kg/m}^2$ ) consumed an ad libitum diet while ingesting an additional 75g of fructose for 14 days on 2 occasions. During the 14 days, subjects maintained either low PA (4500steps/day) or high PA (12,500 steps/day). Prior to and at the conclusion of the intervention, subjects underwent a study day in which they were given a fructose-rich meal (600 calorie mixed meal (45% carbohydrate [7.3% fructose], 40% fat, and 15% protein)) in the morning after a 12 h overnight fast. Blood was sampled at baseline and for 6 h after the meal and analyzed for triglycerides (TG), very-low density lipoproteins (VLDL), and total cholesterol (TC). The postprandial effect of a high fructose diet was determined by calculating total area under the curve (AUC) for TC, VLDL and TG.

**RESULTS:** VLDL AUC significantly increased by  $773.7 \pm 372.9 \text{ mg/dL} \times 6\text{hr}$  from pre to post intervention in the inactive group while the active group increased by only  $265.8 \pm 314 \text{ mg/dL} \times 6\text{hr}$  ( $p=0.015$ ). The inactive, fructose-fed group increased TC AUC by  $2598.16 \pm 1162 \text{ mg/dL} \times 6\text{hr}$  from pre to post intervention compared to the active group which TC AUC increase by  $598.421 \pm 1520 \text{ mg/dL} \times 6\text{hr}$ , however, this was not significant ( $p=.228$ ). There were no significant differences in TG AUC levels.

**CONCLUSIONS:** Physical activity seems to be protective against increases in post-prandial lipemia when fed a diet high in fructose.

**2343** Board #18 MAY 31 2:00 PM - 3:30 PM

**Effects of Moderate Swim Exercise on Adiposity and Metabolic Function in Mice**

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(No relationships reported)

Chronic exercise has been recommended for diabetics as a way to attenuate metabolic changes and prevent obesity.

**PURPOSE:** This study was undertaken to determine the effects of swim training on the metabolic and anthropomorphic response to a high fat (60%) and fructose (10% liquid) diet in C57BL male mice.

**METHODS:** Mice were randomly assigned to one of three groups: Control (CON, Standard Chow & Water, n=10); Sedentary (SED, High Fat Chow & Fructose Water, n=9); and Exercise (EX, High Fat Chow & Fructose Water, n=9). EX mice swam 1 hr/day, 3 days/week, for 8 weeks. SED and CON did not participate in the exercise program. Caloric consumption and body composition were measured weekly (ECHO-MRI). A glucose tolerance test (GTT) was conducted at week 7. Plasma glucose, insulin, leptin, and corticosterone were measured at week 8. Epididymal white adipose tissue (WAT) was analyzed histologically to determine fat cell size. Data were analyzed using ANOVA and *post hoc* tests.

**RESULTS:** Exercise did not improve body fat or fat cell size. Body fat was as high as ~40% in the SED and EX groups as compared to 18% in CON. The increased levels of corticosterone, insulin, and glucose in the fat/fructose groups were reduced by exercise. Corticosterone: CON,  $211 \pm 1.6$  ng/ml; SED,  $571 \pm 0.9$  ng/ml; EX,  $257 \pm 1.6$  ng/ml (SED>ED,  $p < 0.01$ ). Insulin: CON,  $1.2 \pm 0.2$  ng/ml; SED,  $8.3 \pm 2.3$  ng/ml; EX,  $3.8 \pm 0.5$  ng/ml (SED>EX,  $p < 0.05$ ). Glucose: CON,  $136.2 \pm 4.7$  mg/dl; SED,  $153.9 \pm 5.5$  mg/dl; EX,  $126.2 \pm 6.2$  mg/dl (SED>EX  $p < 0.01$ ). GTT was impaired by the fat/fructose diet with levels corrected by exercise ( $p < 0.05$ ).

**CONCLUSION:** These results document the beneficial effects of even moderate exercise on key metabolic parameters in dietary-induced diabetes.

This study was supported by NIH R01 HL093567

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**2344** Board #19 MAY 31 2:00 PM - 3:30 PM

**Time Trial Performance 4 h following Glycogen-Depleting Exercise is Enhanced Similarly with Recovery Non-dairy Chocolate Beverages vs Chocolate Milk**

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(No relationships reported)

Post exercise chocolate milk ingestion has been shown to enhance both glycogen resynthesis and subsequent exercise performance.

**PURPOSE:** To assess whether non-dairy chocolate beverage ingestion post glycogen-depleting exercise can enhance 20km time trial performance 4 h later.

**METHODS:** Ten healthy trained male cyclists ( $21 \pm 2$  y,  $VO_{2max} = 60 \pm 5.2$  ml $\cdot$ kg $^{-1}$  $\cdot$ min $^{-1}$ ; mean $\pm$ SD) completed a series of intense cycling intervals designed to lower muscle glycogen (Jentgens & Jeukendrup, 2003) followed by 4h of recovery and a subsequent 20km cycling time trial. During the first 2h of recovery, participants ingested chocolate dairy (DAIRYCHOC), chocolate soy milk (SOYCHOC), chocolate hemp milk (HEMPCHOC), low fat dairy milk (MILK), or a 0 kcal artificially sweetened, flavored beverage (PLACEBO) at 30min intervals in a double blind, counterbalanced repeated measure design. All drinks, except the PLACEBO were isoenergetic (1010  $\pm$  148 kcal) and provided 1g CHO $\cdot$ kg body mass $^{-1}$  $\cdot$ h $^{-1}$ . Fluid intake across CHOC treatments was equalized (1796  $\pm$  498 ml) by ingesting appropriate quantities of water based on MILK intake. The CHO:PRO ratio was 4:1, 1.5:1, 4:1, and 5:1, for DAIRYCHOC, MILK, SOYCHOC, and HEMPCHOC, respectively.

**RESULTS:** Time trial performance (DAIRYCHOC 34.58  $\pm$  2.5 min, SOYCHOC 34.83  $\pm$  2.2 min, HEMPCHOC 34.88  $\pm$  1.1 min, MILK 34.47  $\pm$  1.7 min) was enhanced similarly vs PLACEBO (37.85  $\pm$  2.1) for all treatments ( $P = 0.019$ ).

**CONCLUSION:** These data suggest that post exercise macronutrient and total energy intake are more important for 20 km time trial performance following glycogen-depleting exercise than protein type or protein: carbohydrate ratio.

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**2345** Board #20 MAY 31 2:00 PM - 3:30 PM

**The Effect Sweet Cassava Polysaccharide (SCP) on Exhaustive Running Performance**

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(No relationships reported)

**PURPOSE:** This study was to examine the effect of sweet cassava polysaccharide (SCP) on endurance performance.

**METHODS:** Thirty male SD rats (7-week old) were divided into three groups: control (C), exercise (E) and exercise with SCP administration (ESCP) at the dosage of 500mg/kg body weight by gastric-intubation for 6 days in addition to standard rat food and plain water. Exercise training was performed in the E and ESCP groups for 5 days (no exercise in the 6th day), and then all rats were sacrificed for determining the levels of gastrocnemius and soleus glycogen content and blood metabolites such as blood glucose, free fatty acid and insulin after the ESCP and E groups completed the exhaustive running. **RESULTS:**

The running time to exhaustion was significantly longer in ESCP group than in E group- (63 vs. 45 minutes,  $p < 0.05$ ). Both gastrocnemius (C, ESCP, and E for  $2.10 \pm 0.51$ ,  $1.70 \pm 0.25$ , and  $1.00 \pm 0.28$  mg/g, respectively,  $p < 0.05$ ) and soleus (C, ESCP, and E for  $3.15 \pm 0.92$ ,  $2.23 \pm 0.44$ , and  $1.09 \pm 0.59$  mg/g, respectively,  $p < 0.05$ ) glycogen content of ESCP and C groups were significantly greater than those of E group, but, only significantly higher in the C group than in the ESCP group for soleus was found. In addition, free fatty acid (C, ESCP, and E for  $1.21 \pm 0.13$ ,  $1.25 \pm 0.12$ , and  $0.84 \pm 0.14$  mEq/L, respectively,  $p < 0.05$ ) and blood glucose (C, ESCP, and E for  $111.4 \pm 5.56$ ,  $109.1 \pm 4.68$ , and  $100.1 \pm 1.91$  mg/dL, respectively,  $p < 0.05$ ) concentrations were significantly higher in the ESCP and C groups than in the E group. **CONCLUSIONS:** A 5-day supplementation of SCP can extend the running time to exhaustion, which might be attributed to elevated muscle glycogen content and free fatty acid levels in blood.

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**2346** Board #21 MAY 31 2:00 PM - 3:30 PM

**Carbohydrate Attenuates Central Fatigue in Cyclists**

Beth W. Glace, Ian J. Kremeric, Malachy P. McHugh, FACSM. *Lenox Hill Hospital, New York, NY.*

(No relationships reported)

**PURPOSE:** Carbohydrate ingestion prolongs fixed-intensity, submaximal exercise. The purpose of this study was to identify the mechanism [peripheral vs. central] by which carbohydrate ingestion delays fatigue after exhaustive cycling.

**METHODS:** 4 men [ $35 \pm 5$  yrs;  $VO_{2peak}$   $66 \pm 4$  ml/Kg/min] were assigned, in a double-blind crossover design, to an artificially sweetened, non-caloric, electrolyte beverage ["Placebo", 4C Totally Light 2 Go] and to a commercially available sports drink ["Carbohydrate", Gatorade] at a rate of 1% of body weight each hour. Subjects cycled for 2 hours at their ventilatory threshold, approximately 66% of  $VO_{2peak}$ , with 5, 1-minute sprints interspersed, followed by a 3-Km time trial. Intensity was then increased to the workload at their respiratory compensation threshold [approx. 85%  $VO_{2peak}$ ] and subjects were encouraged to pedal for as long as possible. Ratings of perceived exertion [RPE] were measured throughout using the Borg scale. Blood glucose, lactate and quadriceps strength were measured pre-exercise, post-3K time trial and post-exhaustion. Isometric strength testing was performed in a semi-reclined position: 1) MVC; 2) MVC with superimposed femoral nerve magnetic stimulation to measure central activation ratio [CAR]; 3) femoral nerve stimulation [PMS] in a 4-second pulse train on a relaxed muscle. Changes in metabolic and strength measurements were analyzed with repeated measures ANOVA.

**RESULTS:** Post-exercise strength was 92% of baseline in the Carbohydrate trial vs. 75% in the Placebo trial [ $p = 0.002$ ]. Preservation of strength with Carbohydrate was due to better maintenance of central activation [Carbohydrate CAR after fatigue was 91% of baseline vs. Placebo CAR 80% of baseline,  $p = 0.036$ ], since there was no evidence of peripheral fatigue based on maintenance of PMS-elicited force [effect of time,  $p = 0.869$ ; time x drink,  $p = 0.938$ ]. Carbohydrate intake tended to improve time trial and ride to exhaustion performance. There was no effect of drink on blood glucose or lactate.

**CONCLUSION:** Carbohydrate ingestion preserves performance via a central mechanism during exhaustive cycling.

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2347 Board #22 MAY 31 2:00 PM - 3:30 PM

**Effects of Carbohydrate Supplementation on Human Growth Hormone and Cytokine Responses during Resistance Exercise**

Pan Soo Kim, Ying Chang, Hyun Lyung Jung, Jun Gu Jung, Ho Youl Kang. *Kyungpook National University, Daegu, Korea, Republic of.*  
(No relationships reported)

**PURPOSE:** This study was to investigate the effects of carbohydrate consumption on human growth hormone (hGH) and cytokine responses during resistance exercise

**METHODS:** Ten male students (Age;  $23.2 \pm 0.4$  yr, Height;  $174.1 \pm 2.0$  cm, Body Weight;  $68.4 \pm 1.7$  kg) were randomly received to the exercise treatment (8RM 3sets) and exercise/carbohydrate (8RM 3sets/CHO). The 8RM 3sets/CHO ingested the carbohydrate ( $1.2$  g/kg bw) during and after resistance exercise which consisted of leg press exercise with three sets using eight repetition maximum (8 RM) load. Blood samples were drawn immediately before (pre) and at 15, 30, 45, 60, 75, 90, 105, and 120 min after exercise. Plasma hGH, total testosterone, cortisol, insulin and glucose levels were determined and Interleukin 1, interleukin  $1\beta$  and interleukin 10 levels were also measured.

**RESULTS:** Plasma hGH level in 8RM 3sets/CHO was significantly decreased at 30, 45, 60, 75, 90 min during exercise compared with the 8RM 3sets ( $p < 0.05$ ). Plasma glucose in 8RM 3sets/CHO was significantly increased at 15, 30, 45, 60, 90 min during exercise compared with the 8RM 3sets and plasma insulin responses in 8RM 3sets/CHO was significantly increased at all times (15–120 min) compared to those of 8RM 3sets ( $p < 0.05$ ). The cortisol level was significantly increased in 8RM 3sets/CHO at 120min after (0) exercise than 8RM 3sets ( $p < 0.05$ ). Testosterone level was significantly reduced at 45, 60, 75, 90, 105, 120 min compared to those of CON ( $p < 0.05$ ). Plasma CK activity and cytokines (IL-6, IL- $1\beta$ , IL-10) were no significantly different between two treatments.

**CONCLUSIONS:** The data of this study indicate that carbohydrate supplementation during resistance exercise could suppress the elevation of plasma growth hormone, but did not affect the concentrations of plasma cortisol and testosterone. In addition, carbohydrate consumption during resistance exercise did not cause the changes of plasma IL-6, IL- $1\beta$ , and IL-10 levels

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2348 Board #23 MAY 31 2:00 PM - 3:30 PM

**Consumption Of A Novel, Carbohydrate-free Recovery Beverage Reduces Muscle Damage And Improves Recovery Post-exercise**

Paul A. Borsa, FACSM<sup>1</sup>, Kelly A. Larkin<sup>1</sup>, Jeffrey S. Martin<sup>2</sup>. <sup>1</sup>University of Florida, Gainesville, FL. <sup>2</sup>University of Missouri-Columbia, Columbia, MO.  
(P.A. Borsa: Contracted Research - Including Principle Investigator; Revalerio Corporation.)

**PURPOSE:** To assess the effects of consuming a novel carbohydrate-free recovery beverage on muscle damage, inflammation and functional recovery following a single bout of isokinetic resistance exercise for the biceps brachii muscle.

**METHODS:** Subjects were blinded and randomly assigned to a beverage (BEV; n=20) or placebo control (PLA; n=20) group. Subjects consumed 2-6 500ml bottles of the BEV or PLA daily, as determined by weight categories, for 23 days. On day 19 subjects completed a fatigue protocol for the biceps in order to induce muscle damage. The fatigue protocol consisted of 3 sets of 20 repetitions using concentric and eccentric contractions of the elbow flexors. Blood draw and clinical measurements were performed pre-exercise and 24, 48, and 96-hrs post-exercise. Clinical measures included maximal isometric arm strength, pain with elbow extension, resting arm angle (RANG) and self-report arm disability. Pain was quantified using a visual analog scale and RANG was measured in degrees. Disability was measured using the QuickDASH self-report questionnaire. Plasma samples were analyzed to determine concentrations of creatine kinase (CK), myoglobin (Mb) and C-reactive protein (CRP).

**RESULTS:** There was no significant difference in maximal isometric arm strength between BEV and PLA pre-exercise and at 48-hr and 96-hr post-exercise. Pain with elbow extension and self-report arm disability were significantly higher in the PLA compared to the BEV group at 48-hr [ $39.2 \pm 16$  v.  $25.4 \pm 13$ ,  $p < 0.01$ ;  $25 \pm 9$  v.  $19.8 \pm 3$ ,  $p < 0.01$ ] and 96-hr [ $17.8 \pm 13$  v.  $7.7 \pm 8$ ,  $p < 0.01$ ;  $11.9 \pm 3$  v.  $16.8 \pm 5$ ,  $p < 0.01$ ] after exercise, while RANG was significantly higher in the BEV group compared to PLA at 48-hr [ $159.2 \pm 7$  v.  $150 \pm 11$ ;  $p < 0.01$ ] and 96-hr [ $163.4 \pm 5$  v.  $158.9 \pm 4$ ,  $p < 0.01$ ] after exercise. Similarly, plasma concentrations for CK (IU/L) and CRP (mg/L) were significantly lower in the BEV group compared to PLA at 48-hr [ $235.6 \pm 280$  v.  $770.6 \pm 934$ ,  $p < 0.05$ ;  $3.1 \pm 2$  v.  $5.4 \pm 4$ ,  $p < 0.05$ ] and 96-hr [ $364 \pm 247$  v.  $948 \pm 1098$ ,  $p < 0.05$ ;  $2.64 \pm 2$  v.  $5.8 \pm 5$ ,  $p < 0.01$ ] after exercise.

**CONCLUSIONS:** Consuming a novel, carbohydrate-free recovery beverage significantly reduced exercise-induced muscle damage and inflammation, and improved biochemical and functional recovery.

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2349 Board #24 MAY 31 2:00 PM - 3:30 PM

**Consumption Of A Novel, Carbohydrate-free Recovery Beverage Attenuates Strength Loss After High Intensity Resistance Exercise**

Kelly A. Larkin, Paul A. Borsa, FACSM. *University of Florida, Gainesville, FL*

(K.A. Larkin: Contracted Research - Including Principle Investigator; Revalerio Corporation.)

**PURPOSE:** To assess the effects of consuming a novel, carbohydrate-free recovery beverage on strength loss and ratings of perceived exertion (RPE) following isokinetic exercise.

**METHODS:** Subjects were blinded and randomly assigned to either a beverage (BEV; n=20) or placebo control (PLA; n=20) group. Subjects consumed 2 to 6 500ml bottles of the BEV or PLA daily, as determined by weight categories, for 18 days. On day 19 subjects completed a fatigue protocol for the elbow flexors. The fatigue protocol consisted of a single bout of isokinetic resistance exercise using 3 sets of 20 repetitions of concentric and eccentric contractions of the biceps brachii. Subjects were tested for isometric strength pre-exercise and again immediately following exercise. The maximal voluntary contraction (MVC) was used as the criterion measure for isometric strength and was recorded in N-m. Ratings of perceived exertion were also assessed following the exercise bout using a modified Borg scale. Borg scale ratings ranged from 6 (no exertion) to 20 (maximal exertion). Strength loss indices were calculated for each subject by dividing the post-exercise strength value with the pre-exercise value multiplied by 100.

**RESULTS:** The BEV group had a smaller decrease in MVC post-exercise than the PLA control group [BEV: pre-ex =  $38.4 \pm 19$ , post-ex =  $19.1 \pm 10$ ; PLA: pre-ex =  $46.5 \pm 26$ , post-ex =  $22.4 \pm 14$ ]. The strength loss index was also significantly lower for the BEV group compared to PLA control [BEV: 0.505, PLA: 0.527;  $p < 0.01$ ]. In addition, the exercise protocol was perceived as less strenuous by the BEV group [BEV: 16.5, PLA: 17.8;  $p < 0.05$ ].

**CONCLUSIONS:** Consuming a novel, carbohydrate-free recovery beverage for 18 days prior to high intensity resistance exercise can significantly reduce muscular fatigue and ratings of perceived exertion.

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2350 Board #25 MAY 31 2:00 PM - 3:30 PM

**Effects Of Carbohydrate And Electrolyte Supplementation On Processing Speed, Selective Attention And Vo2max**

Ali Boolani<sup>1</sup>, Kumar Tammareddi<sup>2</sup>, Bert Jacobson, FACSM<sup>3</sup>, Will Roszel<sup>1</sup>. <sup>1</sup>Oklahoma City University, Oklahoma City, OK. <sup>2</sup>Alvin C. York VA Hospital, Nashville, TN. <sup>3</sup>Oklahoma State University, Stillwater, OK.

(No relationships reported)

**PURPOSE:** The purpose of this study was to evaluate performance on cognitive post sub-maximal VO2Max testing using the Bruce protocol after consumption of water or a carbohydrate-electrolyte solution (CE).

**METHODS:** Volunteers (N=12, age= $21.42 \pm 2.43$ , weight=  $82.34 \pm 33.44$ ; height=  $175$ cm  $\pm$  12.8) from a Historically Black College and University (HBCU) were issued a Stroops task (ST) and Random Numbers (RN) test at baseline. The ST congruent (STC) and incongruent (STI) words were timed and number incorrect was identified. The RN was a one minute timed test with numbers 0-99 randomized in a 10x10 grid. Subjects circled numbers as they were identified. Subjects were given water at the start of their warm-up on a Bruce Protocol (BP) VO2Max test and were asked consume it prior to the end of the first level of the BP. Subjects were administered the test until they reached a perceived exertion of 20 on a Borg rating of perceived exertion (RPE) scale. When a subject reached a RPE of 20, the test was stopped and without rest subjects were re-administered a ST and RN. Subjects were asked to complete the same protocol one week later however, they were administered 400ml of Gatorade G2 fruit punch. Data was analyzed using paired t-tests and test scores were analyzed for pre- and post-test data for both days. Changes in test scores were evaluated using paired t-tests.

**RESULTS:** Analysis yielded significant difference in pre and post-test STI ( $p=.010$ ) and RN ( $p=.006$ ) for water. There was no significant difference in STC ( $p=.613$ ) for water. There was a significant difference in pre and post-test STI ( $p<.001$ ), STC ( $p=.002$ ), but no significant difference in RN ( $p=.587$ ) for CE. No significant differences in changes in STC ( $p=.975$ ), STI ( $p=.181$ ), RN ( $p=.690$ ) for both protocol were identified. A significant difference in VO2Max was also noted ( $p=.002$ )

**CONCLUSIONS:** Significant decreases in STI and an increase score on RN may be attributed to increased cognitive function post-exercise. However no significant difference was found between the changes in of STC, STI and RN may lead us to assume that CE supplementation during exercise does not improve cognitive function more than water. The increase in VO2Max during may be attributed to increased blood glucose post supplementation giving the subject more time before they reached their lactic threshold.

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**2351** Board #26 MAY 31 2:00 PM - 3:30 PM

**CHO Mouth-rinse Improves 16 Km Time Trial Cycling Performance In A Glycogen Depleted State**

Alexis R. Mauger<sup>1</sup>, Harry McGonagle<sup>2</sup>, Lee Taylor<sup>2</sup>, Paul C. Castle<sup>2</sup>. <sup>1</sup>University of Kent, Chatham, United Kingdom. <sup>2</sup>University of Bedfordshire, Bedford, United Kingdom.

(No relationships reported)

Rinsing of carbohydrate (CHO) solutions during exercise can improve performance in fixed work-amount cycle time trials (TT) and automated treadmill running of ~45-60 min duration. Mechanisms responsible for this improved performance have been attributed to a reduced perceived exertion, activation of reward centres in the brain and/or increased cortical excitability. However, this phenomena has never been demonstrated in distance-based TT cycling, or when exercise is performed in a glycogen depleted state.

**PURPOSE:** To determine whether the central effect of CHO mouth-rinse during a 16 km cycling TT improves performance when muscle glycogen has been previously depleted.

**METHODS:** Eight recreationally active subjects completed a VO2max test, a 16 km familiarisation TT and four performance 16 km TT. The evening before each performance TT, subjects completed a previously described muscle glycogen depletion protocol (Van Den Bergh et al. 1996) and only ate a low-CHO evening meal before the subsequent performance TT. During the performance TT, in a double-blind, randomised fashion, subjects either ingested (GluI) or rinsed (GluR) 150 mL of 6.4% glucose solution every 2 km, or ingested (PlaI) or rinsed (PlaR) 150 mL of commercially available non-caloric concentrate sweetened with aspartame and saccharin. Subjects received no feedback during the TT other than distance completed. Measures of blood lactate B[La], blood glucose B[Glu], heart rate (HR), RPE and power output (PO) were recorded during each TT.

**RESULTS:** Time to complete the TT was significantly reduced ( $F_{2,5,17.2} = 4.3, p = 0.02$ ) in the GluR ( $29:53 \pm 2:56$  min) vs. PlaR ( $31:16 \pm 3:15$ ) ( $p = 0.05$ ). The 5% performance improvement in the GluR (compared with PlaR) was accompanied by a mean 21 W higher PO in the first 12 km ( $F_{3,21} = 3.4, p = 0.03$ ) and a mean 8 bpm higher HR ( $F_{3,21} = 3.1, p = 0.04$ ) throughout the TT. No changes in B[La], B[Glu] or RPE across the TT ( $p > 0.05$ ) were observed. No significant differences were observed between the GluI, PlaR and PlaI conditions.

**CONCLUSIONS:** The proposed central changes and subsequent exercise performance improvement accompanying CHO mouth-rinsing during exercise are apparent even when muscle glycogen levels have been previously depleted.

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**2352** Board #27 MAY 31 2:00 PM - 3:30 PM

**Effect Of Carbohydrate Mouth Rinse And/or Ingestion On High-intensity Exercise Performance**

Ajmol Ali, Catherine Moss, Ji Y. Yoo, Bernhard Breier. Massey University, Auckland, New Zealand.

(No relationships reported)

There is equivocal data regarding mouth rinsing with carbohydrate (CHO) and exercise performance. It has been suggested that in a fed state, where muscle and liver glycogen stores are not compromised, glucose levels are maintained and hence mouth rinsing will not affect performance.

**PURPOSE:** To examine effects of fluid intake, CHO mouth rinse, and CHO ingestion on cycling performance under glycogen-compromised conditions.

**METHODS:** Nine recreationally trained cyclists volunteered for this randomised, counterbalanced, double-blind study. Four main trials were performed on an electronically braked cycle ergometer; each trial, separated by 7 days, took place over 2 days. On Day 1 the participants underwent a 90 min glycogen-reducing exercise protocol, immediately followed by a low-carbohydrate meal and then a subsequent overnight fast. The following morning a 1-h time trial performance test was conducted. Subjects performed a certain amount of work as fast as possible for the performance test. For the main trials subjects either a) mouth rinsed with a 15% CHO solution (CHOR), b) ingested 7.5% CHO solution (CHOI), c) mouth rinsed with a taste-matched placebo (PLAR), or d) ingested taste-matched placebo (PLAI); solutions were administered every 12.5% of exercise completed. Blood samples were taken every 25% of exercise.

**RESULTS:** There were no significant differences in performance time between treatments (CHOI  $3927 \pm 288$  s; CHOR  $4101 \pm 236$  s; PLAI  $4125 \pm 316$ ; 4097  $\pm 310$  s; mean  $\pm$  SD;  $P=0.22$ ). However, mean power output was higher in CHOI ( $231 \pm 33$  W) relative to other trials ( $221-223$  W;  $P<0.05$ ). There was a main effect of treatment ( $P<0.001$ ) and interaction of treatment x time for plasma glucose ( $P<0.001$ ); values were similar at the start of exercise ( $4.2-4.9$  mM) but were higher in CHOI at 75% ( $5.4 \pm 0.7$  mM) and 100% ( $5.9 \pm 1.2$  mM) of exercise relative to other trials ( $3.9-4.7$  mM;  $P<0.05$ ). There were treatment ( $P<0.001$ ) and interaction ( $P=0.015$ ) effects for insulin; levels were higher in CHOI between 50-100% of exercise ( $2.8-2.0$  mU/L) relative to other trials ( $1.5-0.4$  mU/L;  $P<0.05$ ).

**CONCLUSIONS:** Mouth rinsing with a CHO solution in a glycogen-compromised condition did not affect exercise performance. CHO ingestion increased glucose concentrations and improved performance relative to fluid ingestion and CHO mouth rinse trials.

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**2353** Board #28 MAY 31 2:00 PM - 3:30 PM

**Pre-exercise Carbohydrate Supplementation Does Not Suppress Rate Of Fatigue During Resistance Exercise In Trained Females.**

Bill I. Campbell<sup>1</sup>, Kelly A. Raposo<sup>1</sup>, Ashley Bullion<sup>1</sup>, Amber Petchonka<sup>1</sup>, Nina Pannoni<sup>1</sup>, Brad Cloer<sup>1</sup>, Shawn Deignan<sup>1</sup>, Tina Vyas<sup>1</sup>, Richard Kreider, FACSM<sup>2</sup>.

<sup>1</sup>University of South Florida, Tampa, FL. <sup>2</sup>Texas A&M University, College Station, TX.

(No relationships reported)

**PURPOSE:** To investigate the effects of ingesting pre-exercise waxy maize carbohydrate on the rate fatigue (as measured by total repetitions performed) during an acute bout of resistance exercise.

**METHODS:** 13 resistance-trained females ( $21.9 \pm 4.8$  yrs;  $163.8 \pm 7.6$  cm;  $62.1 \pm 6.7$  kg) participated in 2 separate resistance exercise sessions separated by seven days. During a familiarization trial, each participant's 1RM for the bench press and leg press was determined. Next, the participants were randomly assigned to either the carbohydrate or placebo treatment session using a double blind, counterbalanced, cross-over design with each participant consuming 1.0g carbohydrate/kg of body mass or a non-caloric placebo beverage 60 minutes before exercise. The source of carbohydrate was waxy maize carbohydrate. The resistance exercise workout required each participant to perform 5 sets of bench press at 75% 1RM followed by 5 sets of leg press at 85% of 1RM performed to muscular failure, with 3 minutes of rest between each set and 5 minutes of rest between the two exercises. The rate of fatigue was calculated as the percentage decline (in repetitions completed) from the first set to the fifth (and final) set in both the bench press and leg press. Data were analyzed by a paired samples t-test ( $p < .05$ ).

**RESULTS:** No statistically significant differences existed between treatments in the rate of fatigue in relation to bench press and leg press. Rate of fatigue for bench press in the carbohydrate group was  $54 \pm 14\%$  and was  $57 \pm 8\%$  in the placebo group. There were no significant differences ( $p = 0.420$ ) between these two groups in relation to rate of fatigue in the bench press. Rate of fatigue for leg press in the carbohydrate group was  $29 \pm 22\%$  and was  $22 \pm 24\%$  in the placebo group. There were no significant differences ( $p = 0.144$ ) between these two groups in relation to rate of fatigue in the leg press.

**CONCLUSIONS:** Pre-exercise carbohydrate supplementation (in the form of waxy maize carbohydrate) does not impact the rate of fatigue during an acute bout of resistance exercise in resistance-trained females.

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2354 Board #29 MAY 31 2:00 PM - 3:30 PM

**Fasting Blood Glucose is Significantly Associated with Metabolic Inflexibility in Hispanic Women**

Sarah E. Deemer<sup>1</sup>, George A. King<sup>2</sup>, Valorie Castro<sup>2</sup>, Fabiola Ibarra<sup>2</sup>, Alexandra Jacquez<sup>2</sup>, Diana Ponce<sup>2</sup>, Mariana Rodriguez<sup>2</sup>, Elizabeth Venegas<sup>2</sup>, Chris L. Melby<sup>1</sup>, Matthew S. Hickey, FACSM<sup>1</sup>. <sup>1</sup>Colorado State University, Fort Collins, CO. <sup>2</sup>University of Texas at El Paso, El Paso, TX.

(No relationships reported)

Metabolic inflexibility is characterized by an attenuated ability to increase CHO oxidation in response to increased circulating glucose and insulin. Such inflexibility is found in type 2 diabetes, and may also be associated with increased diabetes risk in individuals with normal blood glucose concentrations. This link has not been studied in normoglycemic Hispanic women, a group known to be at higher risk for diabetes.

**PURPOSE:** To determine if fasting blood glucose and insulin sensitivity are related to the magnitude of metabolic inflexibility in non-diabetic Hispanic women.

**METHODS:** Insulin sensitivity was assessed using the euglycemic hyperinsulinemic clamp (EHC) technique and changes in substrate oxidation, i.e. metabolic flexibility, were measured by the respiratory exchange ratio (RER) in 23 non-diabetic Hispanic women (mean  $\pm$  SD: age (y): 35.7  $\pm$  13.2; BMI (kg/m<sup>2</sup>): 29.8  $\pm$  6.1; % body fat: 45.9  $\pm$  5.9). Metabolic flexibility was calculated as the RER under insulin-stimulated (EHC) conditions - fasting RER. Fasting glucose (X=80.6 mg/dL) was measured using enzyme electrode technology (YSI 2300 Stat Plus). Data were analyzed using paired *t*-tests and Pearson's Product-Moment Correlation. Significance was set at  $\alpha = 0.05$ .

**RESULTS:** Mean fasting RER (0.82) increased to 0.93 during the clamp ( $P < 0.001$ ), indicative of metabolic flexibility in these women. However, there was a significant inverse correlation between fasting blood glucose and metabolic flexibility ( $r = -0.431$ ,  $P = 0.040$ ) and insulin sensitivity as determined by the glucose-infusion rate was positively correlated with metabolic flexibility ( $r = 0.553$ ,  $P = 0.006$ ). **DISCUSSION:** These data indicate that even in normoglycemic Hispanic women, fasting blood glucose and insulin sensitivity may be predictive of early impairments in metabolic flexibility. Future studies should be undertaken to determine the time-course of development of metabolic inflexibility and risk of diabetes in Hispanic women.

Supported by the USDA - Colorado Agricultural Experiment Station

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2355 Board #30 MAY 31 2:00 PM - 3:30 PM

**Effects of a Carbohydrate Containing Beverage on Thermoregulatory Parameters During Endurance Exercise in a Thermoneutral Environment**

Nicole E. Pollard, Jessica C. Brown, Lindsay R. Laamann, RYanne D. Carmichael, Tracey D. Matthews, Vincent J. Paolone, FACSM. *Springfield College, Springfield, MA.*

(No relationships reported)

**PURPOSE:** The investigation was designed to determine if a 7% carbohydrate containing beverage ingested throughout a high intensity (80-85% of VO<sub>2peak</sub>) cycling bout lasting 45 min would have an effect on thermoregulatory parameters.

**METHODS:** Female subjects with a mean age of 29.9 $\pm$ 5.22 years (N = 10) performed two separate trials of a 45 min cycling session at 80-85% VO<sub>2peak</sub>. In one trial subjects consumed 2 ml·kg<sup>-1</sup> of body weight of a 7% carbohydrate containing beverage 30 min and 15 min before the 45 min cycling session began. The same amount of beverage was consumed during the cycling bout at 15, 30, and 45 min into the exercise session. In the second trial, subjects were given 2 ml·kg<sup>-1</sup> of body weight of a placebo beverage at the same time points. The study was conducted in a crossover design, and the variables included VO<sub>2</sub>, RER, heart rate, core temperature, skin temperature, core to shell gradient, blood pressure, RPE, thermal sensation, blood hemoglobin and blood hematocrit. Variables were measured every 5 min and blood data every 15 min.

**RESULTS:** No significant interaction ( $p > .05$ ) was found between the carbohydrate beverage and placebo beverage ingestion across time in heart rate, core temperature, RPE, RER, thermal sensation or pre and post measures of mean body temperature, mean skin temperature, and core to shell gradient. In addition, no significant main effect for the treatments was found for all of the dependent variables. Significant time effects were found for heart rate, core temperature, RPE, RER, thermal sensation, mean skin temperature, and core to shell gradient. No significant differences were found ( $p > .05$ ) between the ingestion of a carbohydrate and placebo drink before and after an acute exercise bout in the thermoregulatory parameters. A non-statistically significant but possibly physiologically significant percent change in pre and post core to shell gradient was observed. A 69.3% decrease in the width occurred between pre and post core to shell gradient measures for the carbohydrate beverage and a 76.04% decrease in the width occurred for the placebo beverage.

**CONCLUSIONS:** The ingestion of carbohydrate beverages during endurance exercise had no significant effect on thermoregulatory parameters ( $p > .05$ ).

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2356 Board #31 MAY 31 2:00 PM - 3:30 PM

**The Addition of Protein to a Carbohydrate Supplement Enhances Fluid Retention But Not Running Performance**

Craig O. Mattern<sup>1</sup>, Brian Campbell<sup>2</sup>, Tina Carson<sup>1</sup>, Justin Charland<sup>2</sup>, Sam Craven<sup>3</sup>, Natalia Filip<sup>2</sup>, Celia Watt<sup>1</sup>, Ryan Yapple<sup>1</sup>, Byrne K. Heidi<sup>1</sup>. <sup>1</sup>The College at Brockport, SUNY, Brockport, NY. <sup>2</sup>Upstate Medical University, SUNY, Syracuse, NY. <sup>3</sup>Ball State University, Muncie, IN.

(No relationships reported)

**INTRODUCTION:** It is unclear whether or not the isocaloric addition of protein (PRO) to a carbohydrate (CHO) endurance exercise supplement improves exercise performance, recovery, and/or fluid retention.

**PURPOSE:** 1) to determine if a PRO+CHO beverage during and/or after endurance exercise improves performance in a subsequent exercise bout compared to CHO alone, 2) to measure fluid retention as a possible mechanism for enhanced performance.

**METHODS:** Using a randomized crossover design, nine endurance trained subjects (age=33 $\pm$ 4.2 yrs; VO<sub>2max</sub>=65.1 $\pm$ 1.47 ml/kg/min, body fat=7.9 $\pm$ 1.0%) received a beverage containing CHO (0.65g of CHO/kg) or CHO + PRO (0.52g of CHO/kg plus 0.13g of protein/kg) during a one hour run at 68% of VO<sub>2max</sub>. During a 7 hour recovery period subjects then received beverages containing either CHO (1.0g of CHO/kg) or CHO+PRO (0.80g of CHO/kg plus 0.20g of protein/kg) immediately post-exercise, at 1 and 4 hours of recovery. Urine volume and body weight were measured post-exercise, during recovery at hours 3, 5, and 7 to calculate fluid retention. Subjects then ran a 10-km time trial.

**RESULTS:** There were no statistical differences in 10-km running times or measures of blood glucose or insulin during or after exercise among the four nutritional conditions. However fluid retention was significantly higher at hour 5 of recovery in both conditions in which CHO+PRO (37.2 $\pm$ 18.0% and 34.9 $\pm$ 19.3%) was provided during recovery as compared to those in which CHO alone (19.7 $\pm$ 18.0%) was given.

**CONCLUSION:** While a 4:1 ratio of CHO:PRO provided in recovery may enhance fluid retention compared to CHO alone, this did not lead to improved 10-km running performance.

This project was supported by Infinit Nutrition.

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2357 Board #32 MAY 31 2:00 PM - 3:30 PM

**Effects Of A Whey-carbohydrate Supplement On Markers Of Muscle Damage After Concurrent Exercise In Men**

Catherine Saenz, Jenna M. Apicella, Brooke L. Bailey, William J. Kraemer, FACSM, Carl M. Maresh, FACSM, Jeff S. Volek. *University of Connecticut, Storrs, CT.*

(No relationships reported)

Effects of a whey-carbohydrate supplement on markers of muscle damage after concurrent exercise in men

Catherine Saenz, Jenna M. Apicella, Brooke L. Bailey, William J. Kraemer, FACSM, Carl M. Maresh, FACSM, Jeff S. Volek. University of Connecticut, Storrs, CT

Ingestion of whey protein and carbohydrate after varying types of resistance exercise rapidly increase plasma levels of essential amino acids and insulin which has been shown to positively affect muscle protein balance, but its effect on markers of muscle damage remains unclear.

**PURPOSE:** To examine the effects of a whey-carbohydrate supplement ingested mid-workout on exercise-induced muscle damage (EIMD) as determined by blood levels of creatine kinase (CK), myoglobin and fast-twitch skeletal muscle troponin-I (sTnI).



**METHODS:** Eight competitive “Crossfit” men (age,  $27.4 \pm 1.9$  yrs; height,  $180.4 \pm 2.4$  cm; weight,  $92.7 \pm 3.9$  kg; body fat,  $15.8 \pm 1.9$  %) participated in a randomized, placebo-controlled, crossover study. Subjects performed two identical acute exercise trials (AET) held 7 days apart. AET consisted of a resistance exercise portion (5x5 front barbell squat, 80% 1RM, with 2 min rest), a 15 minute rest interval where either water or protein-carbohydrate supplement (28g whey protein isolate, 15g carbohydrate) was consumed, followed by 8X10sec maximal sprints with 45sec rest between bouts. Serum measurements were obtained pre AET and immediately post (IP), 30min post, 60min post, and 180min post AET. CK and myoglobin were analyzed using commercially available assays and sTnI was analyzed by SDS-PAGE under denaturing conditions.

**RESULTS:** CK and myoglobin significantly increased over time indicating that the protocol induced muscle damage. CK levels peaked IP AET (mean  $\pm$  SE, percent change from pre AET, Water:  $42 \pm 4$ ; Supplement:  $44 \pm 9$ ,  $p < 0.05$ ). Myoglobin levels peaked 60min post AET (mean  $\pm$  SE, percent change from pre AET, Water:  $293 \pm 36$ ; Supplement:  $303 \pm 37$ ,  $p < 0.05$ ). sTnI positively correlated with CK ( $r = 0.434$ ;  $p < 0.001$ ). There was no significant difference in CK, myoglobin, or sTnI between supplementation conditions.

**CONCLUSION:** A whey- carbohydrate beverage consumed mid-workout did not attenuate the initial elevation in blood levels of muscle damage in “Crossfit”- trained men after an acute bout of concurrent exercise.

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**2358** Board #33 MAY 31 2:00 PM - 3:30 PM

**Dietary Fiber Does Not Attenuate Postprandial Glycemic Responses Following A High-carbohydrate Meal Adults And Children**

Siddhartha Angadi<sup>1</sup>, Nathan Weltman<sup>2</sup>, Arthur Weltman, FACSM<sup>3</sup>, Jessica Rodriguez<sup>3</sup>, James Patrie<sup>3</sup>, Glenn Gaesser, FACSM<sup>1</sup>. <sup>1</sup>Arizona State University, Phoenix, AZ. <sup>2</sup>University of South Dakota, Sioux Falls, SD. <sup>3</sup>University of Virginia, Charlottesville, VA.

(No relationships reported)

Postprandial hyperglycemia and hyperinsulinemia are both direct and independent risk factors for the development of atherosclerotic cardiovascular disease. Dietary fiber has been previously shown to reduce postprandial glycemic and insulin excursions. We hypothesized that addition of a high-fiber breakfast cereal to a high-carbohydrate meal would blunt postprandial glycemic and insulin excursions.

**PURPOSE:** We examined the effects of dietary fiber (mostly insoluble) on postprandial blood glucose and insulin responses in youth, adults and seniors.

**METHODS:** To assess the effect of dietary fiber on postprandial glycemia, 10 youth (ages 10-17), 12 adults (ages 19-63), and 13 seniors (ages 65-75) completed two meal trials on separate days, following an overnight fast. The high-carbohydrate, low-fiber (HCLF) meal contained 95.7 g carbohydrate, 11.4 g fat, 16.7 g protein, and 3.0 g fiber. The high-carbohydrate, high-fiber (HCHF) meal contained 103.7 g carbohydrate, 12.2 g fat, 21.8 g protein, and 19.3 g fiber (mainly from All-Bran cereal). Blood was drawn at baseline and hourly for 4 hours following meal ingestion. Area under the curve for postprandial glucose and insulin was computed via the trapezoidal rule. Linear contrasts of ANOVA least-squares means were constructed to evaluate differences in postprandial glucose and insulin.

**RESULTS:** Four-hour blood glucose area under the curve (AUC;  $\text{mg} \cdot \text{dl}^{-1} \cdot \text{hour}^{-1}$ ) following both meals was not significantly different ( $p > 0.05$ ) in youth (HCLF =  $390 \pm 36$ , HCHF =  $400 \pm 22$ ), adults (HCLF =  $409 \pm 59$ , HCHF =  $406 \pm 52$ ) and seniors (HCLF =  $426 \pm 52$ , HCHF =  $430 \pm 61$ ). No significant differences between peak postprandial glucose were noted across all 3 age groups. Similarly 4-hour plasma insulin AUC ( $\text{uIU} \cdot \text{ml}^{-1} \cdot \text{hour}^{-1}$ ) following both meals was not significantly different in youth (HCLF =  $97 \pm 46$ , HCHF =  $119 \pm 47$ ), adults (HCLF =  $147 \pm 113$ , HCHF =  $139 \pm 93$ ) and seniors (HCLF =  $170 \pm 124$ , HCHF =  $129 \pm 72$ ). No significant differences between peak postprandial insulin were noted across all 3 age groups.

**CONCLUSIONS:** The addition of dietary fiber (primarily insoluble) to a high-carbohydrate meal failed to attenuate the postprandial glucose and insulin responses in children and young and older adults. Supported by NIH RR00847 and a grant from the Wheat Foods Council.

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**2359** Board #34 MAY 31 2:00 PM - 3:30 PM

**Methylglyoxal And Glyoxal-derived Hydroimidazolone-AGEs Are Reduced When Exercise Training Is Combined With Low-glycemic Index Diet**

Jacob M. Haus<sup>1</sup>, Jacob T. Mey<sup>2</sup>, Thomas P.J. Solomon<sup>3</sup>, Takhar Kasumov<sup>2</sup>, Renliang Zhang<sup>2</sup>, John P. Kirwan, FACSM<sup>2</sup>. <sup>1</sup>University of Illinois at Chicago, Chicago, IL. <sup>2</sup>Cleveland Clinic, Cleveland, OH. <sup>3</sup>Centre of Inflammation and Metabolism, Copenhagen, Denmark.

(No relationships reported)

Aldehydes derived from glucose, such as methylglyoxal (MG-H1) and glyoxal-derived hydroimidazolone (G-H1), react with proteins resulting in glycation that can yield advanced glycation end products (AGEs). AGEs are present at elevated levels in plasma and atherosclerotic lesions from people with diabetes.

**PURPOSE:** We sought to examine the effects of aerobic exercise training combined with either a low- or high-glycemic index (GI) diet on insulin sensitivity and free circulating MG-H1 and G-H1.

**METHODS:** Twenty-seven obese subjects with impaired glucose tolerance (IGT), (mean  $\pm$  SEM age:  $65 \pm 1$  y; BMI:  $35.3 \pm 0.8$   $\text{kg}/\text{m}^2$ ), underwent a 12-wk aerobic exercise-training intervention (1 h/d, 5 d/wk, 85% of  $\text{HR}_{\text{max}}$ ) while randomly assigned to receive either a low-GI diet (LoGIX;  $n = 13$ ,  $40 \pm 0.3$  Units) or a high-GI diet (HiGIX;  $n = 14$ ,  $80 \pm 0.6$  Units). Free plasma MG-H1 and G-H1 (measured by liquid chromatography tandem mass spectrometry), insulin sensitivity (measured by  $40 \text{ mU}/\text{m}^2/\text{min}$  hyperinsulinemic euglycemic clamp), fasting plasma glucose (FPG), glycated hemoglobin (HbA1c), body composition and  $\text{VO}_{2\text{max}}$  were examined.

**RESULTS:** Both groups lost equal amounts of body weight ( $-7.9 \pm 1.6$  kg) and adiposity ( $-4.4 \pm 0.5\%$  body fat) and showed similar improvements in peripheral tissue insulin sensitivity ( $+87.8 \pm 13.3\%$ ) and  $\text{VO}_{2\text{max}}$  ( $+5.9 \pm 0.7$   $\text{ml}/\text{kg}/\text{min}$ ; all  $P < 0.05$ ). FPG was reduced following the lifestyle intervention ( $p = 0.003$ ) and a significant group effect was observed in the LoGIX group ( $p < 0.001$ ). HbA1c was also reduced ( $-0.07 \pm 0.08\%$ ,  $p > 0.05$ ) by the lifestyle intervention but did not reach significance. MG-H1 was reduced in both groups ( $\Delta$ , LoGIX:  $-9.9 \pm 7.5$ ; HiGIX:  $-13.0 \pm 16.3$   $\text{ng}/\text{mL}$ ), however the HiGIX group demonstrated greater reductions in G-H1 compared to LoGIX ( $\Delta$ , LoGIX:  $+1.1 \pm 1.1$ ; HiGIX:  $-0.4 \pm 0.8$   $\text{ng}/\text{mL}$ ,  $p = 0.04$ ).

**CONCLUSION:** The combined aerobic exercise and glycemic index diet lifestyle intervention was successful in improving body composition, aerobic fitness, glycemic control and reactive precursors to AGEs in obese adults with IGT. These data suggest that regular aerobic exercise and a controlled diet can reverse the formation of AGEs which may lead to reduced risk of future diabetes and diabetic complications.

Supported by ACSM Research Endowment Grant (JMH)

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**2360** Board #35 MAY 31 2:00 PM - 3:30 PM

**Post-Exercise Chocolate Milk and Cycling Performance Following 30 Hours of Recovery**

Hsuan-Yu Wan, Jonathon L. Stickford, Emily J. Dawkins, Alice K. Lindeman, Timothy D. Mickleborough, FACSM, Joel M. Stager, FACSM. Indiana University, Bloomington, IN.

(No relationships reported)

**INTRODUCTION:** Post-exercise chocolate milk consumption has been shown to improve subsequent endurance exercise performance following a four-hour recovery period, presumably due to added carbohydrate (CHO). It is unknown whether or not similar findings will extend following a longer recovery period.

**PURPOSE:** To examine the influence of post-exercise chocolate milk consumption on 1) subsequent cycling time trial performance following and 2) macronutrient intake during a 30-h recovery period.

**METHODS:** Twelve trained, male cyclists ( $21.7 \pm 1.8$  y,  $63.0 \pm 4.1$   $\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ ) performed a glycogen-depleting exercise bout followed by a 2-h supplementation period, 28 h of free-living recovery, and a subsequent 40 km cycling time trial on two separate occasions. During the supplementation period, subjects consumed an equal volume of chocolate milk (CM;  $2.0$  g  $\text{CHO}\cdot\text{kg}^{-1}$ ) or a sports drink (SD;  $0.8$  g  $\text{CHO}\cdot\text{kg}^{-1}$ ) in a single-blind, randomized design. Following the supplementation, individuals' food log was recorded during the remaining 28-h recovery period. Performance time ( $T_{\text{TT}}$ ), average power output ( $P_{\text{TT}}$ ), interval heart rates (HR), ratings of perceived exertion (RPE) and voluntary food intake were compared between the treatments using 1- or 2-tailed paired t-tests.

**RESULTS:** No difference in  $T_{\text{TT}}$  (CM:  $4016.1 \pm 71.2$  sec, SD:  $4015.1 \pm 64.1$  sec),  $P_{\text{TT}}$  (CM:  $247.5 \pm 11.6$  W, SD:  $247.5 \pm 11.1$  W), HR, or average RPE (CM:  $16.6 \pm 0.3$ , SD:  $16.7 \pm 0.3$ ) was observed between the CM and SD trials. Thirty-hour total calorie, fat and protein (PRO) intakes were significantly greater in CM compared to SD (CM:  $73.8 \pm 3.4$   $\text{kcal}\cdot\text{kg}^{-1}$ ,  $9.5 \pm 0.6$  g  $\text{CHO}\cdot\text{kg}^{-1}$ ,  $2.9 \pm 0.3$  g  $\text{fat}\cdot\text{kg}^{-1}$ ,  $2.9 \pm 0.2$  g  $\text{PRO}\cdot\text{kg}^{-1}$ , SD:  $60.3 \pm 2.6$   $\text{kcal}\cdot\text{kg}^{-1}$ ,  $8.2 \pm 0.4$  g  $\text{CHO}\cdot\text{kg}^{-1}$ ,  $2.0 \pm 0.2$  g  $\text{fat}\cdot\text{kg}^{-1}$ ,  $2.4 \pm 0.2$  g  $\text{PRO}\cdot\text{kg}^{-1}$ ). However, 28-h free-living food intake did not differ (CM:  $63.0 \pm 3.4$   $\text{kcal}\cdot\text{kg}^{-1}$ ,  $7.5 \pm 0.6$  g  $\text{CHO}\cdot\text{kg}^{-1}$ ,  $2.7 \pm 0.3$  g  $\text{fat}\cdot\text{kg}^{-1}$ ,  $2.4 \pm 0.2$  g  $\text{PRO}\cdot\text{kg}^{-1}$ , SD:  $57.3 \pm 2.6$   $\text{kcal}\cdot\text{kg}^{-1}$ ,  $7.4 \pm 0.4$  g  $\text{CHO}\cdot\text{kg}^{-1}$ ,  $2.0 \pm 0.2$  g  $\text{fat}\cdot\text{kg}^{-1}$ ,  $2.4 \pm 0.2$  g  $\text{PRO}\cdot\text{kg}^{-1}$ ).

**CONCLUSIONS:** Ingestion of CM immediately following exhaustive exercise did not represent an advantage to cyclists performing ~ 1 h of exercise following a day of free-living recovery. The athletes' dietary choices during the free-living period appeared sufficient to replenish muscle glycogen such that it washed out the expected macronutrient benefits of CM.

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**2361 Board #36 MAY 31 2:00 PM - 3:30 PM**  
**Effect Of A Natural Versus Commercial Product On Running Performance And Gastrointestinal Tolerance**

Brandon W. Too, Sarah Cicai, Kali R. Hockett, Elizabeth Applegate, FACSM, Brian A. Davis, FACSM, Gretchen A. Casazza. *University of California at Davis, Davis, CA.*

(No relationships reported)

**PURPOSE:** To examine the effects of raisins and chews on running performance and gastrointestinal (GI) tolerance. **METHOD:** Eleven male ( $29.3 \pm 2.4$  yrs) runners completed three randomized trials (raisins, chews and water only) separated by 7 days apart. Each trial consisted of 80-min submaximal (75%VO<sub>2</sub>max) running followed by a 5-km time trial (TT). Heart rate (HR), respiratory exchange ratio (RER), glucose, lactate, free fatty acids, glycerol, insulin, electrolytes, creatine kinase, GI symptoms and rating of perceived exertion (RPE) were recorded every 20-min during the submaximal trial and at the end of the TT. Whole body muscle soreness and fatigue were also measured.

**RESULTS:** VO<sub>2</sub>, HR, muscle soreness and fatigue, electrolytes, lactate and RPE did not differ due to treatment. RER was significantly higher during the carbohydrate treatments, as was blood glucose ( $104.9 \pm 3.6$ ,  $107.0 \pm 2.5$ ,  $98.0 \pm 2.9$  mg-dl<sup>-1</sup> for raisin, chews and water respectively). Plasma creatine kinase was higher with raisins ( $466.6 \pm 101.7$ ,  $308.2 \pm 58.5$ ,  $321.5 \pm 48.3$  U-L<sup>-1</sup> for raisin, chews and water respectively). Time to complete the TT was shorter for both carbohydrate treatments ( $20.6 \pm 0.8$ ,  $20.7 \pm 0.8$ ,  $21.6 \pm 0.8$  min for raisin, chews and water respectively). GI disturbance was mild for all treatments.

**CONCLUSION:** Both the raisins and chews maintained high blood glucose levels and improved running performance compared to water only. Running performance between the raisins and chews were similar with no significant GI differences. Key words: blood glucose, time trial, respiratory exchange ratio, creatine kinase, carbohydrate, fiber

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**2362 Board #37 MAY 31 2:00 PM - 3:30 PM**  
**Efficacy of Chocolate Lactaid Milk as a Recovery Supplement on Cycling and Strength Performance in Young, Active Women**

Heather A. Flores, Ryan Schmitt, Rachel Shull, Todd A. Astorino. *California State University San Marcos, San Marcos, CA.*

(No relationships reported)

Recovery after intense exercise is vital for optimizing subsequent performance. Nutritional supplements containing carbohydrate (CHO) and protein (PRO) are the primary constituents in recovery drinks. Recently, chocolate milk (CM) has been identified as a potent recovery beverage, although results are equivocal regarding its efficacy.

**PURPOSE:** The aim of the study was to examine the effects of CM on subsequent cycling and strength performance in active women. **METHOD:** Eight active women (age:  $22.3 \pm 3.8$  yr, physical activity:  $9.5 \pm 1.5$  h/wk, and %BF:  $17.5 \pm 3.4$  %) completed familiarization trials including a VO<sub>2</sub>max test, 5 interval training bouts, a 12.9 km cycling time trial (TT), and 10 repetitions of knee extension/flexion (KE/KF) at 60°/s on an isokinetic dynamometer (IKD) over 2 d. At the same time 3 d later, subjects cycled for 30 min at 50 %Wmax followed by eight 60 s bouts at 100 %Wmax to deplete muscle glycogen. Immediately post exercise and 2 h later (50% Kcal), subjects ingested an isocaloric, randomly assigned meal, CHO (Bagel + Gatorade = 370 Kcal, 77 g of CHO) or CM (370 Kcal, 53 g CHO, 6 g fat, and 18 g PRO). The next day, subjects completed a 16.6 km TT followed by 3 bouts of 10 maximal repetitions on the IKD. Three days later, subjects repeated the 2-day exercise protocol and ingested the other recovery beverage after day 1. Subjects standardized dietary intake and refrained from intense exercise for 48 h pre-trial, and all testing was conducted during the follicular phase. Paired t-test and repeated measures ANOVA were used to examine differences in TT performance and peak/average KE/KF torque across time and/or treatment.

**RESULTS:** In response to the TT, mean power ( $157.9 \pm 24.4$  W vs.  $157.3 \pm 29.4$  W), average speed ( $18.8 \pm 1.2$  mi/h vs.  $18.7 \pm 1.4$  mi/h), and overall time ( $32.4 \pm 2.8$  min vs.  $32.0 \pm 2.6$  min) were similar between CM and CHO. There was no change ( $P > 0.05$ ) in muscle force between CM and CHO across bouts ( $P > 0.05$ ). Peak KE torque was similar ( $P > 0.05$ ) with CM ( $88.8 \pm 19.8$  ft/lb,  $89.3 \pm 21.8$  ft/lb, and  $90.4 \pm 18.4$  ft/lb) compared to CHO ( $92.2 \pm 20.6$  ft/lb,  $89.0 \pm 20.3$  ft/lb, and  $91.0 \pm 18.5$  ft/lb) in bouts 1 - 3.

**CONCLUSION:** In active women, there was no difference in subsequent exercise performance after ingesting CM or CHO post glycogen-depleting exercise. Thirty min of cycling may have been inadequate to fully exhaust glycogen stores.

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**2363 Board #38 MAY 31 2:00 PM - 3:30 PM**  
**Understanding The Role Of Lactate And Its Transporters In Cancer**

Rajaa Hussien, George A. Brooks. *University of California, Berkeley, Berkeley, CA.*

(No relationships reported)

The role of lactate and its transporters in healthy muscle tissue is well known, while their role in cancer is still debated. The MDA-MB-231 is a mesenchymal breast-cancer cell line that has high MCT4 expression, lactate production, glycolytic rate, and invasive cancer growth in vivo. Previously, we have shown that the oxygen consumption and expression of MCT1 protein in MDA-MB-231 cell line is very low compared to normal breast cell lines. MCT1 was reported by others to be deleted in MDA-MB-231 cells by promoter hypermethylation. The role of MCT1 deletion in this cell line is not clear.

**PURPOSE:** To determine the role of MCT1 deletion on the proliferation rate of MDA-MB-231 cells.

**METHODS:** MDA-MB-231 cells were transfected with MCT1-CMV7S plasmid or a control CMV7S plasmid. The CMV7S plasmid contains the G148 resistant (neo) gene, which allowed us to generate stable cancer cell lines expressing either a high level of MCT1 or empty vector. Cells were fixed and stained with antibodies to the lactate transporter (MCT1), the mitochondrial marker (Cytochrome, Cyc C), and the proliferation marker (Ki-67), and then visualized using confocal microscopy.

**RESULTS:** Transfected MDA-MB-231 cells expressed MCT1 protein in the plasma membrane and also in concentrated vesicles throughout the cells.

**CONCLUSION:** By various combinations of knocking in MCT1, and/or deleting MCT4 we hope to be able to affect the proliferation rate of MDA-MB-231 cancer cells.

This work is supported by a gift from CytoSport, Inc. RH is supported by the National Science Foundation Graduate Research Fellowship (NSFGRF).

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**2364 Board #39 MAY 31 2:00 PM - 3:30 PM**  
**The Influence Of Nutritional Interventions On The Measurement Of Gross Efficiency During Cycling**

Matthew Cole, Damian A. Coleman, Jonathan D. Wiles. *Canterbury Christ Church University, Canterbury, United Kingdom.*

(No relationships reported)

Many research studies report and monitor cycling efficiency over a sustained period of time. None of these studies report that the nutritional intake was controlled or recorded across the period of assessment.

**PURPOSE:** To determine whether manipulation of nutritional intake before, during and after cycling exercise could influence subsequent gross efficiency measurement.

**METHODS:** Thirty six cyclists were split into three groups and undertook one of three studies. All studies involved repeated 2-hour cycling tests at submaximal exercise intensity (60% of Power at VO<sub>2</sub>max) in a randomised, crossover design. During study A, carbohydrate (CHO) intake was manipulated in the 3-days preceding cycling trials. Participants consumed isocaloric diets (~4000kcal) that contained a high (70%), moderate (45%) or low (20%) proportion of CHO, with the remaining proportions derived from fat and protein (10%) intake. For study B, cyclists consumed a standard 3-day pre-exercise diet and conducted four exercise tests where they consumed either water (600ml.h<sup>-1</sup>), CHO (36g.h<sup>-1</sup>), caffeine (5mg.kg<sup>-1</sup>) or both CHO and caffeine in combination during the test. During study C, cyclists undertook four exercise trials. Following a standard 3-day pre-exercise diet, participants completed the first two tests on consecutive days and consumed either a high or a low CHO diet (identical to study A) in the 24-h period between tests. A week later, this was repeated with the alternative diet ingested in the recovery period between trials. During all tests, expired air was measured at 30 min intervals in order to calculate gross efficiency (GE).

**RESULTS:** A - GE was significantly greater following the High CHO diet than the Mod CHO diet. (HighCHO=20.1 ± 0.5%, ModCHO=19.3 ± 0.6%, mean ± SD; P<0.05). B - The decline in GE over time was significantly attenuated after the ingestion of CHO (Water=-1.8 ± 1.1%, CHO=-0.7 ± 0.1%; P<0.05). C - Dietary intervention did not alter GE (HighCHO =19.5± 0.2%, LowCHO 19.2± 0.4%; P>0.05).

**CONCLUSIONS:** Significant differences in gross efficiency were obtained following alteration of nutritional intake in the 3-days preceding and during exercise. This suggests that nutritional intake should be carefully controlled and monitored to ensure the validity of gross efficiency measurements.

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## D-17 Free Communication/Poster - Clinical Exercise Physiology Pulmonary (Clinical Exercise Physiology Association)

MAY 31, 2012 1:00 PM - 6:00 PM

ROOM: Exhibit Hall

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**2365** Board #40 MAY 31 2:00 PM - 3:30 PM

### Positives of Negative Work: Eccentric Cycling Effects on Skeletal Muscle in Chronic Obstructive Pulmonary Disease

Norah J. MacMillan<sup>1</sup>, Sophia Kapchinsky<sup>1</sup>, Fennigie M. Purves-Smith<sup>1</sup>, Nicolas Sgarioto<sup>1</sup>, Jacinthe Baril<sup>1</sup>, Riany de Sousa Sena<sup>2</sup>, Russell T. Hepple<sup>1</sup>, Ruddy Richard<sup>3</sup>, Helene Perrault<sup>1</sup>, Jean Bourbeau<sup>2</sup>, Tanja Taivassalo<sup>1</sup>. <sup>1</sup>McGill University, Montreal, QC, Canada. <sup>2</sup>Respiratory Epidemiology and Clinical Research Unit, Montreal Chest Institute, Montreal, QC, Canada. <sup>3</sup>Department of Sport Medicine and Functional Explorations, Clermont-Ferrand, France.

(No relationships reported)

Studies in healthy individuals have shown that for the same metabolic cost, significantly greater muscle forces are produced during negative (eccentric) compared to positive (concentric) work. Accordingly, eccentric endurance exercise has been proposed as a feasible approach to enhance exercise intolerance in patients with chronic obstructive pulmonary disease (COPD), particularly as they present with reduced muscle endurance and strength that relate to fiber atrophy and Type 2 fiber predominance.

**PURPOSE:** To elucidate the effects of eccentric endurance training on muscle structure, composition and function in COPD patients.

**METHODS:** 3 of 10 male (65±1.2 yrs) severe COPD patients (FEV1=37.7±2 %predicted) completed 10 weeks of eccentric cycle training. Pre and post testing included assessment of quadriceps muscle: 1) structure determined through a needle biopsy to quantify fiber cross sectional area and type using immunofluorescent labeling of myosin-heavy chain Type 1 and 2 isoforms; 2) composition using DEXA reflected as lean and fat tissue mass; 3) function determined by peak strength and endurance using the isokinetic Biodex dynamometer. The muscle biopsy analyses were done with the investigator blinded to training status (pre versus post).

**RESULTS:** Cross-sectional area increased in Type 1 fibers by 76% (4570±1733 to 9048±3241µm<sup>2</sup>, p=0.06), with little (7.6%) change in Type 2 fibers (5916±594 to 6221±979µm<sup>2</sup>) after training. The proportion of Type 1 fibers increased by 7% (28.6±6.6 to 36.1±21.5%) and Type 2 fibers decreased proportionally (71.4±6.6 to 63.9±21.5%). Thigh lean tissue mass increased (6.43±0.88 to 6.54±0.89kg, p<0.05) and fat mass decreased (2.82±0.65 vs. 2.68±0.59, p<0.05) after training. Muscle endurance power increased by 35% in two patients and there were no changes in peak isokinetic torque.

**CONCLUSIONS:** This randomized clinical trial examining eccentric cycling as a novel training modality for COPD is ongoing. Preliminary findings suggest eccentric cycling induces marked fiber hypertrophy and fiber shift specific to Type 1 fibers in COPD muscle. These cellular changes are associated with improved lean and fat tissue mass of the thigh and improved muscle endurance. Eccentric cycling appears effective in inducing structural and functional adaptations within COPD muscle.

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**2366** Board #41 MAY 31 2:00 PM - 3:30 PM

### Severity of Exercise Intolerance and Functional Aerobic Impairment in Patients with Pulmonary Hypertension

Lisa M. K. Chin<sup>1</sup>, Randall E. Keyser, FACS<sup>2</sup>, Joshua Woolstenhulme<sup>1</sup>, Michelle Kennedy<sup>1</sup>, Bart Drinkard<sup>1</sup>, Gerilynn Connors<sup>3</sup>, Steven D. Nathan<sup>3</sup>, Leighton Chan<sup>1</sup>. <sup>1</sup>National Institutes of Health, Bethesda, MD. <sup>2</sup>George Mason University, Fairfax, VA. <sup>3</sup>Inova Fairfax Hospital, Falls Church, VA.

(No relationships reported)

Pulmonary hypertension (PH) is known to restrict functional capacity, exercise tolerance, and the ability to carry out routine physical activities. However, PH has been understudied and the severity of associated physical limitations is not fully understood.

**PURPOSE:** To examine cardiorespiratory capacity and exercise tolerance in patients with PH.

**METHODS:** Twenty-three patients with PH (Age: 52 ± 11 yrs; BMI: 31 ± 7 kg/m<sup>2</sup>; mean ± SD) and nine sedentary healthy controls (CON; 48 ± 9 yrs; 30 ± 9 kg/m<sup>2</sup>) completed symptom-limited treadmill cardiopulmonary exercise tests (CPET) and 6-minute walk tests (6MWT) as part of the NIH Exercise Therapy for Advanced Lung Disease Trial. Functional aerobic impairment (FAI) was calculated as a percent deviation in peak VO<sub>2</sub> measured by CPET, from an algorithmically predicted peak VO<sub>2</sub> based on age and gender for persons with a sedentary lifestyle (Bruce et al., 1973).

**RESULTS:** Compared to CON, patients with PH had significantly lower peak VO<sub>2</sub> (14.0 ± 4.7 vs. 23.9 ± 6.5 ml/min/kg; P = 0.002), time to peak exercise (630 ± 192 vs. 1144 ± 393 s; P = 0.002), peak work rate (93 ± 48 vs. 228 ± 61 W; P <= 0.001) and VO<sub>2</sub> at anaerobic threshold (9.3 ± 5.0 vs. 13.2 ± 3.7 ml/kg/min; P = 0.015). 6MWT distance was also shorter (P = 0.006) in PH (409 ± 81 m) than in CON (553 ± 130 m). Moderate FAI was observed in patients with PH (41 ± 22 %), while as expected, FAI was not observed in CON.

**CONCLUSIONS:** Overall exercise tolerance was substantially diminished in patients with PH compared to sedentary controls. Observation of FAI in this group reflects the effect of pathomechanisms on cardiorespiratory function. Instrumental activities of daily living (IADL) fall within a range of VO<sub>2</sub> demands between 10.5 and 17.5 ml/kg/min. In patients with PH, cardiorespiratory capacity was determined to be functionally impaired and insufficient for sustaining even low intensity IADL. As such, these patients may greatly benefit from a medically supervised exercise rehabilitation program.

Supported by NIH Clinical Center 1 Z01 CL060068-02 CC.

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**2367** Board #42 MAY 31 2:00 PM - 3:30 PM

### Quantifying Physiological Benefit from Improvements in Exercise Tolerance

Scott R. Murgatroyd<sup>1</sup>, Carrie Ferguson<sup>1</sup>, Daniel T. Cannon<sup>1</sup>, T Scott Bowen<sup>1</sup>, Lindsey A. Wylde<sup>1</sup>, Janos Porszasz<sup>2</sup>, Harry B. Rossiter, FACS<sup>1</sup>. <sup>1</sup>University of Leeds, Leeds, United Kingdom. <sup>2</sup>Harbor-UCLA Medical Center, Los Angeles, CA.

(No relationships reported)

The efficacy of a therapeutic intervention to ameliorate physiological impairments is reflected in improvements in exercise tolerance ( $t_{lim}$ ); however a standardized method for evaluating  $t_{lim}$  change is lacking (Whipp & Ward, *ERJ* 2009). Constant work rate (CWR) testing is said to be more sensitive to changes in exercise tolerance than ramp-incremental (RI) peak work rate ( $WR_{peak}$ ), oxygen uptake ( $VO_{2peak}$ ) or 6 min walk distance. However,  $t_{lim}$  distribution at any fraction of  $WR_{peak}$  is non-normal invalidating standard statistical tests. Accurate interpretation of a physiological benefit should, therefore, estimate the change in WR at a given  $t_{lim}$ .

**PURPOSE** To determine whether a novel algorithm accounts for inter-individual differences in the relationship between physiological and mechanical responses to RI exercise, thus accurately estimating a CWR corresponding to a 6 min  $t_{lim}$  ( $WR_6$ ).

**METHODS** 60 men (mean ± SD: 23 ± 4 yr, 179 ± 7 cm, 78 ± 11 kg) performed 3 protocols to intolerance using electromagnetically-braked cycle ergometry: 1) RI test (15 to 30 W/min) for  $WR_{peak}$  and  $VO_{2peak}$ ; 2) CWR test at  $WR_6$  estimated using the algorithm:  $WR_{peak} - (2 * RI \text{ rate})$ ; 3) Series of CWR tests to determine critical power (CP), the curvature constant (W'), and interpolate 'true'  $WR_6$ .  $VO_2$  was measured breath-by-breath (mass spectrometer, turbine).

**RESULTS** Fitness varied widely among participants: lactate threshold 25 ± 5 (range: 16 - 37) mL/min/kg; CP 3.0 ± 0.5 (1.5 - 4.8) W/kg; W' 239 ± 49 (136 - 360) J/kg;  $VO_{2max}$  51 ± 7 (36 - 75)

mL/min/kg. RI duration was  $16 \pm 4$  (10 - 23) min, and  $WR_{peak}$  was  $329 \pm 38$  (242 - 420) W. Estimated  $WR_6$  ( $288 \pm 37$  (212 - 364) W) resulted in a  $t_{im}$  of  $6.0 \pm 0.3$  (5.1 - 6.9) min, and did not differ ( $p = 0.88$ ;  $R^2 = 0.97$ ) from the 'true'  $WR_6$  ( $287 \pm 36$  (210 - 360) W). Mean bias  $\pm$  95% LoA were  $-2 \pm 13$  W ( $m = -0.04$ ).

**CONCLUSION** The simple algorithm closely estimated  $WR_6$ , predicting the 'true'  $WR_6$  to within 6% in all cases. The algorithm appeared to effectively account for inter-individual variations in common fitness parameters in a diverse group of participants, thus providing a standardized method for determining changes in  $WR_6$ . As such, this approach has the potential to facilitate interpretation of the physiological benefit(s) accrued from exercise training, therapeutic and/or experimental interventions in health and disease.

Support: BBSRC BB/I00162X/1

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**2368** Board #43 MAY 31 2:00 PM - 3:30 PM

**Effects of a 10-week Aerobic Exercise Program on Cardiorespiratory Function in Patients with Interstitial Lung Disease**

Joshua G. Woolstenhulme<sup>1</sup>, Randall E. Keyser, FACSM<sup>2</sup>, Bart E. Drinkard<sup>1</sup>, Lisa Chin<sup>1</sup>, Michelle Kennedy<sup>1</sup>, Steven D. Nathan<sup>3</sup>, Gerilynn Connors<sup>3</sup>, Leighton Chan<sup>1</sup>.  
<sup>1</sup>National Institutes of Health, Bethesda, MD. <sup>2</sup>George Mason University, Fairfax, VA. <sup>3</sup>Inova Fairfax Hospital, Falls Church, VA.

(No relationships reported)

Interstitial lung disease (ILD) is a debilitating condition that limits functional capacity and cardiorespiratory function. Patients with ILD often experience severe exercise intolerance which can limit participation in daily activities. Little is known about the effects of aerobic exercise on cardiorespiratory function and exercise capacity in populations with ILD.

**PURPOSE:** To examine the effects of a 10-week aerobic exercise program on measures of functional capacity and cardiorespiratory function in patients with ILD.

**METHODS:** Six patients with ILD (3 males, 3 females; Age:  $61 \pm 7$  yrs; BMI:  $30 \pm 5$  kg/m<sup>2</sup>; mean  $\pm$  SD) completed treadmill cardiopulmonary exercise tests (CPET) and 6-minute walk tests (6MWT) before and after a 10-week aerobic exercise training program (AET). The AET was comprised of treadmill walking at an intensity of 70-80% of heart rate reserve determined from the initial CPET, for 30-45 minutes, 3 times per week on non-consecutive days.

**RESULTS:** The AET resulted in significant increases in peak VO<sub>2</sub> (from  $17.93 \pm 6.29$  to  $19.93 \pm 5.31$  ml/kg/min;  $p = 0.029$ ), anaerobic threshold (from  $10.2 \pm 2.0$  to  $13.4 \pm 2.4$  ml/kg/min;  $p = 0.002$ ), 6MWT (from  $456 \pm 67$  to  $494 \pm 48$  m;  $p = 0.022$ ), and CPET duration (from  $711 \pm 93$  to  $837 \pm 110$  s;  $p = 0.002$ ).

**CONCLUSIONS:** These are results from the NIH Exercise Therapy for Advanced Lung Disease Trial. Following an intensive 10-week aerobic exercise training regimen, significant improvements in cardiorespiratory function and exercise tolerance were observed. These results suggest that patients with ILD may respond well to an intensive aerobic exercise training program and could possibly benefit from participation in an exercise-based pulmonary rehabilitation program.

Supported by NIH Clinical Center 1 Z01 CL060068-02 CC.

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**D-18 Free Communication/Poster - College/Young Adult**

MAY 31, 2012 1:00 PM - 6:00 PM

ROOM: Exhibit Hall

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**2369** Board #44 MAY 31 3:30 PM - 5:00 PM

**Many College Women Are Not Aware That They Are Over-fat Or Obese**

Aubriane E. Rote, Lori A. Klos, Lynn A. Wheeler, Ann M. Swartz. *University of Wisconsin-Milwaukee, Milwaukee, WI.*

(No relationships reported)

Because awareness of one's own body weight is a key motivator in weight reduction efforts, lack of knowledge of being over-fat or obese poses a challenge for interventions aimed at reducing obesity rates. Previous studies have examined women's ability to self-classify their weight status in comparison with their actual body mass index (BMI). However, little is known about the alignment of perceived weight status and measured percent body fat (%BF).

**PURPOSE:** The purpose of this study was to examine the alignment among perceived weight status, weight status based on BMI, and measured fat status.

**METHODS:** A total of 120 college-aged women ( $19.5 \pm 1.2$  yrs,  $23.4 \pm 3.4$  kg/m<sup>2</sup>,  $31.9 \pm 6.8$  %BF) completed this cross-sectional investigation. Participants self-classified their body weight status on a scale from 1 (very underweight) to 5 (very overweight). BMI was calculated from measured height and weight, and %BF was assessed using dual-energy x-ray absorptiometry (DXA): 21-32% was considered normal fat, 33-39% was considered over-fat, and >39% was obese. Kappa statistics were conducted to examine the alignment among these variables.

**RESULTS:** The alignment between self-classified weight status and measured fat status was poor ( $\kappa = 0.343$ ), while the alignment between perceived weight status and weight status based on BMI was slightly better ( $\kappa = 0.515$ ). The agreement between women's %BF and BMI classifications was poor ( $\kappa = 0.299$ ). Of the 84 women who self-classified their weight as "Normal", results of the DXA scan showed 61(73%) were in fact normal fat, while 16 (19%) women were over-fat and 6 (7%) were obese. When examining BMI results of those same women who self-classified their body weight as "Normal" ( $n=84$ ), 75 (89%) were in fact normal BMI, while 6 (7%) women were overweight and 1 (1%) was considered obese by BMI.

**CONCLUSION:** Results from this analysis provide evidence that many college women are not aware that they are over-fat or obese. Previous studies demonstrate that women struggle to accurately estimate weight status, and results from this investigation demonstrate that this accuracy may be worse when comparing estimations to measured fat status. Efforts to educate college women on body fat and weight status may be part of an effective weight management and obesity prevention strategy.

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**2370** Board #45 MAY 31 3:30 PM - 5:00 PM

**Effects Of Six-month Trunk Stability Exercises On Low Back Pain Prevalence In Young Athletes**

Juliane Mueller, Josefine Weber, Christoph Otto, Steffen Mueller, Frank Mayer. *University of Potsdam, Potsdam, Germany.*

(No relationships reported)

The six-month prevalence of low back pain in young athletes is reported to be about 20%. In prevention and rehabilitation exercise is supposed to be evident. However, it is not clear if a regular 15-minute-exercise is efficient in highly trained athletes.

**PURPOSE:** To examine the effects of trunk stability exercises on low back pain prevalence in young athletes.

**METHODS:** 140 athletes from four elite schools of sport (85 male/ 55 female;  $13 \pm 0.5$  yrs;  $50 \pm 9$  kg;  $14 \pm 5$  h training per week;  $13 \pm 4$  competitions last season) were included in a six-month controlled intervention trial. Subjects were assigned to an intervention (IG;  $n=43$ ) and control (CG;  $n=97$ ) group. The intervention included a progressive trunk exercise program (minimum of thrice a week in the warm-up-phase of normal training). The program was structured into three levels and consisted of four exercises (side-stabilization, pelvis lift, side-jumps, two-legged jump). At baseline and after six month subjective low back pain was assessed (LBP; six-month-prevalence; numeric rating scale). Furthermore, jumping performance (counter movement jump (CMJ): force plate; maximum peak force [Nm], PF<sub>abs</sub>: jumping height [m], JH) was analyzed to control if athletic capability is effected due to intervention. Descriptive analysis was followed by two-way ANOVA (dependent samples) to calculate effects of interaction ( $\alpha=0.05$ ).

**RESULTS:** Athletic capability, controlled by jumping performance, increased in both groups (pre-PF<sub>abs</sub>/post-PF<sub>abs</sub>: IG:  $1132 \pm 237$  Nm /  $1193 \pm 220$  Nm, CG:  $1079 \pm 240$  Nm /  $1135 \pm 238$  Nm; JH<sub>pre</sub>/JH<sub>post</sub>: IG:  $0.24 \pm 0.04$  m /  $0.26 \pm 0.04$  m, CG:  $0.24 \pm 0.04$  m /  $0.26 \pm 0.04$  m). Coaches gave a gapless training documentation for 86% of athletes (IG). IG implemented the program  $2.1 \pm 0.5$  times a week. During the six-month LBP decreased (LBP<sub>pre</sub>/LBP<sub>post</sub>: IG: 28% / 26%; CG: 20% / 16%) ( $p < 0.01$ ). Moreover, there were no interaction-effects between the two groups (LBP:  $p=0.78$ ; PF<sub>abs</sub>:  $p=0.85$ ; JH:  $p=0.62$ ).

**CONCLUSION:** Reduction of LBP and improvement of jumping performance could not be assigned to the effect of the trunk stability program applied. Efficacy of the additional trunk stability exercises as conducted have therefore to be considered critically, mainly due to low compliance of IG. Further studies need to focus on improvement of compliance.

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**2371**    *Board #46*    **MAY 31**    **3:30 PM - 5:00 PM**  
**Impact Of A Modified School Lunch Program On Weight Loss In A Middle School Cohort**

Katalin Skelton. *Marquette University, Milwaukee, WI.* (Sponsor: Paula E Papanek, FACSM)  
(No relationships reported)

The obesity crisis is striking at younger ages with alarming rates in Latino youth. Over 50% of students in grades 1-8 in our charter school are overweight/obese (> 85 percentile). An intervention: Youth Empowered to Succeed (YES) targets 50 middle school students and provides daily fitness & college peer mentoring. Despite almost daily exercise for 1 year, several continue to increase bodyweight (BW). **PURPOSES:** to determine the impact of a one-month intervention of a healthier school lunch on weight loss in a subset and determine the impact on attitudes, self-image and well being.

**METHODS:** Ten students regularly participating in YES were selected because of their difficulty in maintaining their BW, increasing BW in 4 consecutive quarters, despite regular exercise (3x/wk 50 mins). All exercise and afterschool programming remained constant during the intervention. Dietary intervention was created by a registered dietician and developed specifically for Latino children. The meals (27 lunches) were served to small groups in a separate dining hall during which nutritional information was provided including lessons on calorie balance, general nutrition, and tips on healthy eating. No changes to family meals or other programming occurred.

**RESULTS:** Significant weight loss over 1 month (paired t-test  $p < 0.05$ ). On average BW decreased by 3 pounds with a maximum loss of 7. Previously all 10 students had gained BW each quarter and this was the first time any of them lost weight. All students reported more energy, better concentration and attitude post intervention.

**CONCLUSION:** Substitution of a healthy lunch successfully changed a habitual pattern of weight gain in Latino youth engaged in a prescribed fitness program. 9 of 10 lost a significant amount of weight and self-reported feeling better about themselves and their bodies. This study supports the important and long-term implications of providing a healthy lunch in terms of stemming the obesity epidemic in Latino middle school students. Supported by DHHS/OMH grant 1 YEPMP090044-02

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**2372**    *Board #47*    **MAY 31**    **3:30 PM - 5:00 PM**  
**Effects of a Conceptually and Activities Based Course on Health and Fitness Variables among College Students**

Wendy S. Bjerke. *Sacred Heart University, Fairfield, CT.* (Sponsor: Peter Ronai, FACSM)  
(No relationships reported)

**PURPOSE:**

The prevalence of overweight and obesity among 18-24 year olds has increased with overweight status exceeding 20% of the population and 20% of this age group meeting criteria for obesity. The majority of 18-24 year olds in the United States are enrolled part or full time in colleges and universities which suggests that the higher education environment is appropriate for health promotion and education programs targeting young adults. Historically health and fitness courses in higher education have consisted of activities based education courses (APE's) with a shift towards conceptually based courses (CPE's). Short term and longitudinal health related outcomes have been observed for both APE and CPE courses. The purpose of this study is to compare health and behavioral outcomes associated with a combination of these approaches in an APE/CPE course.

**METHODS:** Twenty college students with a mean age of 20 years included 12 males and 8 females who participated in a 14 week APE/CPE course at a University in New England. Body mass index (BMI), body composition, hand grip dynamometry, vertical jump and health behaviors were examined pre and post. Physical fitness and activity associated behaviors were assessed via the International Physical Activity Questionnaire (IPAQ) and included frequency of days and time spent in the last seven days participating in vigorous and moderate physical activity, walking, and sitting.

**RESULTS:** Physical activity behavior associated variables; specifically the number of days and the duration of time spent performing vigorous physical activity increased significantly (from 3.5 to 4.4 days per week,  $p = .005$  and from .7 to 1.4 hours per session,  $p = .02$ ) with no other behavioral or physical variables achieving statistically significant changes during this time period.

**CONCLUSION:** Higher education health and fitness courses for young adults have the potential to impact physical and behavioral health and fitness variables and may provide effective strategies for the reduction of overweight and obesity in young adults. These findings suggest that longitudinal studies and studies comparing APE/CPE courses to other health promotion programs are indicated.

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**2373**    *Board #48*    **MAY 31**    **3:30 PM - 5:00 PM**  
**Campus and Community Safety and Physical Activity Participation Among College Students**

Zi Yan, Patricia L. Ketcham, Bradley J. Cardinal, FACSM. *Oregon State University, corvallis, OR.*  
(No relationships reported)

The Exercise is Medicine<sup>®</sup> on Campus initiative of the American College of Sports Medicine seeks to encourage physical activity participation among college and university students. Campus and community safety may be a factor affecting said behavior.

**PURPOSE:** To examine the relationship between perception of campus and community safety and physical activity participation among college students. **METHOD.** College students ( $N=1366$ , age=21.7±4.1) from a large university in Oregon participated in the study. Self-report data were collected through the *American College Health Association Assessment* in 2010. Perceptions of campus and community safety during the day and night were assessed using a 4-item Likert-scale. Participants were classified as meeting or not meeting the physical activity recommendation (i.e., 5 or more days a week of 30 minutes or more of moderate-intensity physical activity, or 3 or more days a week of 20 minutes or more of vigorous intensity physical activity) on the basis of their responses to two questions.

**RESULTS.** A slight majority of males (55.5%) and females (56.5%) met the physical activity recommendation. Those who met the physical activity recommendation perceived both the campus and community to be safer at night compared to those who did not (For campus: Females,  $M=2.85$  vs.  $M=2.78$ ,  $p < 0.05$ , Cohen's  $d=0.18$ ; Males,  $M=3.62$  vs.  $M=3.48$ ,  $p < 0.01$ , Cohen's  $d=0.23$ ; For community: Females:  $M=2.70$  vs.  $M=2.57$ ,  $p < 0.05$ , Cohen's  $d=0.17$ ; Males,  $M=3.43$  vs.  $M=3.26$ ;  $p < 0.01$ ; Cohen's  $d=0.24$ ). No differences were observed for daytime ( $p > 0.05$ ).

**CONCLUSION.** Increasing campus and community safety at night may positively influence the physical activity behavior of college and university students.

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**2374**    *Board #49*    **MAY 31**    **3:30 PM - 5:00 PM**  
**Relationship Of Waist Circumference, Fitness, And Walking In Male And Female College Students**

Rickie Lee Marker-Hoffman, Matthew G. Hinman, Daniel Chi Shing Yeung, Jeanne D. Johnston. *Indiana University, Bloomington, IN.* (Sponsor: Georgia C. Frey, FACSM)  
(No relationships reported)

Previous research has examined weight (WT) and physical activity (PA) in the college students demonstrating an increase in WT over the college years and a decrease in PA. The relationship between waist circumference (WC), fitness (FIT), and walking may offer additional insight.

**PURPOSE:** To examine the relationship between WC, FIT, and walking in college students.

**METHODS:** Participants were recruited from a mid-Western University via face-to-face contact, email, and fliers. FIT was assessed with three measures: PACER multi stage 20-meter shuttle run (PACER), modified pull-up (MPU), and one-minute sit-up (SU). Anthropometric assessment included height, WT, and average of 3 WC measurements. Body fat (BF) was assessed using bioelectrical impedance. Self-reported PA was assessed with the International Physical Activity Questionnaire (IPAQ) to determine minutes of walking and PA per week. Descriptive statistics, independent t-test (by sex), ANOVA (by class), and Pearson's Correlation were utilized to determine differences and relationships for PA, FIT, and WC.

**RESULTS:** The sample included 149 male (mean age 20.2, SD 1.5) and 203 females (mean age 19.9, SD 1.4), with 46.8 % residing in dorms/residence halls. There was a significant difference between weight (WT) and WC by class ( $p < 0.001$ ). However, when examined by sex, only men had a significant difference by class for WT, BF, and WC ( $p < 0.005$ ). A non-significant but decreasing trend in moderate, vigorous, and walking (TPA) by class was found. Furthermore, there was a non-significant but decreasing trend for men's walking and TPA by class, whereas vigorous and moderate PA appeared to remain more constant. WC was correlated with moderate PA for freshman only ( $p < 0.005$ ). For men, WC was significantly correlated with PACER

( $r = -.290, p < 0.001$ ). WC was correlated with PACER ( $r = -.279, p < 0.001$ ) and MPU ( $r = -.258, p < 0.001$ ) in women. Furthermore, walking was correlated with PACER ( $r = -.165, p < 0.05$ ) and SU ( $r = -.206, p < 0.001$ ).

**CONCLUSION:** Overall, there was a decrease in TPA for this sample and significant increase in WT and WC by class, which is consistent with previous research. The relationship between PA, FIT, and body composition differed by sex and should be examined in greater detail.

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**2375** Board #50 MAY 31 3:30 PM - 5:00 PM

**Changes In Physical Activity And Body Composition In Female Freshmen During Their First Academic Year**

Michael V. Fedewa<sup>1</sup>, Matthew P. Thorpe<sup>2</sup>, Mina C. Mojtahedi<sup>2</sup>, Dolores D. Guest<sup>2</sup>, Bhibha M. Das<sup>1</sup>, Emily M. Mailey<sup>2</sup>, Michael D. Schmidt<sup>1</sup>, Ellen M. Evans, FACSM<sup>1</sup>. <sup>1</sup>University of Georgia, Athens, GA. <sup>2</sup>University of Illinois, Urbana-Champaign, IL.  
(No relationships reported)

The transition to college often invokes changes in physical activity (PA) behaviors that may alter weight status in young adults. Contemporary studies indicate that in addition to moderate to vigorous physical activity (MVPA), sedentary (SED) time may also have implications for health.

**PURPOSE:** The aim of this study was to assess changes in weight status and physical activity in female freshmen in a university setting their first academic year.

**METHODS:** Female freshmen ( $n=162; 18.0 \pm 0.3$  y) were assessed for height and weight to determine body mass index (BMI) and waist circumference (WC). Physical activity was assessed via accelerometer in minutes of SED, light (LPA), moderate (MPA), vigorous (VPA), and moderate + vigorous (MVPA) at the beginning and end of the academic year.

**RESULTS:** At baseline, females had normal weight status ( $62.7 \pm 8.7$  kg, BMI  $22.9 \pm 3.1$  kg/m<sup>2</sup>, WC  $82.6 \pm 8.7$  cm). Over the academic year weight, WC, and SED increased ( $1.6 \pm 2.6$  kg,  $0.8 \pm 4.2$  cm,  $29.9 \pm 103.9$  min); while LPA and MVPA decreased ( $26.9 \pm 71.0$  min,  $9.1 \pm 34.1$  min, respectively, all  $p < 0.05$ ). Subjects were further classified as Gainers (>3% weight gain), Maintainers (<3% weight change), and Losers (weight loss >3%). No changes in SED, LPA, or MVPA were observed among Losers, although few freshman lost weight ( $n = 13$ ). In Maintainers ( $n = 77$ ), LPA and MPA decreased ( $28.7 \pm 62.6$  min and  $7.9 \pm 33.8$  min respectively). However, Gainers ( $n = 72$ ) experienced a reduction in LPA and MVPA ( $29.2 \pm 78.4$  min and  $11.0 \pm 33.9$  min respectively), while SED increased ( $47.7 \pm 111.5$  min) (all  $p < 0.05$ ).

**CONCLUSION:** Unfavorable changes in weight status among female freshman may be related to decreased physical activity and increased sedentary time during their first year on a college campus. On-going analysis is exploring the implications for changes in weight due to changes in PA, dietary intake, stress, sleep and medications (i.e. oral contraceptives).

Grant Support: USDA 2008-55215-18825

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**2376** Board #51 MAY 31 3:30 PM - 5:00 PM

**Still Active In College ? The Contribution Of College Physical Education On Exercise And Physical Active Behaviors.**

Jean Lemoyne<sup>1</sup>, Pierre Valois<sup>2</sup>. <sup>1</sup>Université du Québec à Trois-Rivières, Trois-Rivières, QC, Canada. <sup>2</sup>Université Laval, Quebec city, QC, Canada. (Sponsor: François Trudeau, FACSM)  
(No relationships reported)

Most epidemiological studies demonstrated an important decline in physical activity between teenage years and the young adulthood. However, few longitudinal data is available regarding the influences of physical education during transition between high school and college.

**PURPOSE:** The objective of this study is to analyze the evolution of physical activity behaviors during college, among a sample of Quebec's college students where it is compulsory. We also wanted to verify the contribution of physical education on the maintenance of physical activity.

**METHODS:** Data was drawn from an initial sample of 417 college students (275 females, 142 males) participating in mandatory physical education classes. Mean age of the participants was  $17.8 \pm 2.4$  years. A longitudinal design was conducted over a 2 year period, involving 6 waves of assessment, measuring self-reported physical activity. Latent growth analysis was conducted, first to analyze the rate of change for physical activity and then to observe the potential influences of physical education on the maintenance of physical activity. **RESULTS:** Results revealed excellent fit indices for each models (CFI > 0.97, RMSEA > 0.03). During the college years, there is a slight but significant increase in physical activity, suggesting a direct influence of physical education ( $p < 0.05$ ). The best fit for the rate of change trajectory was following a cubic function, suggesting substantial influences of the physical education program on active behaviors. Further analysis revealed a significant decrease ( $p < 0.05$ ) of physical activity between each trimester, suggesting little influence of the program. The most important influences of physical education were observed among the less active groups.

**CONCLUSIONS:** Physical education permits and encourages the maintenance of a minimal level of physical activity. Over a 2 year physical education program, less predisposed groups at the initial level seemed to be more influenced towards the adoption of physical activity. However, influences of physical education seemed to disappear between each trimesters, suggesting a minimal influence from the program. Further research is needed to better understand the influences of the physical education program. Funded by the Ministère de l'Éducation du Loisir et du Sport, Quebec.

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**2377** Board #52 MAY 31 3:30 PM - 5:00 PM

**Faster Rate of Weight-loss Associated with Female Athlete Triad Components in Youth**

Sheng-An Lo<sup>1</sup>, Chieh-Ling Wang<sup>2</sup>, Shu-Chich Chen<sup>1</sup>, Kuei-Hui Chan<sup>1</sup>. <sup>1</sup>National Taiwan Sport University, Taoyuan, Taiwan. <sup>2</sup>Shih Hsin University, Taipei, Taiwan.  
(No relationships reported)

The female triad (triad) is an interrelated condition of low energy availability, amenorrhea, and osteoporosis. A large body of evidence suggests that the populations who suffer from the triad components are mainly athletic and physically active women. Inappropriate weight-loss behaviors are one of the main factors causing the triad. However, weight-loss attempts are common in young women. They may be susceptible to the triad components regardless of physical activity levels.

**PURPOSE:** To determine the prevalence of the triad in athletes and non-athletes with weight-loss attempts.

**METHODS:** One hundred thirty-four female competitive athletes ( $20.1 \pm 1.5$  yrs) and 144 healthy female non-athletes ( $20.1 \pm 1.1$  yrs) were recruited from 2 colleges. Each subject completed screening questionnaires assessing eating disorders (EDs), menstrual status, weight-loss experience, and physical activity levels. The EDs were assessed by 26-item eating attitudes test (EAT-26). The physical activity levels were assessed by the short version of International Physical Activity Questionnaire. The body fat percentage (%BF) and bone strength (bone mineral density and bone quality) were also measured by eight-polar tactile-electrode impedance meter and ultrasoundometer, respectively.

**RESULTS:** The %BF of non-athletes were significantly higher than athletes ( $28.3 \pm 5.6\%$  vs.  $25.3 \pm 5.8\%$ ,  $p < 0.05$ ). Subjects with EDs, menstrual dysfunction (MD), or both reported they lost  $1.9 \pm 0.5$ ,  $1.6 \pm 0.7$ , or  $1.7 \pm 0.8$  kg per wk during the past year. Therefore, the definition of faster rate was weight-loss >1.5 kg/wk in this study. Between subjects with faster and slower rate of weight-loss, significant differences were found in the rate of weight-loss ( $2.1 \pm 0.7$  vs.  $0.9 \pm 0.6$  kg/wk,  $p < 0.05$ ), EAT-26 score ( $18.8 \pm 6.2$  vs.  $12.2 \pm 9.3$ ,  $p < 0.05$ ), and the prevalence of MD (32 vs. 0%,  $p < 0.05$ ). No significant differences were found in Z-scores [bone mineral density ( $0.7 \pm 0.8$  vs.  $1.0 \pm 0.4$ ,  $p < 0.05$ )] and stiffness index [bone quality ( $108.2 \pm 14.4$  vs.  $111.5 \pm 15.3$ ,  $p < 0.05$ )] between 2 groups.

**CONCLUSIONS:** Our study suggests weight-loss >1.5 kg/wk is associated with the developments of EDs and MD in youth.

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**2378** Board #53 MAY 31 3:30 PM - 5:00 PM

**Coronary Heart Disease Risk Factors and Knowledge in a Young Adult Subpopulation**

Nicholas F. Boer, Gregory Heath, FACSM. Univ. of Tennessee, Chattanooga, TN.  
(No relationships reported)

Risk factors for coronary heart disease (CHD) are common among young adults aged 20-30 years, however there are no established guidelines within the U.S. for when to begin screening for CHD risk among this population

**PURPOSE:** To determine if young adults know their risk for CHD, specifically values for fasting blood glucose (gluc) and cholesterol (chol), and examination of prevalence of CHD risk factors among young adults attending a medium-sized university in the Southeast U.S. was carried out.

**METHODS:** 60 female college students ( $21.7 \pm 2.4$  years) and 40 male students ( $21.4 \pm 1.7$ ) completed a survey to assess health habits and CHD risk factors prior to completing a fitness testing battery. The exam included measured blood pressure, maximal aerobic fitness, strength measures, body composition, flexibility and balance.

**RESULTS:** None of the women or men reported knowing their fasting chol or gluc concentrations. The proportion of the other risk factors included the following: 1.7% of women and 0% of men reported a family history of heart disease; 3.4% of women and 15% of men reported being inactive; 3.4% of women and 10% of men were regular smokers; 60% of women and 55% of men had a body mass index (BMI) 25 but less than 30; with 3.4% of women and 15% of men having a BMI >30; there were no reports of hypertension among the women or men; 17.5% of women had one CHD risk factor and 37.5% of men had at least one risk factor for CHD.

**CONCLUSIONS:** Risk factor levels are low in this group of exercise science students (for whom the survey and fitness tests were compulsory) and students who chose to undergo a fitness battery. Neither healthy individuals with no risk factors nor individuals with one or more risk factors knew their fasting chol and gluc levels. Therefore, they did not know their personal risk for CHD.

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## D-19 Free Communication/Poster - Creatine

MAY 31, 2012 1:00 PM - 6:00 PM

ROOM: Exhibit Hall

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### 2379 Board #54 MAY 31 2:00 PM - 3:30 PM

#### Oxidative Stress In The Serum Of Exercised Rats Supplemented With Creatine

Michel B. Araújo<sup>1</sup>, Leandro P. Moura<sup>1</sup>, Marcelo C. Junior<sup>1</sup>, Rodrigo A. Dalia<sup>1</sup>, Fabricio A. Voltarelli<sup>2</sup>, Amanda C. Sponton<sup>1</sup>, Maria Alice R. Mello<sup>1</sup>. <sup>1</sup>São Paulo State University, Rio Claro, Brazil. <sup>2</sup>Mato Grosso Federal University, Rio Claro, Brazil.

(No relationships reported)

**PURPOSE:** There is evidence that creatine may exert antioxidant activities. This study analyzes the effects of aerobic training and creatine supplementation on biomarkers of oxidative stress in the serum of rats.

**METHODS:** Adults male wistar (90 day old) rats were submitted to a Maximal Lactate Steady State (MLSS) test in order to identify the aerobic/anaerobic metabolic transition during treadmill running. Soon afterwards, the rats were divided into 6 groups: Trained Creatine (TCr), Trained (T), Trained Maltodextrin (TM), Control Creatine (CCr), Control Maltodextrin (CM) and Control (C). Trained rats ran on a treadmill for 40 minutes per day, 5 days per week for 8 weeks, at a speed equivalent to per individual MLSS. Creatine supplemented rats received creatine monohydrate per 5 days per week (0.107g/kg body weight (b.w)) and maltodextrin (0.160g/kg b.w), by gavage during the 8 weeks. The maltodextrin supplemented rats received maltodextrin (0.160g/kg b.w) by gavage. At the end of the experiment, all the rats were sacrificed and the amount of the substances that reacted with thiobarbituric acid (TBARs) and catalase (CAT), superoxide dismutase (SOD) and glutathione peroxidase (GSH-GPx) activities in the serum were analyzed.

**RESULTS:** The amount of TBARs was not different among the groups. There also were no significant differences between the groups in relationship to CAT and SOD activities. On the other hand, GSH-GPx activity was lower in the TM group (2.24+1.75) group than other groups (TCr 3.87+1.47; T 2.85+1.63; CCr 5.60+1.73; CM 4.28+2.32 and C 2.85+1.06).

**CONCLUSION:** These results suggest that neither exercise or supplementation did not affect the redox state of the animals.

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### 2380 Board #55 MAY 31 2:00 PM - 3:30 PM

#### Thermoregulatory And Cardiovascular Responses To Creatine, Glycerol And Alpha Lipoic Acid In Trained Cyclists

Thelma P. Polyviou, Takas Pantazis, Wu Chean Lee, Dalia Malkova, Yannis P. Pitsiladis, FACSM. University of Glasgow, Glasgow, United Kingdom.

(No relationships reported)

It has been shown that supplementation with creatine (Cr) and glycerol (Gly), when combined with glucose (Glu) necessary for the enhancement of Cr uptake by the muscle, induces significant improvements in thermoregulatory and cardiovascular responses during exercise in the heat.

**PURPOSE:** To determine whether Cr/Gly-induced thermoregulatory and cardiovascular responses are maintained or even enhanced when the majority (~75%) of the Glu in the Cr/Gly supplement is replaced with the insulinotropic agent alpha lipoic acid (Ala).

**METHODS:** 22 healthy endurance trained cyclists were randomly assigned to receive either 11.4 g of Cr-H<sub>2</sub>O, 1 g of Gly/kg body mass (BM) and 150 g of Glu (Cr/Gly/Glu) or 11.4 g of Cr-H<sub>2</sub>O, 1 g of Gly/kg BM, 100 g of Glu and 1000 mg Ala (Cr/Gly/Glu/Ala) for 7 days. Exercise trials were conducted pre- and post-supplementation and involved 40 min of constant-load cycling exercise at 70% VO<sub>2</sub>max followed by a self-paced 16.1 km time trial at 30 °C and 70% relative humidity.

**RESULTS:** BM increase, although not statistically significant ( $p=0.056$ ), was noted in most individuals: 1.75(0.1-3.0) kg and 0.9(0.0-2.1) kg (median (range) in the Cr/Gly/Glu and in the Cr/Gly/Glu/Ala, respectively. Heart rate (HR) and core temperature ( $T_{core}$ ) were significantly lower post-supplementation: HR was reduced on average by  $3.0 \pm 1.2$  beats/min and by  $1.8 \pm 1.4$  beats/min (mean  $\pm$  SD) in the Cr/Gly/Glu and Cr/Gly/Glu/Ala trials, respectively while  $T_{core}$  was reduced by  $0.2 \pm 0.1$  on both trials; the reduction in HR and  $T_{core}$  was not different between the two supplementation groups.

**CONCLUSION:** Cr/Gly-induced improvements in thermoregulatory and cardiovascular responses during exercise in heat were not affected with part replacement of Glu with Ala.

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### 2381 Board #56 MAY 31 2:00 PM - 3:30 PM

#### The Effects of Creatine Supplementation and Plyometric Training on Vertical Jump and Sprint Performance

Solomon H. Young, David L. Gee, Kelly L. Pritchett, Robert C. Pritchett. Central Washington University, Ellensburg, WA.

(No relationships reported)

Creatine (Cr) supplementation is associated with improving measurements of maximal strength. However, since Cr supplementation is also associated with weight gain, this may impair weight impacted exercises like jumping and sprinting.

**PURPOSE:** The purpose of this study was to determine the effects of Cr supplementation on vertical jump and sprint performance during 4 weeks of plyometric training.

**METHODS:** Using a randomized, double-blind design, subjects were assigned to receive either Cr or placebo (Pl) for 4-weeks. A total of 13 subjects completed the study (6 = Pl, 7 = Cr). Data was collected at baseline (T0), post-loading (T1), and post-maintenance (T2). Measures included body weight, height, bioelectrical impedance analysis (BIA), single and multiple vertical jump performance, (4 x 10m) shuttle sprint time, and anaerobic power using a 30-s Wingate trial. BIA was used to determine total body water (TBW). Subjects were instructed to maintain a normal diet and to follow a training program designed for this study. Data was analyzed using repeated measures two-way ANOVA for differences (time x treatment) and *t*-tests to assess the absolute change in values for all measures.

**RESULTS:** The interaction over time between treatment groups revealed significantly greater increases in body weight, body mass index (BMI), and average Wingate power ( $p < 0.05$ ) for the Cr group. Using the absolute change in values, *t*-tests revealed significant increases in body weight (mean gain = 1.0 kg,  $p = 0.003$ ) and TBW (mean gain = 0.4 kg,  $p = 0.03$ ) in the Cr group compared to Pl after T1. No significant changes in single jump height or shuttle sprint time were seen with either Cr or Pl groups. Average Wingate power tended to increase from T0 to T2 in the Cr group (mean % change = +5.9%) with no change in the Pl group ( $p = 0.06$ ). Average repeated vertical jump height from T0 to T2 tended to decline in the Pl (mean change = -7.5%) compared to Cr (mean change = -0.2%,  $p = 0.07$ ).

**CONCLUSION:** Although weight increased with Cr supplementation, it did not impede sprint and jump performance. Cr supplementation did tend to increase power as measured using the non-weight impacted Wingate test. Cr supplementation can be recommended to athletes wishing to increase power and weight without negatively affecting sprint and vertical jump performance.

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**2382** Board #57 MAY 31 2:00 PM - 3:30 PM

**Magnesium Creatine Chelate and Whey Protein Supplementation Effects Combined with Periodized Training on Body Water**

Lorrie R. Brilla, FACSM, David N. Suprak, Rory Callahan. *Western Washington University, Bellingham, WA.*

(L.R. Brilla: Contracted Research - Including Principle Investigator; Albion Laboratories.)

**Creatine is often “stacked” with protein supplementation to enhance performance. Magnesium augments creatine absorption. The efficacy of these supplements in combination with a superimposed training program has not been well established.**

**PURPOSE:** To compare the effects of supplementation with magnesium-creatine chelate (C), C with whey protein stack (W), and a placebo (P), combined with periodized resistance training (RT), on total and compartmentalized body water.

**METHODS:** Healthy, recreationally active subjects (n=23) completed the study. Subjects were randomly assigned, in a double-blind format, to C (400-mg magnesium with 5-g creatine per day), W (35 g of whey protein, in addition to C supplement), and P (dextran). The 8-week RT progressively increased strength and power in a linearly periodized fashion. Testing was conducted pre and post RT and supplementation program. Strength testing was 1-repetition maximum (1RM) bench press (BP) and back squat (BS). Total body water (TBW) and both intracellular (ICF) and extracellular (ECF) fluid compartments were determined with bioimpedance. The effects of time and group were assessed with a two-way repeated measures ANOVA

**RESULTS:** There were no group by time interactions or group effects for any of the performance variables ( $P > 0.05$  for each). Significant increases in strength were observed for both 1RM BP and BS ( $P < 0.001$  for each) over time for all groups (BP  $\Delta$ kg: P 4.83, C 6.82, W 5.81; BS  $\Delta$ kg: P 12.78, C 7.42, W 13.13). There were no significant changes in TBW ( $P > 0.05$ ). ICF had a significant time by group interaction ( $P < 0.05$ ), and subsequent simple effects analysis showed C (+1.5%) and W (+1.26%) increased and P (-0.34%) decreased. ECF had a significant time by group interaction ( $P < 0.05$ ), and subsequent simple effects analysis reflected the shifts from the ICF.

**CONCLUSIONS:** In healthy, recreationally active individuals, participation in periodized RT has a greater effect on improving strength than superimposed supplementation with either C or W. No significant changes in TBW were noted. However, ICF and ECF were significantly affected by supplementation showing a shift to increased ICF, with magnesium creatine chelate increasing to a greater extent than the whey stack group.

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**2383** Board #58 MAY 31 2:00 PM - 3:30 PM

**No Adverse Effects Associated with Low-Dose Longer-Duration Creatine Supplementation in Older Adults**

Eric S. Rawson, FACSM<sup>1</sup>, Andrew C. Venezia<sup>1</sup>, Christopher D. Still<sup>2</sup>. <sup>1</sup>Bloomsburg University, Bloomsburg, PA. <sup>2</sup>Geisinger Medical Center, Danville, PA.

(No relationships reported)

The effects of low dose, longer-term creatine supplementation on kidney function and reported adverse events in older men and women have not been described.

**PURPOSE:** The purpose of this study was to assess the effects of low-dose, longer-duration creatine supplementation on makers of health in older adults.

**METHODS:** Thirty-five older men and women (mean age 71 yr) ingested 2.3 g of creatine (n=18) or placebo (n=17) per day for six weeks. A renal function test consisting of blood levels of Potassium, Chloride, CO<sub>2</sub>, Anion Gap, Glucose, Blood Urea Nitrogen, Creatinine, Calcium, Phosphorous, and Albumin were assessed pre- and post-supplementation. Reported frequency of adverse events related to muscle, gastrointestinal, and kidney function was collected at baseline, and at 3 and 6 weeks post-supplementation. Renal function between groups was assessed with an ANOVA, and frequency of adverse events was assessed with a Chi square analysis.

**RESULTS:** Creatine supplementation had no effect on any measured marker of renal function from pre- to post-supplementation (mean change score creatine vs. placebo) Sodium (-0.2 vs. -0.3 mmol/L), Potassium (0.1 vs. -0.1 mmol/L), Chloride (-0.7 vs. 0.1 mmol/L), CO<sub>2</sub> (1.6 vs. 0.2 mmol/L), Anion Gap (-1.0 vs. -0.6 mEq/L), Glucose (-6.1 vs. 7.1 mg/dL), Blood Urea Nitrogen (-0.2 vs. 1.0 mg/dL), Creatinine (-0.1 vs. 0.01 mg/dL), Calcium (0.1 vs. -0.05 mg/dL), Phosphorous (0.2 vs. 0.02 mg/dL), and Albumin (0.02 vs. 0.00 g/dL) (all  $p > 0.05$ ). Additionally, there were no differences in the frequency of reported adverse events between creatine and placebo supplemented groups pre-supplementation, or at 3 or 6 weeks post-supplementation (all  $p > 0.05$ ).

**CONCLUSIONS:** Low dose, longer-duration creatine supplementation is not associated with increased risk of adverse events in older adults. It may be unnecessary for older adults who have normal kidney function to have a renal panel prior to low-dose creatine supplementation. Also, these data support the findings of previous studies that showed no adverse effects associated with creatine supplementation. **FUNDING:** National Institutes of Health National Center for Complementary and Alternative Medicine (1R15 AT003938-01).

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**2384** Board #59 MAY 31 2:00 PM - 3:30 PM

**Combined Ergogenic Effects Of Creatine Added To Different Types Of Carbohydrates, Maltodextrin And Ribose**

Carlos Eduardo Costa<sup>1</sup>, Helena Angélica P. Batatinha<sup>1</sup>, Erico C. Capetuto<sup>2</sup>. <sup>1</sup>Mackenzie Presbyterian University, São Paulo, Brazil. <sup>2</sup>Mackenzie Presbyterian University and São Judas Tadeu University, São Paulo, Brazil.

(No relationships reported)

Creatine supplementation is a resource that assists in training to increase lean mass and strength by promoting ATP resynthesis and consequently protein synthesis. Ribose is a pentose that is involved in the resynthesis of adenosine nucleotides, providing more ATP and prolonging anaerobic activity. Maltodextrin is a complex carbohydrate that helps spare glucose for muscle and central nervous system delaying the state of fatigue.

**PURPOSE:** We investigated the effects of creatine supplementation alone and combined with 2 types of carbohydrates (ribose and maltodextrin).

**METHODS:** We had 20 subjects divided into 4 groups: CrG (Creatine Group), CrMG (Creatine and Maltodextrin Group), CrRG (Creatine and Ribose Group), CrRMG (Creatine, Ribose and Maltodextrin Group), all groups did 1MR test at bench press exercise and 3 sets of maximum repetitions with 3 minutes interval between each set. All groups did one week load of 10g of creatine, 10g of Ribose and 20g of Maltodextrin every day according to each group. 7 days later they repeated the same tests. Data were analyzed using one way ANOVA test,  $p < 0.05$  was adopted.

**RESULTS:** on the 1MR test significant difference was observed between CrG ( $3.4 \pm 2.3$ ) e CrRMG ( $11.6 \pm 4.9$ ), the CrRG e CrMG wasn't show significant differences compared to the others, suggesting that combined supplementation promotes strength gains. Maximum repetitions test showed no statistical differences. CrRMG however presented a trend to sustain the number of maximum repetitions throughout the 3 sets.

**CONCLUSIONS:** We can conclude that the use of 1 type of carbohydrate combined with creatine wasn't able to improve 1MR test. However when we combined ribose and maltodextrin with creatine significant increases were detected.

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**2385** Board #60 MAY 31 2:00 PM - 3:30 PM

**Creatine Supplementation Increases Physical Function And Lower-limb Lean Mass In Osteoarthritis: A Role For Myostatin?**

MARINA Y. SOLIS<sup>1</sup>, Manoel Neves Jr<sup>1</sup>, Guilherme Giannini Artioli<sup>2</sup>, Hamilton Rochel<sup>2</sup>, Ricardo Fuller<sup>1</sup>, Fabiana Braga Benatti<sup>2</sup>, Ana Lucia De Sá Pinto<sup>1</sup>, Fernanda Rodrigues Lima<sup>1</sup>, Antonio Herbert Lancha Jr<sup>2</sup>, Eloísa Bonfá<sup>1</sup>, Bruno Gualano<sup>2</sup>. <sup>1</sup>School of Medicine - University Of São Paulo, São Paulo, Brazil. <sup>2</sup>School of Physical Education and Sport - University Of São Paulo, São Paulo, Brazil.

(No relationships reported)

Creatine monohydrate (CrM) supplementation has been suggested as a therapeutic intervention in some chronic disabilities, including knee osteoarthritis (OA). However, little is known about the molecular mechanism underlying the beneficial response to CrM. In this respect, a few studies have suggested that chronic CrM supplementation could increase lean mass partially by



modulating myostatin (MSTN) pathway **PURPOSE:** To assess the effects of CrM supplementation combined with resistance training on muscle function, lower-limb lean mass, and MSTN pathway in women with knee OA.

**METHODS:** A 12-week randomized, double-blind, placebo-controlled clinical trial was performed. Twenty-three postmenopausal women with knee OA were submitted to lower-limb resistance training (3 times a week) and randomly assigned to either CrM supplementation (20 g/d for 1 week and 5 g/d thereafter) or placebo (PL). Physical function (as assessed by timed-stands test) and lower-limb lean mass (as assessed by DXA) were assessed at baseline (PRE) and after 12 wk (POST). Additionally, muscle samples were taken at PRE and POST and MSTN pathway was assessed by quantitative real-time (qPCR).

**RESULTS:** Physical function and lower-limb lean mass were significantly improved only in the CrM group (PRE:  $15.7 \pm 1.4$ , POST:  $18.1 \pm 1.8$ ,  $p = 0.006$ ; PRE:  $13.3 \pm 2.3$ ; POST:  $13.8 \pm 2.0$ ,  $p = 0.04$ ; respectively). qPCR revealed no alteration in MSTN expression and MSTN binding proteins, i.e., SMAD-7, follistatin, follistatin-like 3 (FSTL3), activin receptor IIb (ACTV-IIb) and growth and differentiation factor-associated serum protein (GASP-1) ( $p > 0.05$ ) as a consequence of CrM combined with exercise.

**CONCLUSION:** CrM supplementation improves physical function and lower-limb lean mass in postmenopausal women with knee OA who underwent resistance training. However, MSTN pathway seems not be implicated in these beneficial adaptations. Further studies should investigate other molecular mechanisms behind CrM-induced lean mass accretion. Supported by Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP) - Grant #2010/15450-3.

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**2386** Board #61 MAY 31 2:00 PM - 3:30 PM

**Creatine Supplementation Does Not Affect Measured Renal Function In Resistance Trained Subjects: A Pilot Study**

Rebeca Lugaresi<sup>1</sup>, Marco Leme<sup>1</sup>, Vitor de Sales Painelli<sup>1</sup>, Marcelo Tatit Sapienza<sup>2</sup>, Fabiana Braga Benatti<sup>1</sup>, Hamilton Roschel<sup>1</sup>, Carlos Ugrinowitsch<sup>1</sup>, Antonio Carlos Seguro<sup>2</sup>, Ana Lucia Pinto<sup>2</sup>, Fernanda Rodrigues Lima<sup>2</sup>, Antonio Herbert Lancha Jr<sup>1</sup>, Bruno Gualano<sup>1</sup>. <sup>1</sup>School of Physical Education and Sports University of Sao Paulo, Sao Paulo, Brazil. <sup>2</sup>Medicine School University of Sao Paulo, Sao Paulo, Brazil.

(No relationships reported)

A growing number of human studies have reported the safety of creatine supplementation on estimated glomerular filtration rate (GFR) (e.g., creatinine clearance). However, there is a paucity of data on the effect of creatine supplementation in measured GFR in subjects ingesting a high-protein intake.

**PURPOSE:** To investigate the effects of creatine supplementation on measured GFR in resistance trained subjects ingesting a high-protein diet (ranging from 1.2 to 10.7 g/Kg BW/day).

**METHODS:** A 12-week randomized, double-blind, placebo-controlled

trial was conducted. Fifteen resistance trained males were randomly assigned to either the creatine (CR) or the placebo (PL) group. The CR group (n=8) received 20g/day of creatine for five days followed by

5g/day throughout the study. The PL group (n=7) received the same amount of dextrose. At baseline (PRE) and after 12 weeks of intervention (POST), 51Cr-EDTA clearance, creatinine clearance, serum and urinary sodium and potassium, urea urinary, albuminuria and proteinuria were assessed. Food intake was assessed by a 7-day food record.

**RESULTS:** 51Cr-EDTA clearance was unchanged within and between groups (PRE

CR:  $101.31 \pm 14.37$ , PL:  $106.51 \pm 20.57$ ; POST CR:  $104.61 \pm 14.45$ , PL:  $97.3 \pm 17.05$  mL/min/1.733). Protein intake was similar between groups and did not change throughout the study (PRE CR:  $1.8 \pm 0.8$ , PL:  $1.7 \pm 0.3$ ; POST CR:  $1.6 \pm 0.9$ , PL:  $1.4 \pm 0.6$  g/kg bw/day). Creatinine clearance was also comparable between groups before and after the supplementation (PRE CR:  $2.2 \pm 0.5$  PL:  $1.6 \pm 0.7$ , POST CR:  $2.41 \pm 0.33$ , PL:  $2.1 \pm 0.6$  g/vol 24h). Additionally, serum creatinine, proteinuria, urinary and serum sodium and potassium, urea urinary and albuminuria remained stable and within normal range in both groups.

**CONCLUSION:** Creatine supplementation did not affect measured GFR or any other parameter of kidney function in resistance-trained subjects ingesting a high-protein diet, further confirming that this supplement is safe to the kidneys. Future studies should investigate whether this holds true in a long-term basis.

Supported by FAPESP (2010/13345-8).

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**2387** Board #62 MAY 31 2:00 PM - 3:30 PM

**Creatine Monohydrate: Daily Blood Pressure Monitoring During the Loading Phase of Supplementation**

Gary M. Castello, Emily J. L. Asuncion, Michael S. Boyd, Natalie A. Exsted, Sawyer A. Hildebrandt, Ryan R. Reidt, Ashley M. Rundle, Paul T. Verschaetse. Winona State University, Winona, MN. (Sponsor: Mark Sothmann, FACSM)

(No relationships reported)

Creatine monohydrate (CM) is considered to be a safe nutritional supplement. The loading phase of CM supplementation is associated with shifts in total body water and plasma volume that may affect blood pressure. However, few studies have measured blood pressure during the loading phase of CM supplementation.

**PURPOSE:** The aim of this study was to determine if CM supplementation in normotensive college-aged males induces a daily blood pressure increase during the supplementation-loading phase.

**METHODS:** Participants' blood pressure, shoulder extension active range of motion (AROM), arm girth, arm volume, plasma volume, blood volume, hematocrit, and hemoglobin were measured daily for five days of supplementation (4x5gxd<sup>1</sup>x5d) of either CM (n=12) or placebo (P; n=12).

**RESULTS:** The CM group did not experience significant changes in systolic blood pressure (mmHg) (CM  $126.7 \pm 1.9$  Day 5; P  $125.5 \pm 2.6$  Day 5) or diastolic blood pressure (mmHg) (CM  $83.8 \pm 2.2$  Day 5; P  $82.3 \pm 2.1$  Day 5) compared to P. There were significant time x treatment interaction ( $p = 0.001$ ) and treatment effect ( $p = 0.03$ ) supporting a decline in AROM (cm) in the CM group compared to P (CM  $38.3 \pm 2.2$  Day 1, CM  $34.0 \pm 2.0$  Day 5; P  $41.0 \pm 2.5$  Day 1, P  $43.2 \pm 2.5$  Day 5). There was a significant time x treatment interaction ( $p = 0.026$ ) supporting an increase in arm volume (ml) in the CM group compared to P (CM  $2443 \pm 99$  Day 1, CM  $2470 \pm 92$  Day 5; P  $2372 \pm 74$  Day 1, P  $2374 \pm 75$  Day 5). An increase in plasma volume (%Δ from baseline) ( $p = 0.014$ ) (CM  $1.48 \pm 2.6$  Day 2, CM  $6.03 \pm 4.0$  Day 5; P  $3.25 \pm 2.7$  Day 2, P  $5.05 \pm 2.9$  Day 5) and a decrease in hematocrit (%) ( $p = 0.026$ ) (CM  $0.47 \pm 0.014$  Day 1,  $0.45 \pm 0.008$  Day 5; P  $0.46 \pm 0.012$  Day 1,  $0.45 \pm 0.006$  Day 5) were observed.

**CONCLUSION:** These findings suggest that CM supplementation in the loading phase does not affect blood pressure in normotensive college-aged males, and in regards to blood pressure is considered safe in this population. CM reduces shoulder extension AROM presumably due to increased tissue volume secondary to fluid shifts.

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**2388** Board #63 MAY 31 2:00 PM - 3:30 PM

**Creatine Supplementation plus Strength Training on Cognition and Depression in Elderly Women: A Pilot Study**

Christiano R. Alves, Fabiana Braga Benatti, Aline Cristina Trito, Ana Lúcia de Sá Pinto, Hamilton Roschel, Fernanda Rodrigues Lima, Rosa Maria Pereira, Antonio Herbert Lancha Junior, Bruno Gualano. University of São Paulo, São Paulo, Brazil.

(No relationships reported)

It has been suggested that both strength training and creatine supplementation alone may ameliorate depression and improve a variety of cognition performance measures.

**PURPOSE:** to investigate the possible combined effect of these strategies on depression and cognitive function in elderly people.

**METHODS:** we performed a 12-week randomized double-blind placebo-controlled pilot-study to explore the possible synergic effect of creatine supplementation and strength training on depression and cognition function in elderly women. Participants (n=34) aged  $\geq 60$  years were randomly assigned into one of the four groups: 1) placebo (Pl), 2) strength training plus placebo (Pl-Tr), 3) creatine (Cr), and 4) strength training plus creatine (Cr-Tr). The Pl-Tr and Cr-Tr were submitted to strength training twice a week throughout the study. The Cr and Cr-Tr groups received 20 g/day of creatine for 5 days followed by 5g/day for 12 weeks. The Pl and Pl-Tr groups received exactly the same dose of dextrose. At baseline (PRE) and after 12 weeks (POST 12), a geriatric depression scale and a battery of cognitive tests were applied to the volunteers. Data were expressed as percent changes from POST to PRE and tested by one-way ANOVA.

**RESULTS:** Neither creatine supplementation nor strength training nor the combination of both were able to improve cognition, as assessed by Mini Mental State Examination (Pl: + 1.4%, Pl-Tr: + 1.6%, Cr: + 3.1%, Cr-Tr: + 3.7%,  $p = 0.56$ ), Digit Span Forward (Pl: + 0.0%, Pl-Tr: - 6.5%, Cr: - 4.0 %, Cr-Tr: + 15%,  $p = 0.50$ ), Digit Span Backward (Pl: + 8.6%, Pl-Tr: - 3.4%, Cr: +

0.0%, Cr-Tr: + 6.8%,  $p = 0.46$ ), Stroop Test Color, Non-Color and Word-Color conditions (Pl: - 8.3%, Pl-Tr: + 0.0%, Cr: - 3.4%, Cr-Tr: - 8.2%,  $p = 0.13$ ; Pl: - 8.9%, Pl-Tr: - 12.0%, Cr: - 15.2%, Cr-Tr: - 5.1,  $p = 0.88$ ; and Pl: - 9.6%, Pl-Tr: - 3.9%, Cr: + 1.0%, Cr-Tr: + 2.1%,  $p = 0.02$ ) and Trail Making Test A (Pl: - 2.6%, Pl-Tr: - 11.9%, Cr: - 0.3%, Cr-Tr: + 7.6%,  $p = 0.10$ ). The geriatric depression scale was also unchanged among the groups (Pl: - 4.7%, Pl-Tr: - 29.2%, Cr: - 13.3%, Cr-Tr: - 23.8%,  $p = 0.64$ ).

**CONCLUSION:** 12 weeks of creatine supplementation associated or not with resistance training was unable to improve cognitive function and depression in mentally healthy elderly women. The longer-term follow-up of this study with a larger sample will confirm the veracity of this conclusion.

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## D-20 Free Communication/Poster - Energy Balance and Metabolic Responses

MAY 31, 2012 1:00 PM - 6:00 PM  
ROOM: Exhibit Hall

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### 2389 Board #64 MAY 31 3:30 PM - 5:00 PM

#### Differential Responses of Metabolic Syndrome Components to Tumor Necrosis Factor- $\alpha$ Levels over 16-Weeks

Mary P. Miles, FACSM, Colleen P. Miller, Amy C. Hartz, Gregory N. Rueggesser, Katherine A.M. McNulty, John C. Christopher. *Montana State University, Bozeman, MT.*

(No relationships reported)

Tumor necrosis factor- $\alpha$  (TNF) is an inflammatory cytokine that interferes with insulin signaling and associates with risk for development of insulin resistance and related metabolic problems. It is important to know whether elevations in TNF are an early indication of accelerated progression of the metabolic syndrome components.

**PURPOSE:** To determine whether healthy, overweight adults with lower versus higher basal levels of TNF have measurable changes in variables related to metabolic syndrome over a 16-week time period.

**METHODS:** Adults ( $n=40$ ) were measured pre- (INITIAL) and post-16 weeks (FINAL) for BMI, waist circumference, blood pressure, and fasting glucose, insulin, triglycerides (TG), HDL, TNF, interleukin (IL)-6, C-reactive protein (CRP), and homeostatic model assessment of insulin resistance (HOMA-IR). Participants were ranked by INITIAL TNF concentrations, and the lowest 15 and highest 15 were placed in LOW and HIGH TNF groups. There were 11/4 and 13/2 women/men in the LOW and HIGH groups, respectively.

**RESULTS:** INITIAL values were similar between groups with the exceptions of a trend ( $P=0.09$ ) for higher CRP ( $1.53 \pm 0.53$  vs  $2.29 \pm 0.83$  mg/l) and a trend ( $P=0.07$ ) for greater waist circumference ( $88.5 \pm 6.5$  vs  $93.6 \pm 8.1$  cm) in the HIGH compared to LOW TNF group. HDL increased ( $P<0.05$ ) over time with no difference between groups. There was a trend for decreased systolic and diastolic blood pressure ( $P=0.08$  for both), an increase in insulin ( $P=0.08$ ) and HOMA-IR ( $P=0.09$ ). Group by time interactions ( $P<0.05$ ) were measured for IL-6 and TG. Post-hoc analysis identified trends for IL-6 to decrease ( $P=0.10$ ) and for TG to increase ( $P=0.06$ , from  $95.7 \pm 36.4$  to  $114.7 \pm 48.5$  mg/dl) in the HIGH TNF group.

**CONCLUSION:** These findings provide preliminary evidence that insulin levels and HOMA-IR increase over time in overweight individuals, independent of TNF levels. Fasting insulin and HOMA-IR primarily reflect insulin sensitivity of liver and beta-cell activity. However, an increase in TG, an occurrence linked to insulin resistance in adipose tissue, was more pronounced in the HIGH TNF group. Thus, the effect of higher plasma TNF levels in overweight individuals may vary by tissue.

This study was funded by a grant from the American Heart Association Western States Affiliate.

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### 2390 Board #65 MAY 31 3:30 PM - 5:00 PM

#### Energy Expenditure During and After Standard Exercise While on a Carbohydrate or Fat Restriction Diet

Rachel M. Perron, Robert J. Brychta, Kong Y. Chen, Carla M.M. Prado, Mario Siervo, Laura Musse, Kevin D. Hall. *National Institutes of Diabetes Digestive and Kidney Disease, Bethesda, MD.*

(No relationships reported)

**PURPOSE:** As different dietary interventions may lead to variable energy expenditure and weight loss, we aimed to measure exercise and post-exercise energy expenditure during calorically equal dietary restrictions of carbohydrate versus fat.

**METHODS:** Eight obese subjects (4 male, 4 female; BMI  $\geq 30$  kg/m<sup>2</sup>) were fed a low carbohydrate (LC) or a low fat (LF) diet in a randomized, crossover design. Subjects spent 5 days on a baseline (weight-maintenance) diet and 6 days on either an LC or LF diet (30% caloric reduction) with a 2-10 week washout period between diets. During both baseline and diet conditions, subjects spent 60 minutes daily walking at a consistent, self-selected pace on a treadmill. Oxygen consumption (VO<sub>2</sub>) and carbon dioxide production (VCO<sub>2</sub>) were measured in a metabolic chamber. Energy expenditure (EE) and respiratory quotient (RQ) were calculated during exercise and for 30 minutes post-exercise. Pairwise t-test was used to compare changes in metabolic parameters on each diet relative to baseline. P value was set at  $<0.05$ .

**RESULTS:** A comparable negative energy balance was achieved during the LC ( $-634 \pm 213$  kcal/day) and LF ( $-592 \pm 148$  kcal/day) caloric restricted periods, which induced at the end of each period a weight loss of  $-1.5 \pm 0.3$  kg ( $p<0.05$ ) and  $-1.2 \pm 0.3$  kg ( $p<0.05$ ), respectively. Exercise EE and post-exercise EE did not change during the two dietary interventions. However, exercise and post-exercise RQ values significantly decreased during the LC diet whereas RQ values did not change during the LF diet.

**CONCLUSION:** Exercise and post-exercise respiratory quotient, but not energy expenditure, responded to a significant restriction of dietary carbohydrate, but not dietary fat.

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### 2391 Board #66 MAY 31 3:30 PM - 5:00 PM

#### Post-exercise Growth Hormone Kinetics Differ Between Assay Methods During Energy Balance

Dennis E. Scofield, David W. DeGroot, FACSM, Matthew R. Ely, J Philip Karl, Andrew J. Young, FACSM, Bradley C. Nindl, FACSM. *U.S. Army Research Institute of Environmental Medicine, Natick, MA.*

(No relationships reported)

The secretion of growth hormone (GH)--characterized by molecular heterogeneity that includes molecular weight variants and aggregates--is modulated in part by both changes in nutritional status and exercise. Treating serum samples with glutathione prior to assay is a method used to break disulfide-linked GH aggregates and potentially increase GH assay signal. The effect of this method on samples obtained during periods of energy imbalance is unknown.

**PURPOSE:** To determine the effect of glutathione (GSH) treatment on serum GH samples obtained during energy balance (EB), underfeeding (UF) and overfeeding (OF).

**METHODS:** 10 men ( $22 \pm 2$  yrs) were assigned to 3 interventions over 12 days: 4 days each of EB, UF (60% of EB), and OF (150% of EB). Subjects exercised on a cycle ergometer at 50% VO<sub>2peak</sub> for 20 min on the 4th day of each intervention. Blood samples were obtained pre-, post- and 30 min post-exercise. Serum GH concentrations were determined in reduced (+GSH) and non-reduced (-GSH) states using a commercially available IRMA assay. Data were analyzed using RM ANOVA ( $P \leq 0.05$ ) with a Tukey HSD post-hoc test when appropriate.

**RESULTS:** During all feeding conditions the mean GH signal was significantly increased in the +GSH samples (EB: +GSH:  $2.2 \pm 0.07$  vs. -GSH:  $1.8 \pm 0.7$  ng/mL;  $P < 0.01$ ; UF: +GSH:  $1.3 \pm 0.3$  vs.  $1.0 \pm 0.3$  ng/mL;  $P = 0.04$ ; OF: +GSH:  $0.8 \pm 0.2$  vs. -GSH:  $0.6 \pm 0.2$  ng/mL;  $P < 0.01$ ). During EB, *post hoc* testing indicated a greater GH assay signal in +GSH ( $3.0 \pm 0.8$  ng/mL) vs. -GSH ( $2.4 \pm 0.6$  ng/mL) at post-exercise ( $P < 0.01$ ).

**CONCLUSION:** These data demonstrate that compared to untreated serum samples, the addition of GSH to serum prior to assay allows for the detection of significant alterations in post-exercise GH concentrations due to the detection of disulfide-linked GH aggregates. The mechanism by which nutritional status affects the differential response of GH aggregates to aerobic exercise and their influence on post-exercise homeostasis remains to be determined.

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**2392** Board #67 MAY 31 3:30 PM - 5:00 PM  
**The Metabolic Responses Of Work Load Matched High Intensity Intermittent Exercise**  
Tracey Gerber, Alan Hayes, Christos G. Stathis. *Victoria University, Melbourne, Australia.* (Sponsor: David Bishop, FACSM)  
(No relationships reported)

**While high intensity intermittent exercise (HIIE) training programs show greater decreases in indirect measures of adiposity (skinfold and dual x-ray absorptiometry) than continuous exercise training programs, there is limited information about potential mechanisms.**

**PURPOSE:** The aim of this study was to elucidate reasons behind this finding and to examine the influence of exercise intensity during HIIE on potential fat loss.

**METHODS:** Healthy, untrained males completed a  $\text{VO}_{2\text{max}}$  test and 2 HIIE protocols a) 20s cycling at 150%  $\text{VO}_{2\text{peak}}$ , with 40s rest (20:40 HIIE), and b) 10s cycling at 300%  $\text{VO}_{2\text{peak}}$ , with 50s rest (10:50 HIIE); both were followed by a 90-min recovery. Blood and respiratory gases were collected and heart rate and rating of perceived exertion (RPE) monitored. Student T test, 2 way repeated measures ANOVA and Tukey's post hoc analysis were used to identify significant differences ( $p < 0.05$ ). All procedures were approved by the Victoria University Human Research Ethics Committee.

**RESULTS:** On completion of the two HIIE no differences were observed in heart rate, oxygen consumption ( $\text{VO}_2$ ), carbon dioxide production ( $\text{VCO}_2$ ) and RPE. While plasma lactate increased during both HIIE protocols, the decline in the recovery period was significantly higher following the 10:50 HIIE ( $p < 0.05$ ). No group differences were seen in plasma glucose, however at the end of HIIE plasma insulin was significantly elevated from rest 15 min post the HIIE ( $p < 0.05$ ). During HIIE and recovery, plasma glycerol increased significantly more with 20:40 HIIE compared to the 10:50 HIIE bout. Excess post exercise oxygen consumption (EPOC) was significantly greater in the 10:50 HIIE compared to the 20:40 HIIE bout ( $P < 0.05$ ).

**CONCLUSIONS:** During HIIE, physiological responses to the 2 protocols were not different demonstrating the effectiveness of the workload matched design. Plasma markers of fat metabolism indicate 20:40 HIIE utilises relatively greater fat than 10:50 HIIE ( $p < 0.05$ ), while the greater plasma lactate during HIIE and the recovery period are indicative of an increased glycolysis during the 10:50 bout ( $p < 0.05$ ). The elevated EPOC following both bouts of HIIE provides a potential mechanism for enhanced energy utilisation with bouts of higher workloads.

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**2393** Board #68 MAY 31 3:30 PM - 5:00 PM  
**Acute Effects of Resistance Exercise vs. Endurance Exercise on Postprandial Fuel Partitioning**  
Patrick M. Davitt, Gregory C. Henderson, Shawn M. Arent, FACSM. *Rutgers University, New Brunswick, NJ.*  
(No relationships reported)

The ability to alter postprandial metabolism in favor of increased energy expenditure and fatty acid (FA) oxidation could help attenuate the retention of body fat.

**PURPOSE:** To compare acute effects of resistance exercise (RE) and endurance exercise (EE) to a resting control (C) for effects upon subsequent postprandial energy substrate partitioning in obese women.

**METHODS:** Sedentary, obese women ( $n=10$ ; Body weight =  $101.0 \pm 8.0$  kg; BMI =  $37.1 \pm 2.3$ ) participated in a crossover designed study. Each subject was studied on 3 occasions: RE, EE, and C. Subjects completed a body composition, 10-repetition maximum (10RM), and aerobic capacity test ( $\text{VO}_{2\text{peak}}$ ). A 1 h total body high intensity RE workout consisted of 3 sets of 10 repetitions for 8 exercises at a load of 90% the 10RM. EE consisted of walking on a treadmill at 65%  $\text{VO}_{2\text{peak}}$  for 1 h. A standardized meal of 20 kcal/kg FFM (CHO-48%, Fat-36%, Protein-16%) was administered 30 min after exercise. Pulmonary gas exchange was assessed immediately before the meal and at 40, 80, 160, 240, 320, and 400 min afterwards in order to assess changes in metabolic rate, fat oxidation, and carbohydrate oxidation. RM ANOVAs were used for statistical analysis. Values were calculated as averages over the 400 min assessment period.

**RESULTS:** In comparison to C, both RE and EE led to an increased rate of fat oxidation (RE,  $0.58 \pm 0.07$  kcal/min; EE,  $0.54 \pm 0.06$  kcal/min; C,  $0.41 \pm 0.03$  kcal/min,  $P < 0.05$ ) with no significant difference between RE and EE. There was no significant difference in carbohydrate oxidation between any conditions (RE,  $0.85 \pm 0.05$  kcal/min; EE,  $0.88 \pm 0.06$  kcal/min; C,  $0.94 \pm 0.06$  kcal/min). Postexercise increase in % energy from fat was significant in RE ( $P < 0.05$ ) and approached significance in EE ( $P = 0.05$ ) (RE,  $41.4 \pm 3.6$  %; EE  $39.1 \pm 3.3$  %; C,  $32.3 \pm 1.9$  %). Postexercise decrease in % energy from carbohydrate was significant in RE ( $P < 0.05$ ) and approached significance in EE ( $P = 0.05$ ) (RE,  $58.6 \pm 3.6$  %; EE,  $60.9 \pm 3.3$  %; C,  $67.7 \pm 1.9$  %).

**CONCLUSION:** Acute, moderate intensity EE and high intensity RE both enhance the rate of fat oxidation in the postprandial period in obese women when compared to a sedentary control. The results indicate that RE and EE may be equally effective in altering postprandial energy substrate partitioning, and the findings may have implications for designing weight loss programs.

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**2394** Board #69 MAY 31 3:30 PM - 5:00 PM  
**The Effects Of Resistance Exercise Training On Food Intake In Young Rats**  
Fábio M. Lorenzetti, Daniela Fojo Seixas Chaves, Guilherme Giannini Artioli, Juliana Leandro da Silva, Antonio Herbert Lancha Junior. *University of Sao Paulo, São Paulo, Brazil.*  
(No relationships reported)

**INTRODUCTION:** Physical exercise is responsible for altering various physiological parameters. Although several studies report a phenomenon known as "anorexia induced by exercise" in response to endurance exercise, little is known about the effects of resistance exercise on food intake.

**PURPOSE:** To verify the patterns of food intake of young rats (~4 months) in response to a 12-week resistance training protocol.

**METHODS:** The rats were kept in individual cages in inverted light/dark cycle and had free access to food and water. They were divided in two groups: a sedentary control group (CON) and a trained group (TR). The training consisted of 35 sessions, one session a day, 3 days a week. In each session rats performed a total of 30 repetitions at 80% of the previously established maximum force. This protocol has been successfully used in our lab to induce muscle hypertrophy. Food intake was measured in a daily basis every morning. To compare the difference between treatments at each time point, we used analysis of variance (ANOVA) for repeated measures.

**RESULTS:** No significant differences between groups were found for body weight at both PRE (CON= $401.38 \pm 1.06$ g; TR= $402.13 \pm 1.46$ g) and POST intervention (CON= $500.38 \pm 48.64$ g; TR= $507.63 \pm 24.12$ g). Likewise, there was no significant difference between groups for food intake, at any time of the study (PRE: CON= $30.00 \pm 0.00$ g; TR= $29.00 \pm 1.07$ g; POST: CON= $29.00 \pm 3.21$ g; TR= $29.00 \pm 3.21$ g).

**CONCLUSIONS:** According to the data obtained, we can conclude that 35 sessions of strength training with 80% of maximum load does not affect the voluntary food intake and weight in an animal model for resistance exercise training. Supported by FAPESP: 2010/08329-3 and 2010/10852-6.

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**2395** Board #70 MAY 31 3:30 PM - 5:00 PM  
**Effects Of Different Modes Of Exercise On Appetite In Young Men**  
Hiroshi Kawano, Mayuko Mineta, Meiko Asaka, Masashi Miyashita, Yuko Gando, Takafumi Ando, Shigeharu Numao, Shizuo Sakamoto, Mitsuru Higuchi, FACSM. *Waseda University, Tokorozawa, Japan.*  
(No relationships reported)

It is known that an acute bout of high-intensity exercise induces appetite suppression. Recent research suggests that the appetite stimulating hormone secreted from the gut, acylated ghrelin, mediates exercise-induced appetite changes. However, it remains unclear whether there are differences in appetite and acylated ghrelin responses to different modes of exercise (i.e. weight bearing exercise versus non-weight bearing exercise). Rope skipping exercise is traditional exercise modality that everyone who had experienced during elementary school years in Japan, and it has characteristic exercise modality that it has a great up-and-down motions of the center of mass.

**PURPOSE:** This study was to examine the effects of exercise mode on appetite and plasma acylated ghrelin.

**METHODS:** Sixteen healthy young men (age  $24.6 \pm 0.5$  yrs, body mass  $65.7 \pm 1.6$  kg, maximal oxygen uptake  $46.6 \pm 1.6$  ml/kg/min) participated in this study. After 12-h fasting, all subjects undertook three, 160 min trials, 1) rope skipping exercise ( $291 \pm 9$  kcal, 3 sets x 10 min with 5 min interval, then rested for 120 min), 2) bicycle ergometer exercise ( $298 \pm 10$  kcal, 3 sets x 10 min with 5 min interval, then rested for 120 min), 3) control (rested for 160 min). Plasma concentration of acylated ghrelin and hunger evaluated by visual-analog scale (0 mm Not Hungry - 100 mm Very Hungry) were measured throughout.

**RESULTS:** Two-way ANOVA revealed significant ( $P < 0.05$ ) interaction effects for hunger and acylated ghrelin, indicating suppressed hunger and acylated ghrelin during rope skipping and

bicycle ergometer exercises. There were no significant trial effects for hunger and acylated ghrelin. The amount of change in appetite from baseline during exercise was greater in the rope skipping trial ( $-30 \pm 7$  mm) than both bicycle ergometer ( $-9 \pm 5$  mm) and control trials ( $3 \pm 3$  mm) by one-way ANOVA ( $P < 0.05$ ). However, there was no difference of change in plasma concentration of acylated ghrelin from baseline between in rope skipping and bicycle ergometer exercise trials.

**CONCLUSION:** These results suggest that rope skipping exercise with dramatic ups and downs in center of mass may have greater effect of exercise-induced suppression of appetite but not of acylated ghrelin compared with bicycle ergometer exercise without ups and downs.

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**2396** Board #71 MAY 31 3:30 PM - 5:00 PM

**Effects Of Exercise On Appetite And Ad Libitum Energy Intake In Men And Women**

Megan M. Yamashiro, Jake Hinkel-Lipsker, Hanne Wolff, Katherine Stredler, Nero Evero, Terry Hackney, Todd A. Hagobian. *California Polytechnic State University San Luis Obispo, San Luis Obispo, CA.* (Sponsor: Barry Braun, FACSM)  
(No relationships reported)

Short-term aerobic exercise suppresses appetite and subsequent energy intake in men, however it remains unclear whether this occurs in women.

**PURPOSE:** To determine whether exercise alters subjective appetite ratings, appetite hormones and ad libitum energy intake differently in men and women.

**METHODS:** 11 healthy men ( $22 \pm 2$  yrs;  $16 \pm 6$  %BF;  $42.9 \pm 6.5$  ml/kg-min) and 10 healthy women ( $21 \pm 2$  yrs;  $23 \pm 3$  %BF;  $39.9 \pm 5.5$  ml/kg-min) completed a no-exercise and exercise condition in a counterbalanced, cross-over fashion. Subjects either rested for 60 minutes (no-exercise) or exercised on a cycle ergometer at  $\sim 70\%$  VO<sub>2</sub> max until 30% of their total daily energy expenditure was expended (Men; exercise expenditure =  $975 \pm 195$  kcal; Women; exercise expenditure =  $713 \pm 86$  kcal). Hunger and satiety ratings and insulin concentrations were assessed before and up to 30 minutes post each condition using a repeated measure ANOVA. Forty minutes after completion of both conditions, subjects were given an ad libitum buffet meal and relative energy intake was calculated as energy intake minus exercise expenditure.

**RESULTS:** There was no significant sex or condition effect in appetite ratings (i.e., hunger and satiety) and insulin concentrations. Absolute energy intake was significantly higher ( $P < 0.05$ ) in the exercise and no-exercise conditions in men ( $1648 \pm 950$ ,  $1216 \pm 633$  kcal, respectively) compared to women ( $591 \pm 183$ ,  $590 \pm 231$  kcal, respectively). Relative energy intake was significantly lower ( $P < 0.05$ ) after exercise compared to no-exercise in men ( $558 \pm 813$ ,  $1133 \pm 619$  kcal, respectively) and women ( $-205 \pm 248$ ,  $530 \pm 233$  kcal, respectively). However, relative energy intake was highly variable as 12 out of 21 subjects had lower energy intake after exercise, whereas 9 subjects had higher relative energy intake.

**CONCLUSIONS:** We observed no change in appetite ratings or insulin concentrations in either sex. However, ad libitum relative energy intake was lower after exercise in both men and women. Other key hormones (e.g. peptide-YY, acylated ghrelin) may have a more profound role in appetite regulation and may explain the lower relative energy intake.

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**2397** Board #72 MAY 31 3:30 PM - 5:00 PM

**Fetuin-A Responses to Incremental Weight Loss**

Peter W. Grandjean, FACSM<sup>1</sup>, Guang Ren<sup>2</sup>, Xiaoming He<sup>2</sup>, Teayoun Kim<sup>2</sup>, Laurel A. Littlefield<sup>1</sup>, Robert L. Bowers<sup>2</sup>, Felipe Araya-Ramirez<sup>2</sup>, A Jack Mahurin, FACSM<sup>3</sup>, Suresh T. Mathews<sup>2</sup>. <sup>1</sup>Baylor University, Waco, TX. <sup>2</sup>Auburn University, Auburn, AL. <sup>3</sup>Baptist Hospital, Montgomery, AL  
(No relationships reported)

Fetuin-A is a hepatokine known to attenuate insulin action by suppressing insulin receptor tyrosine kinase activity. Fetuin-A concentrations are elevated in obesity, insulin resistance and type 2 diabetes and can be reduced with weight loss. Dose-response relationships between changes in fetuin-A concentrations and incremental weight loss and changes in body composition have not been characterized.

**PURPOSE:** The objectives of this investigation were to characterize the effects of incremental weight loss on circulating concentrations of fetuin-A and to determine relationships between fetuin-A and changes in body composition in obese men.

**METHODS:** Sixteen obese men (age =  $43.3 \pm 9.0$ ; weight =  $106.5 \pm 17.8$  kg; BMI =  $33.4 \pm 4.4$  kg/m<sup>2</sup>; body fat =  $36 \pm 4\%$ ) were assigned to regularly-practiced exercise and dietary restriction in order to reach a targeted weight loss of 8 to 10% of initial body weight over a 6 to 10-month period. Fasting blood samples were analyzed for fetuin-A concentrations and clinical markers of insulin sensitivity and changes in body fat and body fat distribution were measured at regular weight loss intervals (2-4%, 4-6%, 6-8% and target weight loss).

**RESULTS:** Fetuin-A was significantly reduced with 2-4% weight loss (83 mg/mL or 18.7%) and decreased by 126 mg/mL or 28.5% with target weight loss ( $p = 0.0002$ ). Body fat decreased by 4% ( $p < 0.0001$ ) and lean mass decreased by 3% ( $p < 0.0001$ ) with the targeted weight loss. Markers of insulin sensitivity [HOMA and glucose/insulin ratio, reported previously: MSSE Vol. 43 (5) No. 2462, 2011] were improved with as little as 4-6% weight-loss ( $p < 0.05$ ). Reductions in fetuin-A were correlated with the decrease in total fat mass measured after reaching target weight (0.67,  $p = 0.0045$ ).

**CONCLUSIONS:** As little as 2-4% weight loss resulted a decrease in fetuin-A concentrations. Continued weight and body fat loss resulted in further decrements in fetuin-A and improved insulin sensitivity. The decrease in fetuin-A was associated with a reduction in fat mass that occurred with 6-8% weight loss in obese men.

Funded by an Alabama Agriculture Experiment Station Foundation Grant

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**2398** Board #73 MAY 31 3:30 PM - 5:00 PM

**Effects Of Visfatin Rs4730153 Snps On Exercise-induced Weight Loss Of Chinese Obese Children And Adolescents**

aiping lai<sup>1</sup>, wenhe chen<sup>2</sup>, Kelly Helm<sup>3</sup>. <sup>1</sup>Zhejiang College of Sports, HangZhou, China. <sup>2</sup>Shanghai University of Sport, Shanghai, China. <sup>3</sup>Valparaiso University, Valparaiso, IN.  
(No relationships reported)

**PURPOSE:** To investigate the effects of Visfatin gene polymorphism RS4730153 on exercise-induced weight loss.

**METHODS:** 88 obese children and adolescents of Han Chinese were subjected to 4 weeks of aerobic exercise to lose weight. By using ligase detection-polymerase chain reaction(LDR-PCR) sequence typing techniques,RS4730153 polymorphism of Visfatin gene of individual subject was determined, physical shape, functions, quality and metabolic indicators of glucose and lipid metabolism before and after exercise intervention were measured.

**RESULTS:** AG genotype frequency was 15.9% among subjects. Significant changes were found when indicators of all genotypes were compared before and after aerobic exercise. Compared indicators of all genotypes before with after aerobic exercise, there were significant changes. Pre-exercise triglyceride (TG) levels were significantly different between two genotypes (GG:  $1.40 \pm 0.74$  mmol/L; AG:  $1.86 \pm 1.11$  mmol/L;  $P = .050$ ). Exercise-induced changes of HOMA- $\beta$  level between two genotypes were significantly different (GG:  $220.50 \pm 178.81$ ; AG:  $332.23 \pm 207.90$ ;  $P = .050$ ). Gender also influenced changes of various metabolic indicators by exercise.

**CONCLUSIONS:** Visfatin single nucleotide variants RS4730153 exist in obese Han Chinese children and adolescents. Weight loss via exercise may be improved by reducing TG levels or by increasing insulin sensitivity of obese children with homozygous Visfatin RS4730153.

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**2399** Board #74 MAY 31 3:30 PM - 5:00 PM

**Is there Longitudinal Agreement between Methods to Estimate Total Body Water on Adolescents?**

José Ramón Alvero Cruz<sup>1</sup>, Elvis Camero<sup>2</sup>, Jesús Barrera Expósito<sup>1</sup>, José Carlos Fernández García<sup>2</sup>, Luis B Sardinha<sup>3</sup>. <sup>1</sup>Faculty of Medicine. University of Málaga, Málaga, Spain. <sup>2</sup>Faculty of Education Sciences. University of Málaga, Málaga, Spain. <sup>3</sup>Technical University of Lisbon, Lisbon, Portugal.  
(No relationships reported)

Accurate estimation of total body water (TBW) is a cornerstone of the body composition assessment, since it is used to estimate fat-free mass and fat mass. Also, TBW changes have several implications on performance and health. However, there is a lack of knowledge about the agreement between gold standard and field methods to assess longitudinal changes of TBW, mainly on adolescents.

**PURPOSE:** The aim of this study was to explore the agreement between deuterium dilution method and whole-body bioelectrical impedance analysis (BIA) before and after 2 years of follow-up on adolescents.

**METHODS:** 73 adolescents (36 girls and 35 boys) were assessed (age= 13.6 ±1.2 yr, BMI= 22.0 ±3.2 kg/m<sup>2</sup>) during a 2-years follow-up period (2YFU) which was between October 2006 and 2008. TBW was determined by the isotope (deuterium oxide (<sup>2</sup>DO)) dilution technique using an isotope-ratio mass-spectrometer and a BIA by the traditional protocol. Paired sample T-test was performed to compare differences between TBW estimated by BIA and deuterium before (DifB-<sup>2</sup>DO<sub>1</sub>) and after (DifB-<sup>2</sup>DO<sub>2</sub>) 2YFU. Bland and Altman plot (B&A) and Kendall's Tau were carried out in order to analyze the agreement and bias between methods. Differences between TBW by <sup>2</sup>DO and BIA were calculated (DifB-<sup>2</sup>DO). Independent sample T-test between DifB-<sup>2</sup>DO<sub>2</sub> and DifB-<sup>2</sup>DO<sub>1</sub> was used in order to analyze if the magnitude of differences was statistically significant between moments.

**RESULTS:** Paired sample T-test did not show significant differences between methods either before (31.9 ±4.5 vs. 32.1 ±4.8 kg, BIA and <sup>2</sup>DO respectively; *p*>0.05) or after 2YFU (33.6 ±4.3 vs. 35.1 ±5.4 kg, BIA and <sup>2</sup>DO respectively; *p*>0.05). The B&A showed that DifB-<sup>2</sup>DO<sub>2</sub> had large confidence intervals (CI= -8.70 to 5.62 kg) and a significant proportional bias (Kendall's Tau = 0.31, *p*<0.001). Independent sample T-test between DifB-<sup>2</sup>DO before and after was statistically significant (-1.36 kg, *p*<0.001).

**CONCLUSION:** The main finding of this study was that after a 2YFU, BIA underestimated the TBW larger than before the follow up period. Also, DifB-<sup>2</sup>DO<sub>2</sub> had more variability and a great negative tendency than DifB-<sup>2</sup>DO<sub>1</sub>. So, our data indicate that higher TBW values greater underestimating by BIA. These results must be taken in consideration when TBW changes are assessed by BIA, mainly during maturation periods.

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**2400** Board #75 MAY 31 3:30 PM - 5:00 PM

### Adult-Child Differences in Substrate Utilization Following Moderate and Vigorous Intensity Cycle Ergometer Exercise

Justin R. Bland<sup>1</sup>, Karin A. Pfeiffer, FACSM<sup>1</sup>, Joey C. Eisenmann<sup>2</sup>, Lorraine Weatherspoon<sup>1</sup>, Kimberly S. Maier<sup>1</sup>. <sup>1</sup>Michigan State University, East Lansing, MI. <sup>2</sup>Helen DeVos Children's Hospital, Grand Rapids, MI.

(No relationships reported)

**INTRODUCTION:** Previous research has shown fat oxidation, measured by respiratory exchange ratio (RER), to be greater in children than in adults at rest and during exercise. Few studies have investigated substrate utilization post-exercise in children.

**PURPOSE:** To examine adult-child differences in substrate utilization following moderate and vigorous intensity exercise performed on the cycle ergometer.

**METHODS:** 20 children and 23 adults visited the laboratory on three separate occasions and completed an exercise trial each day: VO<sub>2</sub>max test, moderate exercise (MOD), and vigorous exercise (VIG). Maximum power output (MaxPO) during the VO<sub>2</sub>max test was used to determine workload for MOD (35% MaxPO) and VIG (70% MaxPO) exercise. MOD and VIG trials were randomized and counterbalanced. Participants rested for 30 minutes (min) prior to exercise; the last 20 min were used for baseline VO<sub>2</sub> measures. In order to mimic child physical activity patterns, tests were 2-min square-wave intervals lasting 1 hour for the MOD trial and 30 min for the VIG trial. Expired gas measurements began 10 min prior to the cessation of exercise and continued for 30 min. Substrate utilization was examined using multivariate analysis of variance (ANOVA) for RER at minutes 1, 5, 10, 15, and 20 post-exercise. Another ANOVA model statistically controlling for caloric intake and gender was also performed.

**RESULTS:** After MOD, children's RER was significantly lower than adults at 1, 5, and 10 min (0.84 ± 0.05 vs. 0.90 ± 0.05; 0.93 ± 0.05 vs. 1.00 ± 0.08; and 0.86 ± 0.03 vs. 0.91 ± 0.05, respectively; all *p* < 0.01; effect sizes of 0.61, 0.26, and 0.29, respectively). After VIG, RER was similar in children and adults at min 1 and 10; however, children's RER in min 5 was significantly lower than adults (1.02 ± 0.06 vs. 1.15 ± 0.11, *p* = 0.001; effect size of 0.60). Children's RER in min 15 and 20 was significantly higher than adults' (0.83 ± 0.05 vs. 0.77 ± 0.06; 0.83 ± 0.05 vs. 0.75 ± 0.06, respectively; *p* ≤ 0.001; effect sizes of 1.66 and 2.12, respectively).

**CONCLUSIONS:** Children had lower RER than adults after MOD, but higher RER 15 and 20 min after VIG. Children rely more on fat oxidation at rest and during exercise than adults. This study observed children to utilize a greater proportion of carbohydrates than adults after VIG.

Funded by Michigan State University College of Education

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**2401** Board #76 MAY 31 3:30 PM - 5:00 PM

### Using the Bite Counter Device to Measure Energy Intake in Overweight African Americans

Phillip W. Jasper, Jenna L. Scisco, Veronica G. Parker, Adam W. Hoover, Eric R. Muth. Clemson University, Clemson, SC.

(No relationships reported)

Energy intake can be measured using tools such as paper-and-pencil and electronic food diaries, dietary recalls, food frequency questionnaires, and food history questionnaires (Thompson & Subar, 2008). Energy intake estimation with these tools can be challenging, and none of these methods allow the individual to measure their energy intake automatically and in real time. The Bite Counter is a watch-like device that can measure bites of food taken during a meal. This study was the first observational study using the Bite Counter in free-living humans.

**PURPOSE:** To determine the relationship between the numbers of bites taken during meals and three variables: kilocalories, meal duration, and meal location.

**METHODS:** Bite Counter devices were worn by 13 African-American participants (7 females, mean age = 55.5 (SD = 9.1), mean BMI = 36.8 (SD = 7.4)). Participants wore the Bite Counter on their dominant wrist for one week. Participants recorded bites of food by turning the device on when they began eating a meal and off when they finished eating a meal. Participants also completed daily dietary recalls using the Internet-based Automated Self-Administered 24-Hour Recall (ASA24 Beta version, National Cancer Institute, Bethesda, MD, 2009). Kilocalories for each meal and meal location were obtained from the ASA24. Bites for each meal and meal duration were obtained from the Bite Counters.

**RESULTS:** 147 meals were included in the analysis. Participants took an average of 42 bites (SD = 26) per meal, ate an average of 549 kilocalories (SD = 379) per meal, and ate for an average of 15 minutes (SD = 10) at each meal. 101 meals were eaten at home, and 46 meals were eaten outside of the home (e.g., work, restaurants). Correlational analyses indicated positive relationships between kilocalories and bites, *r*(145) = .31, *p* < .01, and meal duration and bites, *r*(145) = .87, *p* < .01. Significantly more bites were taken during meals eaten outside of the home (*M* = 51, *SD* = 35) compared to those eaten at home (*M* = 38, *SD* = 20, *t*(145) = 2.80, *p* < .05).

**CONCLUSIONS:** This small-scale study in African-American, overweight adults indicated that bites may serve as a measure of energy intake and meal duration. Additionally, bite count could be used to help individuals identify locations where their energy intake may increase.

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**2402** Board #77 MAY 31 3:30 PM - 5:00 PM

### The Effects of Massage Therapy on Weight Management

Mark Blegen, FACSM<sup>1</sup>, Hannan Hassan<sup>1</sup>, Megan Gosselin<sup>1</sup>, Alisse Indrellie<sup>1</sup>, Heidi Sande<sup>1</sup>, Tracey Matthews<sup>2</sup>. <sup>1</sup>St. Catherine University, St. Paul, MN. <sup>2</sup>Springfield College, Springfield, MA.

(No relationships reported)

Cortisol is an adrenal cortex hormone and is released in response to stress. Massage has been shown to lower cortisol levels in individuals. High levels of cortisol in the body are associated with increases in fat mass and distribution.

**PURPOSE:** To examine if receiving weekly massages would influence salivary cortisol, bodyweight, blood pressure, and heart rate.

**METHODS:** Blood pressure, heart rate and salivary cortisol were measured pre-massage, post-massage, 15 min post-massage and 30 min post-massage. In the control setting, variables were measured at the same time point. For body weight a 2 X 2 repeated measures factorial ANOVA was computed to examine body weight. Measures were taken pre- and post-massage and pre- and post-control. In addition, 2 X 4 Repeated Measures ANOVAs were conducted for HR, SBP, DBP and salivary cortisol with an alpha level of 0.05.

**RESULTS:** A significant difference (*p* < 0.05) between the control and massage conditions was found for body weight. No significant difference (*p* > 0.05) between the two groups existed for body weight at pre-test (massage: 189.75 ± 24.15 lbs, control: 190.81 ± 24.60 lbs). Subjects weighed significantly less (*p* < 0.05) after massage than during the control session (massage: 186.94 ± 24.50 lbs, control 190.94 ± 23.71 lbs). For SBP, a significant interaction between time and condition existed. At baseline and the end of the condition, the massage group had significantly lower mean SBP (118.00 ± 11.39; 118.25 ± 6.50) than the control condition (128.5 ± 16.50, 127.63 ± 10.30). For heart rate, significant differences (*p* < 0.05) were found for the condition. Subjects had a significantly lower (*p* < 0.05) mean heart rate during the massage condition (67.38 ± 3.59) than the control condition (75.56 ± 3.39). For DBP, the massage condition had a

significantly lower mean DBP ( $78.13 \pm 3.28$ ) than the control condition ( $86.13 \pm 2.45$ ). For salivary cortisol the massage condition exhibited a significantly lower value ( $1.15 \pm 0.08$ ,  $1.42 \pm 0.07$ ).

**CONCLUSION:** Receiving weekly massages may be an adjunct to a weight management plan by reducing cortisol and thereby influencing body weight.

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## D-21 Free Communication/Poster - Fitness and Performance Testing III

MAY 31, 2012 1:00 PM - 6:00 PM  
ROOM: Exhibit Hall

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**2403** Board #78 MAY 31 2:00 PM - 3:30 PM

### Gender Differences in Isokinetic Strength and Endurance among Division II Athletes

Elizabeth Mathews, Kara Feller, Robert S. Van Zant. *The University of Findlay, Findlay, OH.*  
(No relationships reported)

**PURPOSE:** Gender disparity is noted in ACL injury. Muscles acting on the knee provide dynamic stabilization to the joint. The purpose of this study was to identify the gender differences in isokinetic muscular strength and endurance among Division II athletes in sports (soccer, basketball, volleyball) most susceptible to ACL injury.

**METHODS:** 33 Division II athletes (15 female, 18 male) provided informed consent for participation. Prior to their competitive season, athletes were tested for knee flexion and extension muscular strength and endurance in both dominant (D) and non-dominant (ND) legs using a Biodex 3 isokinetic dynamometer. Once seated and stabilized, subjects first performed 6 maximal repetitions at 1.04 and 4.19 radians per second (rad/sec). To test muscular endurance, subjects then performed 60 maximal repetitions at 3.14 rad/sec. Peak torque (PT), time to PT, PT to body weight ratio (PT/BW), and agonist/antagonist ratio (AGON/ANTAG) were determined at all 3 test speeds. In the endurance set, percent total work performed in the first third and final third of the set, as well as 30 and 60 sec recovery percentage of PT were assessed. All tests were conducted by the same investigator, providing standardized verbal feedback. All parameters were analyzed for group (gender) differences via independent t-test using SPSS statistical software.

**RESULTS:** Males were significantly ( $p < 0.05$ ) taller, heavier and leaner than females. In D and ND knee extension at all test speeds, males generated significantly greater PT and PT/BW. No gender differences were noted in time to PT, AGON/ANTAG, or any of the muscular endurance parameters. In D and ND knee flexion at all test speeds, males generated significantly greater PT and, with the exception of D leg at all speeds, PT/BW. No differences were noted in time to PT, AGON/ANTAG, or any of the endurance measures.

**CONCLUSIONS:** Even when corrected for body weight differences, Division II male athletes generate significantly greater knee extension torque and, in the ND leg, knee flexion torque. No gender differences were noted regarding muscular endurance in knee extension and flexion. Female Division II athletes may lack comparable dynamic knee joint stability relative to their male peers due to their reduced ability to generate maximal muscular strength.

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**2404** Board #79 MAY 31 2:00 PM - 3:30 PM

### Heart Rate Variability and Maximal Oxygen Consumption in Healthy College Students

Andrew G. Thompson<sup>1</sup>, Carmine Grieco<sup>1</sup>, David Swain, FACSM<sup>1</sup>, James Onate<sup>2</sup>, Nelson Cortes<sup>3</sup>. <sup>1</sup>Old Dominion University, Norfolk, VA. <sup>2</sup>The Ohio State University, Columbus, OH. <sup>3</sup>George Mason University, Fairfax, VA.  
(No relationships reported)

The relationship between heart rate variability (HRV) and maximal oxygen consumption (VO<sub>2</sub>max) is equivocal. Results from recent studies suggest the relationship between HRV and VO<sub>2</sub>max is inconclusive.

**PURPOSE:** To examine possible correlations between resting HRV and VO<sub>2</sub>max in twenty-four healthy college students ( $22 \pm 3.7$  yr).

**METHODS:** HRV time and frequency-domain measures were calculated from electrocardiogram (ECG) recordings taken by a BioHarness during supine metronomic breathing (6 bpm). Five minutes of recumbent rested breathing was performed prior to five minutes of ECG recording. An incremental, maximal treadmill test and closed circuit spirometry was used to determine VO<sub>2</sub>max ( $51.6 \pm 11.1$  mL·min<sup>-1</sup>·kg<sup>-1</sup>).

**RESULTS:** Several significant inverse correlations between HRV indices and resting heart rate were found in both time and frequency-domain measures: Standard Deviation of Normal R-R intervals ( $r = -0.876$ ,  $p < 0.001$ ), Root Mean Squared of the Standard Deviation ( $r = -0.827$ ,  $p < 0.001$ ), HRV Triangular Index ( $r = -0.789$ ,  $p < 0.001$ ), Low Frequency (LF) in milliseconds ( $r = -0.758$ ,  $p < 0.001$ ), and High Frequency (HF) in milliseconds ( $r = -0.725$ ,  $p < 0.001$ ). There were, however, no significant correlations between HRV indices and VO<sub>2</sub>max.

**CONCLUSIONS:** These findings suggest that in a healthy college-aged population HRV and VO<sub>2</sub>max are independent of one another. Future research should examine the differences in athletic performance of equally fit individuals with different HRV profiles.

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**2405** Board #80 MAY 31 2:00 PM - 3:30 PM

### The Effect Of Bio-feedback Manipulation On Incidence Of Plateau At VO<sub>2</sub>max.

Oliver Caddy<sup>1</sup>, Paul Bond<sup>1</sup>, Dan Gordon<sup>1</sup>, Richard Barnes<sup>2</sup>, Marie Gernigon<sup>3</sup>. <sup>1</sup>Anglia Ruskin University, Cambridge, United Kingdom. <sup>2</sup>Cambridge University, Cambridge, United Kingdom. <sup>3</sup>University of Angers, Angers, France.  
(No relationships reported)

**PURPOSE:** The purpose of this study was to determine the effects of altering the perception of effort, for the duration of a maximal oxygen uptake (VO<sub>2</sub>max) trial, through bio-feedback on the incidence of plateau at VO<sub>2</sub>max.

**METHOD:** Following Local University Institutional ethical approval, 7 active male participants volunteered to participate (age  $23.9$  yrs  $\pm 5.0$ ; mass  $82.8$  kg  $\pm 9.4$ ; stature  $180.9$  cm  $\pm 9.4$ ; VO<sub>2</sub>max  $49.19$  ml·kg<sup>-1</sup>·min<sup>-1</sup>  $\pm 5.41$ ). All participants completed four gradient-based VO<sub>2</sub>max trials on a treadmill using a ramp of 0.5%·30s<sup>-1</sup> at a constant speed of 10kph  $\pm 1$ . The initial trial served as a familiarisation. During the remaining three trials, which were completed in a randomised order, heart rate was displayed to the participants as the actual value (HR-A) and with variation of -10 b·min<sup>-1</sup> (HR-L) and +10 b·min<sup>-1</sup> (HR-H). Throughout all four trials VO<sub>2</sub> was recorded on a breath by breath basis using a pre-calibrated metabolic cart. The chosen criterion for attainment of a plateau response was a  $\Delta VO_2 \leq 50$  ml·min<sup>-1</sup> between the final two consecutive 30s sampling periods. At least one secondary criterion for the attainment of VO<sub>2</sub>max was employed: RER  $> 1.15$ ;  $\Delta RER \geq 0.4$ ; HR<sub>max</sub> 220-age  $\pm 10$  b·min<sup>-1</sup>; RPE  $> 19$ .

**RESULTS:** Across all three conditions there was no significant difference in VO<sub>2</sub>max and end workload ( $p > 0.05$ ). The  $\Delta VO_2$  values (ml·kg<sup>-1</sup>·min<sup>-1</sup>) between the final two consecutive 30s samples were HR-L  $68.95 \pm 46.42$ ; HR-A  $23.78 \pm 24.15$ ; HR-H  $55.27 \pm 61.29$ .  $\Delta VO_2$  was significantly lower in HR-A than HR-L ( $p = 0.04$ ) but there was no significant difference between HR-L and HR-H or HR-H and HR-A ( $p > 0.05$ ). The incidence of plateau varied across trials, HR-L 43%, HR-A 86%, HR-H 57%. RPE remained statistically unchanged ( $p > 0.05$ ) HR-L  $18.5 \pm 1.6$ ; HR-A  $18.7 \pm 1.8$ ; HR-H  $19 \pm 1.2$ .

**CONCLUSION:** These data are implicit of a detrimental effect on the attainment of a plateau in VO<sub>2</sub>max, with manipulation of biofeedback. Given the disassociation between RPE and the behaviour of  $\Delta VO_2$  at exhaustion, it is conceivable that differences in plateau attainment are instead related to a deviation from the mental map set during the familiarisation trial. Such a divergence may detract from the efficacy of a teleoanticipatory pacing strategy and, in turn, influence the central regulatory command at the end of a VO<sub>2</sub>max trial.

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2406 Board #81 MAY 31 2:00 PM - 3:30 PM

**Impact Of K4b2 Calibration Drift On Respiratory Measurements During Walking And Running**

Chris Easton<sup>1</sup>, Chris C.F. Howe<sup>1</sup>, Richard O. Matzko<sup>1</sup>, Fabio Piaser<sup>2</sup>, Yannis P. Pitsiladis, FACSM<sup>2</sup>. <sup>1</sup>Kingston University, Kingston upon Thames, United Kingdom. <sup>2</sup>University of Glasgow, Glasgow, United Kingdom.  
(No relationships reported)

The K4b<sup>2</sup> (COSMED s.r.l, Rome, Italy) is a portable metabolic analyser designed to measure breath-by-breath respiratory variables in the field. While the majority of published evidence suggests that the K4b<sup>2</sup> is valid and reliable during rest and exercise, it has been previously demonstrated that the accuracy of the %O<sub>2</sub> and %CO<sub>2</sub> measurements can drift over time (McLaughlin *et al.* 2001. *Int J Sports Med* 22(4): 280-284). However, the effect of K4b<sup>2</sup> calibration drift on respiratory variables during prolonged exercise tests is presently unclear.

**PURPOSE:** To examine the accuracy of K4b<sup>2</sup> measurements of VO<sub>2</sub>, VCO<sub>2</sub> and V<sub>E</sub> following a one hour delay between calibration and measurement.

**METHODS:** Ten male participants (age: 31 ± 11 years, height: 181 ± 3 cm and body mass: 84.1 ± 10.0 kg) completed three maximal discontinuous incremental exercise tests on a motorized treadmill at speeds corresponding to 4, 5, 6, 8, 10, 12, 14 and 16 km·hr<sup>-1</sup>, or until volitional exhaustion. Participants completed 3 min of exercise at each speed, followed by 3 min active recovery for all speeds above 10 km·hr<sup>-1</sup>. Respiratory variables were measured continuously using either a laboratory based metabolic cart (Oxycon Pro, Carefusion, Germany) (OP), a K4b<sup>2</sup> calibrated immediately before use (K4b<sup>2</sup>) or a K4b<sup>2</sup> calibrated one hour prior to the test (K4b<sup>2</sup>DEL).

**RESULTS:** VCO<sub>2</sub> and V<sub>E</sub> were not different when measured by K4b<sup>2</sup> ( $P=0.27$ ,  $P=0.53$  respectively) or K4b<sup>2</sup>DEL ( $P=0.14$ ,  $P=0.39$  respectively) compared to the OP. VO<sub>2</sub> was not different between OP and K4b<sup>2</sup> ( $P=0.19$ ) but K4b<sup>2</sup>DEL overestimated VO<sub>2</sub> compared to the OP at faster running speeds ( $P=0.05$ ). Bland and Altman analysis indicated good agreement in the measurement of VO<sub>2</sub> between OP and K4b<sup>2</sup> with a mean difference of 38 ml·min<sup>-1</sup> and limits of agreement between -285 and 208 ml·min<sup>-1</sup>. The mean difference between K4b<sup>2</sup>DEL and OP was 84 ml·min<sup>-1</sup> with limits of agreement between -469 and 302 ml·min<sup>-1</sup>.

**CONCLUSIONS:** The K4b<sup>2</sup> overestimated VO<sub>2</sub> during faster running speeds following a one hour delay between calibration and measurement. Whilst care should be taken when using this device for longer duration exercise tests, the extent of the differences were small and newer models of the K4b<sup>2</sup> are fitted with a periodical recalibration mechanism which may eliminate this issue.

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2407 Board #82 MAY 31 2:00 PM - 3:30 PM

**Gas Exchange Fatigue Thresholds From Ramp Versus Step Incremental Cycle Ergometer Tests**

Miranda T. Goodman, Jorge M. Zuniga, Chad Harris, FACSM. *Western New Mexico University, Silver City, NM.* (Sponsor: Chad Harris, FACSM)  
(No relationships reported)

**PURPOSE:** The purpose of this study was to compare the VO<sub>2</sub> (L·min<sup>-1</sup>) associated with the gas exchange threshold (GET) and respiratory compensation point (RCP) for ramp versus step incremental cycle ergometer tests.

**METHODS:** Seven male and seven female subjects (age = 23.36 ± 3.34 years; body mass = 71.65 ± 11.10 kg) performed a ramp (15 W·min<sup>-1</sup>) and step (30 W every 2 min) incremental cycle ergometer tests to exhaustion (in random order) to determine VO<sub>2</sub> max (L·min<sup>-1</sup>) RCP (VO<sub>2</sub> L·min<sup>-1</sup>), and GET (VO<sub>2</sub> min<sup>-1</sup>). The values GET and RCP were determined using the V-slope method. GET and RCP were defined as the VO<sub>2</sub> values corresponding to the intersection of 2 linear regression lines derived separately from the data points below and above the breakpoints for VCO<sub>2</sub> vs. VO<sub>2</sub> (GET) and V<sub>E</sub> vs. VCO<sub>2</sub> (RCP). In addition, the total work performed (kJ) during each protocol was calculated from the integral of power output versus time. Paired *t*-tests were used to analyze the mean differences between the ramp and step protocols.

**RESULTS:** The results showed no significant differences in VO<sub>2</sub> (L·min<sup>-1</sup>) between ramp and step incremental cycle ergometer tests for VO<sub>2</sub> max (ramp = 2.94 ± 0.74 L·min<sup>-1</sup> and step = 2.91 ± 0.70 L·min<sup>-1</sup>,  $p = 0.91$ ), GET (ramp = 1.86 ± 0.51 L·min<sup>-1</sup> and step = 1.90 ± 0.57 L·min<sup>-1</sup>,  $p = 0.83$ ) and RCP (ramp = 2.46 ± 0.63 L·min<sup>-1</sup> and step = 2.47 ± 0.56 L·min<sup>-1</sup>,  $p = 0.95$ ). A significantly greater ( $p = 0.01$ ) amount of total work was performed for the step (118.27 ± 45.51 kJ) versus the ramp (108.12 ± 39.70 kJ) test.

**CONCLUSION:** The results of the present study indicate that despite the increased amount of work performed for the step versus the ramp incremental cycle ergometer test, there were no significant differences in the VO<sub>2</sub> (L·min<sup>-1</sup>) associated to the gas exchange fatigue thresholds that demarcate the moderate from heavy (i.e., GET) and heavy from severe (i.e., RCP) exercise intensity domains.

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2408 Board #83 MAY 31 2:00 PM - 3:30 PM

**Metabolic Responses When Jogging on an Anti-Gravity Treadmill**

Michael A. Figueroa<sup>1</sup>, James Manning, FACSM<sup>1</sup>, John M. Wolkstein<sup>2</sup>, Patricia Escamilla<sup>1</sup>. <sup>1</sup>William Paterson University, Wayne, NJ. <sup>2</sup>MCRC Physical Therapy, West Orange, NJ.  
(No relationships reported)

**PURPOSE:** To determine whether there would be any significant differences in metabolic work when jogging to maximal aerobic capacity on an anti-gravity treadmill, using differential air pressure, at different percentages of body weight (100%, 90% and 80% BW).

**METHODS:** Metabolic data were collected on 10 subjects (5 males, 5 females) on three separate days, which were separated by two weeks. The order in which body weight was manipulated was randomized on each day of testing. Maximal oxygen consumption was assessed using the Bruce Protocol and a metabolic cart.

**RESULTS:** Absolute VO<sub>2</sub>max values (L/min) were significantly different between, but not within genders, at each percent of body weight (100%BW: males = 3.4 ± 1.1 vs. females = 2.4 ± 0.25; 90%BW: males = 3.3 ± 1.1 vs. females = 2.4 ± 0.4; 80%BW: males = 3.4 ± 0.9 vs. females = 2.3 ± 0.3,  $p < 0.05$ ). Relative VO<sub>2</sub>max (ml/kg/min) was not found to be significantly different at 100%, 90% or 80% BW (42 ± 8 vs. 43 ± 9 vs. 42 ± 7,  $p = 0.99$ ). Heart rate (HR), respiratory exchange ratio (RER) values and substrate utilization were also not found to be significantly different between body weight percentages during any stage of testing.

**CONCLUSION:** Removal of up to 20% bodyweight did not alter metabolic responses (VO<sub>2</sub>, HR, RER, substrate utilization) during jogging to maximal aerobic capacity. Prescribed cardiovascular training intensities can be achieved with a reduction in ground reaction forces. This type of weight-assisted device may be an effective alternative during rehabilitation or recovery after an event in order to maintain cardiovascular fitness.

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2409 Board #84 MAY 31 2:00 PM - 3:30 PM

**Exercise Tolerance During Cardiopulmonary Exercise Testing**

Adrian Midgley<sup>1</sup>, Peter Clough<sup>1</sup>, Fiona Earle<sup>1</sup>, Earle Keith<sup>1</sup>, Jason Siegler, FACSM<sup>2</sup>. <sup>1</sup>University of Hull, Hull, United Kingdom. <sup>2</sup>University of Western Sydney, Sydney, Australia.  
(No relationships reported)

**PURPOSE:** Subjects are expected to continue exercising to their limit of tolerance during a cardiopulmonary exercise test (CPET), since a maximal or near maximal effort is generally considered necessary for valid test results. However, very little is known about exercise tolerance during CPET.

**METHODS:** Fifty apparently healthy men visited the laboratory on two occasions. The first visit was mainly to familiarise the subjects with the equipment and test procedures and to complete questionnaires and a pain threshold test. On the second visit, subjects performed a maximal incremental treadmill test. After the test they completed a questionnaire to establish why they terminated the test when they did, to rate how helpful they found the verbal encouragement given during the test, how long they estimated it would have been before they would have collapsed on the treadmill or fell off the back if they did not terminate the test at the moment they did (time to collapse), and whether they set themselves any performance goals. Maximum jump height and lung function were measured before and after the CPET.

**RESULTS:** Twenty-three men terminated the test mainly due to leg fatigue and discomfort, 11 due to breathing discomfort, 2 due to safety concerns, and 14 because of other reasons. The mode for the total number of reasons that subjects stated influenced why they terminated the test when they did was six (range = 12). The median (IQR) estimated time to collapse was 45 (60) s. Correlates of time to collapse were perceived pre-exercise mental and physical readiness ( $r_s = -0.32$ ,  $p = 0.024$ ), self-reported preference for ( $r_s = -0.41$ ,  $p = 0.011$ ) and tolerance to ( $r_s = -$

0.35,  $p = 0.031$ ) high-intensity exercise, and change in maximal voluntary ventilation ( $r_s = -0.37$ ,  $p = 0.011$ ). The change in maximal jump height ( $r = 0.17$ ,  $p = 0.26$ ) and pain threshold ( $r_s = -0.19$ ,  $p = 0.20$ ) were not significantly correlated to time to collapse. The median (IQR) perception of the usefulness of verbal encouragement was 70 (37), where zero was 'not at all helpful' and 100 was 'extremely useful'. Thirty-nine of the subjects set themselves some sort of performance goals before or during the CPET.

**CONCLUSIONS:** The present study indicates that psychological factors result in termination of a CPET a relatively long before any physiological catastrophe occurs.

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**2410 Board #85 MAY 31 2:00 PM - 3:30 PM**

**Influence Of Endurance Training On The Development Of Hemoglobin Mass During Adolescence**

Jon P. Wehrlin, Thomas Steiner. *Swiss Federal Institute of Sport, Magglingen, Switzerland.* (Sponsor: Ben Levine, FACSM)

(No relationships reported)

It is well known, that adult elite endurance athletes are characterized by about 30% higher hemoglobin mass ( $Hb_{mass}$ ) than untrained subjects. However, it is unclear, if this is due to endurance training, a better genetic predisposition of the athletes combined with a selection process, or other factors. Interestingly,  $Hb_{mass}$  at age 16 yrs is reported to be not different between endurance athletes and untrained subjects.

**PURPOSE:** To study the development of  $Hb_{mass}$  in elite endurance athletes and age matched untrained controls during adolescence with a longitudinal approach.

**METHODS:** We measured  $Hb_{mass}$  in 10 Swiss national team endurance athletes (AG: cross-country skiers and triathletes) as well as in 12 age matched non endurance training controls (CG) every 0.5 yrs from age 16 to age 18.5 yrs (T1 - T6) with the optimized carbon monoxide re-breathing technique.

**RESULTS:**  $Hb_{mass}$  increased ( $p < 0.001$ ) in the AG and was  $797 \pm 96$  g (T1),  $826 \pm 110$  g (T2),  $852 \pm 114$  g (T3),  $876 \pm 120$  g (T4),  $897 \pm 116$  g (T5) and  $902 \pm 123$  g (T6) as well as in the CG ( $p < 0.001$ ) from  $766 \pm 95$  g (T1) to  $797 \pm 90$  g (T2),  $833 \pm 100$  g (T3),  $845 \pm 94$  g (T4),  $855 \pm 95$  g (T5) and  $868 \pm 98$  g (T6). There were no differences between the groups in the initial  $Hb_{mass}$  level and in the rate of increase per year between the AG (5.2 $\pm$ 2.1%) and the CG (5.6 $\pm$ 4.7%). These rates of increase were individually highly different and ranged between 2.5 and 9.3% in the AG and between 1.2 and 16.9% in the CG. The correlation between the increase in  $Hb_{mass}$  and the increase in body weight was  $r = 0.81$  ( $p < 0.01$ ). Body weight related  $Hb_{mass}$  increased ( $p < 0.05$ ) during the measurement period from  $12.7 \pm 1.0$  g/kg (T1) to  $13.1 \pm 1.3$  g/kg (T6) in the AG as well as from  $12.1 \pm 0.9$  g/kg (T1) to  $12.6 \pm 0.7$  g/kg (T6) in the CG ( $p < 0.05$ ).

**CONCLUSION:**  $Hb_{mass}$  increases during adolescence, but there is no difference in increase rates between national team endurance athletes and untrained subjects. The amount of endurance training seems, therefore, not to influence the development of  $Hb_{mass}$  in adolescent subjects. The increase in  $Hb_{mass}$  is strongly correlated with the increase in bodyweight and increase rates are highly individually different. Other unknown factors may be responsible for these different increase rates in  $Hb_{mass}$  during adolescence.

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**2411 Board #86 MAY 31 2:00 PM - 3:30 PM**

**All-out Critical Power Test Predicts Time-to-exhaustion During Ramp Incremental And Constant-work-rate Exercise**

Weerapong Chidnok<sup>1</sup>, Fred J DiMenna<sup>2</sup>, Stephen J Bailey<sup>1</sup>, Daryl P Wilkerson<sup>1</sup>, Anni Vanhatalo<sup>1</sup>, Andrew M Jones, FACSM<sup>1</sup>. <sup>1</sup>University of Exeter, Devon, United Kingdom. <sup>2</sup>Adelphi University, Garden City, NY.

(No relationships reported)

The power-duration relationship for severe-intensity exercise is defined by two parameters: the critical power (CP) and the  $W'$  which represents a fixed amount of work that can be performed above CP. These parameters can be established in a 3-min all-out cycling test, where the end-test power represents the CP and the work done above CP represents the  $W'$ . According to the power-duration principle, the total work done  $>CP$  ( $W_{>CP}$ ) during exhaustive exercise is the same irrespective of the work-rate forcing function, provided that the work-rate does not fall below CP.

**PURPOSE:** To test the hypothesis that the CP and  $W'$  derived from the 3-min all-out test accurately predict time-to-exhaustion ( $T_{lim}$ ) during ramp incremental and constant-work-rate (CWR) exercise  $>CP$ .

**METHODS:** Following ethical approval, seven recreationally-active male subjects (mean  $\pm$  SD: age  $21 \pm 4$  years) completed a ramp incremental test, a 3-min all-out test for the determination of CP and  $W'$ , and a CWR test until exhaustion on a cycle ergometer. The CWR was predicted to result in exhaustion in 3 min using the power-duration equation [ $P = (W'/180 \text{ s}) + CP$ ] and the predicted  $T_{lim}$  in the ramp test ( $T_p$ ) was calculated as:  $T_{lim} = CP/S + \sqrt{(2W'/S)}$ , where S is the ramp slope (0.5 Watts/s). Data were analyzed using paired samples  $t$ -tests and Pearson correlation coefficients. Significance was accepted at  $P < 0.05$ .

**RESULTS:** The CP and  $W'$  estimated in the 3-min all-out test were  $260 \pm 60$  W and  $16.5 \pm 4.0$  kJ. The  $W_{>CP}$  during the CWR ( $16.5 \pm 7.4$  kJ) and the ramp incremental test ( $16.4 \pm 8.4$  kJ) were not different from the  $W'$  measured in the all-out test ( $P > 0.05$ ). The predicted  $T_{lim}$  ( $754 \pm 122$  s) for the ramp incremental test was not different from ( $P > 0.05$ ), and was highly correlated with, the actual  $T_{lim}$  ( $753 \pm 121$  s;  $r = 0.92$ ,  $P < 0.01$ ). The predicted  $T_{lim}$  in the CWR test of 180 s was not different from ( $P > 0.05$ ), and was highly correlated with, the actual  $T_{lim}$  ( $185 \pm 24$  s;  $r = 0.99$ ;  $P < 0.01$ ).

**CONCLUSION:** The 3-min all-out test accurately predicted the  $T_{lim}$  during both ramp incremental and CWR exercise. These results provide further evidence that the power-duration parameters estimated in a single-visit all-out protocol provide meaningful predictions of exercise tolerance, and support the notion that only a finite amount of work is achievable above CP before exhaustion.

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**2412 Board #87 MAY 31 2:00 PM - 3:30 PM**

**The Effect of a Priming Exercise on Cardiac Output Kinetics**

Ryan A. Seeto, Greg D. Wells, Scott G. Thomas. *University of Toronto, Toronto, ON, Canada.*

(No relationships reported)

A priming or warm-up exercise has been shown to accelerate oxygen uptake kinetics in a subsequent exercise; however, the mechanisms in which these changes occur is not well understood. One possible explanation for the accelerated oxygen uptake kinetics following a priming exercise may be due to adaptations in cardiac output (Q).

**PURPOSE:** To determine the effects of a priming exercise on Q kinetics.

**METHODS:** Following an assessment day to determine  $VO_{2max}$  and lactate threshold, seven moderately trained cyclists ( $VO_{2max}$ :  $58.4 \pm 11.6$  mL $\cdot$ min $^{-1}$  $\cdot$ kg $^{-1}$ ; height:  $1.75 \pm 0.07$  m; weight:  $73.9 \pm 14.1$  kg; age:  $29 \pm 6$  yrs) performed 6 minutes of cycling at a work rate equal to 10% above lactate threshold (unprimed; U) followed by a 3 minutes of no cycling and 6 minutes of cycling at an equivalent work rate to U (primed; P). Bioelectrical impedance was used to determine Q. Kinetics were modeled using a monoexponential equation and comparison between U and P trials were made using ANOVA.

**RESULTS:** While the Q time constant ( $\tau$ ) was not significantly different between U and P trials ( $42.3 \pm 9.6$  vs.  $39.7 \pm 10.7$  s,  $p = 0.62$ ), baseline Q was trended higher in the P trial ( $5.1 \pm 0.8$  vs.  $6.6 \pm 1.9$  L $\cdot$ min $^{-1}$ ,  $p = 0.06$ ). The absolute asymptotic Q value was significantly higher in the P trial ( $15.9 \pm 2.1$  vs.  $16.7 \pm 2.1$  L $\cdot$ min $^{-1}$ ,  $p < 0.05$ ). Heart rate (HR) kinetics shared a similar trend with Q. The HR  $\tau$  was not significantly different between U and P ( $41.1 \pm 7.2$  vs.  $40.9 \pm 9.1$  s.,  $p = 0.95$ ) while baseline HR ( $68.9 \pm 8.8$  vs.  $83.7 \pm 14.0$  beats $\cdot$ min $^{-1}$ ,  $p < 0.025$ ) and absolute asymptotic HR ( $152.8 \pm 13.3$  vs.  $159.7 \pm 14.3$  beats $\cdot$ min $^{-1}$ ,  $p < 0.005$ ) were significantly higher in the P trial.

**CONCLUSIONS:** There was no significant difference between the HR and Q  $\tau$  of the U and P trial and there is significant increase in baseline HR and close to a significant increase in baseline Q in the P trial. Differences in Q response with priming may be due to absolute stroke volume. Faster  $VO_2$  kinetics with priming does not reflect a faster rate of Q adjustment.

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**2413 Board #88 MAY 31 2:00 PM - 3:30 PM**

**Changes of Incremental Exercise VO2 Kinetics between Different Fitness Levels**

Pei-Fan Wang, Li-Lan Fu, Yi-Tzu Chen. *National Taiwan Sports University, Taoyuan, Taiwan.*

(No relationships reported)

The analysis of  $VO_2$  kinetics in the previous studies focused more often in continuous exercise test. However, incremental exercise as an evaluation test or prescription raised clinical attention recently, but research evidence is still scant.



**PURPOSE:** The purpose of this study was to investigate the changes of incremental exercise VO<sub>2</sub> kinetics between people with different fitness level.

**METHODS:** Physically active college male students were recruited into this study. There were two groups of subjects, high-fitness (HF: 20.22 ± 2.11 yr, 177.89 ± 4.48cm, 72.06 ± 10.88 kg, VO<sub>2max</sub>: 58.87 ± 1.62 ml.kg<sup>-1</sup>.min<sup>-1</sup>; n=9) and low-fitness (LF: 19.33 ± 1.12 yr, 177.78 ± 5.95 cm, 79.82 ± 13.34 kg, VO<sub>2max</sub>: 44.10 ± 2.31 ml.kg<sup>-1</sup>.min<sup>-1</sup>; n=9). All subjects completed two 6-min bouts of moderate-intensity (63%VO<sub>2max</sub>) and severe-intensity(95%VO<sub>2max</sub>) running incremental exercise test (separated by 10 min of rest). Breath-by-breath pulmonary gas exchange (SensorMedics, Vmax 29) and HR were measured. One-way repeated-measure ANOVA was used to compare the ΔVO<sub>2</sub> of each minutes between the 2 groups under different intensity.

**RESULTS:** TheΔVO<sub>2</sub> during SI exercise [HF: ΔVO<sub>2(2-1), (3-2), (4-3), (5-4), (6-5)</sub>:11.48, 6.65, 0.49, 0.73, -0.73ml.kg<sup>-1</sup>.min<sup>-1</sup>; LF: ΔVO<sub>2(2-1), (3-2), (4-3), (5-4), (6-5)</sub>: 6.0, 6.49, 1.31, 0.54, -0.54 ml.kg<sup>-1</sup>.min<sup>-1</sup>, respectively] was plateaued at third minute for both groups (VO<sub>2</sub> between 3 and 4 min, HF: p = .15, LF: p = .26). TheΔVO<sub>2</sub> during MI exercise [HF: ΔVO<sub>2(2-1), (3-2), (4-3), (5-4), (6-5)</sub>: 9.51, 3.11, 0.48, -0.30, 0.30 ml.kg<sup>-1</sup>.min<sup>-1</sup>; LF: ΔVO<sub>2(2-1), (3-2), (4-3), (5-4), (6-5)</sub>: 6.41, 3.4, 0.98, 0.27, -0.27 ml.kg<sup>-1</sup>.min<sup>-1</sup>, respectively] was plateaued at third minute for LF groups (VO<sub>2</sub> between 3 and 4 min, p = .87), but at second minute for the HF group (VO<sub>2</sub> between 2 and 3 min, p = 1.5).

**CONCLUSIONS:** Under moderate-intensity exercise, subjects at different fitness level achieved stages of stable VO<sub>2</sub> at different timing. HF participants can reach stable VO<sub>2</sub> earlier than participants in LF.

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**2414** Board #89 MAY 31 2:00 PM - 3:30 PM

**Effect Of Exercise Order On Cardiorespiratory And Perceptual Responses To Concurrent Exercise**

Nicholas W. Aguirre<sup>1</sup>, Jeremy G. Tan<sup>1</sup>, Daniel R. Coats<sup>1</sup>, Barry A. Spiering<sup>2</sup>, Lee E. Brown, FACSM<sup>1</sup>, Jared W. Coburn, FACSM<sup>1</sup>, Daniela A. Rubin<sup>1</sup>, Daniel A. Judelson, FACSM<sup>1</sup>. <sup>1</sup>California State University, Fullerton, Fullerton, CA. <sup>2</sup>United States Army Research Institute of Environmental Medicine, Natick, MA.  
(No relationships reported)

A training bout combining resistance (RE) and endurance exercise (EE) in a single session is termed concurrent exercise (CE). To date, few investigations have characterized the acute physiological and perceptual responses to CE order despite its popularity of its use for sport, recreational and health reasons. Since exercise order might influence RE and/or EE quality (and thereby overall training adaptations), elucidating these acute responses is integral for optimizing program design.

**PURPOSE:** To examine the effects of CE order on cardiorespiratory and perceptual responses.

**METHODS:** Nine healthy, concurrently trained subjects (age = 22.7 ± 1.7 y; mass = 84.8 ± 11.9 kg; height = 176.1 ± 7.4 cm) performed two CE trials: one in which RE (squat, bench press, lat pulldown: 60% 1-RM, 4 sets x 10 reps, 90-s rest) preceded EE (RE-EE) and one in which EE (cycling: 80% ventilatory threshold for 30-min) preceded RE (EE-RE). Heart rate (HR) and rating of perceived exertion (RPE) were recorded following each set of RE and every five minutes during EE. In addition, VO<sub>2</sub> and respiratory exchange ratio (RER) were recorded every 2.5 minutes during EE.

**RESULTS:** Subjects experienced significantly greater HR throughout RE in EE-RE (151 ± 5 bpm) compared to RE-EE (136 ± 5 bpm), concomitant with increased RPE during the squat exercise (EE-RE = 15 ± 2; RE-EE = 13 ± 1). Similarly, the HR and RPE elicited by EE during EE-RE significantly exceeded RE-EE for the first 10 and 15 min of exercise, respectively. Finally, VO<sub>2</sub> significantly increased and RER significantly decreased periodically during EE in RE-EE compared to EE-RE.

**CONCLUSIONS:** In conclusion, 1) preceding RE with EE increases RE cardiovascular and perceptual demands, and 2) preceding EE with RE increases EE caloric expenditure, fat oxidation, HR and RPE. This study supports performing RE before EE if superior caloric expenditure and fat oxidation is desired during EE, albeit at a higher physiological and perceptual cost.

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**2415** Board #90 MAY 31 2:00 PM - 3:30 PM

**Strength And Cardiovascular Fitness Measures Over Time Regarding Sex, Age, And Season Of Testing**

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(No relationships reported)

Muscular strength and cardiovascular fitness are often assessed during short- and long-term research studies. Familiarization sessions are intended to habituate participants with testing procedures, but they are typically used before initial data collection and not prior to follow-up testing.

**PURPOSE:** To examine the repeatability of muscular strength and VO<sub>2max</sub> measures over 6 months regarding age, sex, and season of initial testing, and to determine if repeating a familiarization session after a 6 month time period is necessary.

**METHODS:** 208 participants (100 men and 108 women, aged 20-76 yr) completed a familiarization session at visit 1 consisting of all strength assessments. Baseline testing occurred 3 days later and consisted of handgrip, isometric, and isokinetic strength measures of the dominant arm and leg at visit 2 and visit 3, which were also separated by 3 days; VO<sub>2max</sub> was assessed only at visit 2. After 6 months, participants completed the same strength assessments at visit 4 and 5; VO<sub>2max</sub> was assessed only at visit 4. A second familiarization visit was not performed prior to visit 4 or 5. Data were analyzed using a repeated measures analysis of variance (ANOVA). Significant interactions were investigated *post hoc* using a Tukey's HSD test.

**RESULTS:** No changes in strength over time with regard to sex, age cohort, or season were observed in grip strength, isometric elbow flexor and knee extensor strength, and isokinetic elbow flexor strength at 60 and 180 deg.sec<sup>-1</sup>. For example, isometric elbow flexor strength was similar at baseline (51.5 ± 1.4 Nm) and 6 months (52.0 ± 1.4 Nm), and VO<sub>2max</sub> did not change from baseline (33.3 ± 0.7 ml.kg<sup>-1</sup>.min<sup>-1</sup>) to 6 months (33.0 ± 0.7 ml.kg<sup>-1</sup>.min<sup>-1</sup>). A Time X Age Cohort interaction was observed for isokinetic knee extensor strength at 60 and 180 deg.sec<sup>-1</sup> (p<0.01), and further analysis showed that younger adults increased in strength over time for isokinetic knee extensor exercise at 180 deg.sec<sup>-1</sup> (118.6 ± 4.8 Nm to 127.0 ± 4.8 Nm).

**CONCLUSIONS:** Remarkable stability in strength and VO<sub>2max</sub> measures was observed over time for both sexes across the lifetime, and season of testing did not affect changes in strength from baseline to 6 month testing. Repeating a second familiarization after a 6-month time period may not be necessary.

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**2416** Board #91 MAY 31 2:00 PM - 3:30 PM

**A Simplified Approach For Estimating VT And RCT**

Giancarlo Condello, Ezekiel Reynolds, Aimee Schneider, Erica Wherry, Megan Knutson, Erika Casolino, Scott Doberstein, Mark Gibson, Jos J. de Koning, FACSM, Carl Foster, FACSM. University of Wisconsin-La Crosse, La Crosse, WI.  
(No relationships reported)

Determining absolute values for training intensity (e.g. running speed) often requires extensive laboratory evaluation that is not widely available or practical beyond the setting of elite athletes.

**PURPOSE:** This study evaluates whether physiologic thresholds, useful for training prescription (ventilatory threshold (VT) & respiratory compensation threshold (RCT)), can be determined as simple percentages of maximal running velocity during an incremental treadmill test.

**METHODS:** Thirty-one physically active students (16 male: age 22.5 ± 2.2y, height 183 ± 5cm, weight 81.9 ± 11.1kg, VO<sub>2max</sub> 59.3 ± 8 ml\*kg<sup>-1</sup>\*min<sup>-1</sup>; 15 female: age 21.8 ± 2.5y, height 163 ± 6cm, weight 61.8 ± 7.8kg, VO<sub>2max</sub> 50.6 ± 4.4 ml\*kg<sup>-1</sup>\*min<sup>-1</sup>) performed incremental, maximal treadmill running (1% grade, start @ 5 km\*h<sup>-1</sup> for 3 min + 0.8 km\*h<sup>-1</sup> every minute) with respiratory metabolism measured using open circuit spirometry. In stages where 1 min was not completed, maximal speed was interpolated based on proportional stage time. The speed at VT and RCT were determined by visual inspection of each individual test.

**RESULTS:** The mean ± sd maximal running speed for all subjects combined was 15.4 ± 2.1 km\*h<sup>-1</sup>. The mean ± sd running speed at VT (10.1 ± 1.6 km\*h<sup>-1</sup>) and RCT (12.9 ± 1.8 km\*h<sup>-1</sup>) represented 67 ± 9 and 84 ± 6 % of maximal running speed, respectively. Using lower and upper 95% confidence intervals for VT and RCT, respectively, ≤64% and ≥86% of maximal speed should produce conditions consistent with <VT and >RCT.

**CONCLUSION:** The VT and RCT can be predicted from simple percentages of the maximal running speed with reasonably accuracy, and may provide a simplified method of training prescription.

**2417** Board #92 **MAY 31 2:00 PM - 3:30 PM**  
**Physiological and Perceptual Responses to Inclined Walking With and Without Handrail Support**  
 John D. Smith, Kevin H. Kendrick. *Texas A&M University-San Antonio, San Antonio, TX.* (Sponsor: David Nichols, FACSM)  
 (No relationships reported)

Level and inclined treadmill walking is a common form of exercise in the home and at fitness centers. While rails (handrails) are available for balance purposes when walking on a treadmill, exercisers will often use the rails as supports, most noticeably when walking on an incline.

**PURPOSE:** To examine the effect of handrail holding on physiological and perceptual responses while walking on an inclined treadmill.

**METHODS:** Thirty-eight participants (33.9±9.1 yrs, 169.5±10.2 cm, 78.2±24.2 kg) walked at 4.8 kph (3 mph) for 3 minutes under 3 conditions in this continuous protocol in the following order: 1) level without the use of the rails, 2) at 10% grade while holding onto the handrail, and 3) at 10% grade without the use of the handrail. Metabolic measurements were recorded using a ParvoMedics TrueOne 2400 metabolic system (Sandy Lake, UT) interfaced with a Polar heart rate monitor and averaged for one minute during the final minute of each stage. Rating of perceived exertion (RPE) was measured with the Borg's 6-20 scale during the last 10 seconds of each stage. Data were analyzed using repeated measures ANOVA and are presented as mean ± SD.

**RESULTS:** Level walking resulted in significantly lower responses compared to graded walking while holding the rails for heart rate (104.5±18.0 vs 119.6±20.6 b/min, p<.05), VO<sub>2</sub> (14.3±3.3 vs 19.6±3.6 ml/kg/min, p<.05), and RPE (7.8±1.7 vs 9.6±2.1, p<.05). Likewise, graded walking while holding the rails resulted in significantly lower responses compared to graded walking without holding the rails for heart rate (119.6±20.6 vs 140.6±22.9 b/min, p<.05), VO<sub>2</sub> (19.6±3.6 vs 25.6±3.5 ml/kg/min, p<.05), and RPE (9.6±2.1 vs 11.9±2.4, p<.05).

**CONCLUSION:** Using the rail as a support may be beneficial with the use of an incline when greater workloads are warranted and an increase in speed is not desired. Handrail use while walking on an incline will result in a lowered metabolic response compared to not holding the rail. While greater intensity can be achieved with holding the handrail during incline walking compared to level walking, the intensity when holding the rails on an incline is not as great compared to incline walking without the rails.

**2418** Board #93 **MAY 31 2:00 PM - 3:30 PM**  
**Effect of Intermittent Capillary Blood Sampling on Physiological Responses During Load Incremented Cycle Ergometry**  
 Monica Taylor. *University of Pittsburgh, Pittsburgh, PA.*  
 (No relationships reported)

Effect of intermittent capillary blood sampling on physiological responses during load incremented cycle ergometry.

Taylor, M., Shafer, A., Wisniewski, K., Haile, L., Panzak, G., Nagle, E., FACSM, L., Goss, F., FACSM, and Robertson, R., FACSM. University of Pittsburgh, Pittsburgh, PA

The measurement of capillary blood to assess the lactate inflection point is used for health-fitness and performance applications. However it is unknown if capillary blood sampling impacts physiological responses during exercise testing.

**PURPOSE:** To compare the effect of capillary blood sampling on peak oxygen consumption (VO<sub>2</sub> peak; l·min<sup>-1</sup>), heart rate at VO<sub>2</sub> peak (HR<sub>p</sub>; b·min<sup>-1</sup>), Total Cycle Time (TCT; min), and Ventilatory breakpoint (V<sub>pt</sub>) during a load incremented cycle protocol.

**METHODS:** Eleven males (22.9±3.4 years), and ten females (22.1±2.7 years) performed two load incremented cycle ergometer tests (Trial A and Trial B) to obtain VO<sub>2</sub> peak (l·min<sup>-1</sup>), Ventilation (V<sub>e</sub>; l·min<sup>-1</sup>), VCO<sub>2</sub> (l·min<sup>-1</sup>), VO<sub>2</sub> (l·min<sup>-1</sup>), and HR (b·min<sup>-1</sup>) were recorded each min. The V<sub>pt</sub> was determined as the %VO<sub>2</sub>peak at which V<sub>e</sub>:VO<sub>2</sub> increased without an accompanying increase in V<sub>e</sub>:VCO<sub>2</sub>. TCT was recorded at test termination. Trial A included capillary blood lactate (BLa) measures taken during the last min of each stage. Trial B used an identical protocol without BLa measures. The order of administration of Trial A and Trial B was counter-balanced. **RESULTS:** There were no differences in VO<sub>2</sub> peak, HR<sub>p</sub>, TCT, and V<sub>pt</sub> between Trial A and Trial B (p>0.05).

**CONCLUSION:** Capillary blood sampling does not appear to adversely influence aerobic fitness variables during exercise testing. This finding supports incorporating capillary blood sampling into exercise testing protocols.

| Results |   |           |  |             |            |            |   |            |
|---------|---|-----------|--|-------------|------------|------------|---|------------|
| SEX     | VO <sub>2</sub> peak (l·min <sup>-1</sup> ) |           | HR <sub>p</sub> (b·min <sup>-1</sup> ) |             | TCT (min)  |            | V <sub>pt</sub> (%VO <sub>2</sub> peak) |            |
| Trial   | Trial A                                     | Trial B   | Trial A                                | Trial B     | Trial A    | Trial B    | Trial A                                 | Trial B    |
| Male    | 3.20±0.53                                   | 3.15±0.44 | 184.45±10.75                           | 186.09±9.93 | 17.81±3.55 | 16.44±3.69 | 67.09±7.20                              | 66.27±7.70 |
| Female  | 2.23±0.41                                   | 2.25±0.46 | 185.20±7.08                            | 185.50±7.32 | 13.94±3.21 | 14.42±2.84 | 72.70±7.93                              | 71.40±9.09 |

**2419** Board #94 **MAY 31 2:00 PM - 3:30 PM**  
**Aerobic Performance Recovers Within One Week After Blood Donation, With or Without Iron Supplementation**  
 Joel R. Krentz, Tyler B. Judd, Philip D. Chilibeck. *University of Saskatchewan, Saskatoon, SK, Canada.*  
 (No relationships reported)

Recently, our lab has shown that the time course for recovery of peak aerobic power after blood donation is between 2-3 weeks. Supplementation of iron may improve this recovery as iron is a constituent of hemoglobin.

**PURPOSE:** To examine the effects of iron supplementation on recovery of aerobic performance and red blood cell components after blood donation.

**METHODS:** 8 subjects (6 males, 2 females, 36 y, peak aerobic power 52.7 ml/kg/min) participated in the study. In a counter-balanced double-blind design subjects were randomized to receive either iron (65 mg) or placebo daily after donating blood. Subjects underwent 2 baseline testing days prior to donation. Recovery was monitored 24 hours post-donation and then weekly thereafter for 5 weeks. Exercise consisted of 45 minutes of cycle ergometry at ~50% peak work rate immediately followed by a 5 km time trial. At each time point pre-exercise hemoglobin and hematocrit levels were measured and ratings of perceived exertion (RPE) were taken at the 15, 30, 45 minute points of the pre-time trial exercise bout.

**RESULTS:** There were time main effects for both time trial performance and hemoglobin values (p<0.05). Post hoc analysis revealed that performance of the time trial was 5.5% slower the day after donation compared to baseline (417 SD 42 s vs. 395 SD 31 s; p<0.01) but then recovered by week 1 (406 SD 37 s). Hemoglobin decreased after donation (baseline = 15.4 SD 0.9 g/dL; 1 day after donation = 13.8 SD 1.1 g/dL p<0.05) and never recovered to pre-donation levels (13.3 SD 1.4 g/dL at 5 weeks). There was a time main effect of "time of exercise" for RPE with values increasing as exercise duration increased (p<0.001). No significant group by time interactions were observed for any of the measures.

**CONCLUSION:** Aerobic performance is significantly reduced the day after blood donation but recovers within one week, even in the absence of hemoglobin recovery. Iron supplementation does not affect aerobic performance or blood component recovery after donation.

Funded by the Saskatchewan Academy of Sports Medicine and NSERC

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2420 Board #95 MAY 31 2:00 PM - 3:30 PM

**Total Hemoglobin Mass, Erythrocyte Volume and VO<sub>2</sub>max in Overweight and Normal Weight Healthy Subjects**

Trine Karlsen, Ingeborg M. Leinan, Fredrik Bækkerud, Frederic Solberg, Asbjørn Støylen, Ulrik Wisløff, Øivind Rognmo. *Norwegian University of Science and Technology, Trondheim, Norway.*

(No relationships reported)

Endurance athletes have significantly higher hemoglobin mass than recreational athletes and total hemoglobin mass correlates well with maximal oxygen uptake (VO<sub>2</sub>max). Less data is available on total hemoglobin mass in inactive overweight subjects.

**PURPOSE:** In a cross sectional study compare total hemoglobin mass, erythrocyte volume and VO<sub>2</sub>max between overweight and normal weight subjects.

**METHODS:** In 20 physically inactive overweight subjects (12 women/8men, age 41 ± 9 Yr, BMI 30 ± 3), and 20 normal weigh subjects (12 women/8 men, age 40 ± 15 Yr, BMI 23 ± 3), total hemoglobin mass and erythrocyte volume was measured with the improved CO-rebreathing method. Maximal oxygen consumption was measured in all subjects with an individualized ramp protocol to exhaustion.

**RESULTS:** Total hemoglobin mass was 758 ± 159 g and 736 ± 199 g in overweight compared to normal weight subjects respectively (n.s). Total erythrocyte volume was 2.24 ± 0.44 L and 2.16 ± 0.56 L in overweight compared to normal weight subjects respectively (n.s). Relative haemoglobin mass and erythrocyte volume was significantly reduced in overweight subjects compared with normal weight subjects. As the mean body weight in the overweight group was 20 kg greater than in the normal weight group relative hemoglobin mass was lower in overweight versus normal weight subjects (8.5 ± 1.5 g · kg<sup>-1</sup> and 10.4 ± 1.5 g · kg<sup>-1</sup>) (p = 0.001), and relative erythrocyte volume was lower in overweight versus normal weight subjects (25.1 ± 4.0 ml · kg<sup>-1</sup> and 30.8 ± 3.7 ml · kg<sup>-1</sup>) (p = 0.001). Absolute VO<sub>2</sub>max (L · min<sup>-1</sup>) was not significantly different between the two groups, while relative VO<sub>2</sub>max was significantly reduced in the overweight subjects versus in the normal weight subjects (36.3 ± 6.9 ml · kg<sup>-1</sup> · min<sup>-1</sup> and 50.0 ± 9.0 ml · kg<sup>-1</sup> · min<sup>-1</sup>). Total hemoglobin mass was significantly correlated with absolute VO<sub>2</sub>max (r = 0.807, p = 0.001) in the measured subjects.

**CONCLUSIONS:** Total hemoglobin mass and erythrocyte volume was identical in overweight and normal weigh subjects, and was within the expected range for untrained subjects. Relative hemoglobin mass, erythrocyte volume and VO<sub>2</sub>max was reduced in the overweight subjects due to 20 kg larger body weight compared to the normal weight subjects. Reduced relative VO<sub>2</sub>max is unrelated to total haemoglobin mass in overweight inactive subjects.

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2421 Board #96 MAY 31 2:00 PM - 3:30 PM

**Maximal Physiologic And Kinematic Parameters During Partial Weight Unloading Treadmill Testing**

Boris Gojanovic, Phil Cutti, Rebecca Shultz, Gordon O. Matheson. *Stanford University, Stanford, CA.*

(No relationships reported)

**PURPOSE:** This study investigated maximal cardio-metabolic stimulation while running in a lower body positive pressure treadmill (AG), that reduces body weight (BW) and impact. The AG allows reduction of BW down to 20% and is used in rehabilitation of musculoskeletal injuries, but could have potential for high speed running in healthy athletes, especially if workload can remain maximally elevated at high speeds.

**METHODS:** 14 trained (9 male) runners (age 27 (5), 10k personal best 38.1 (1.1) min) completed a classical short 10 to 15 minutes treadmill incremental test (CON) to measure aerobic capacity and heart rate (VO<sub>2</sub>max and HRmax). They completed 4 identical tests (48 hours apart) on the AG at BW of 100%, 95%, 90% and 85% (AG100 to AG85). Stride length (SL) and rate (SR) were measured at peak velocities (V<sub>peak</sub>) by high-speed video analysis.

**RESULTS:** VO<sub>2</sub>max (ml·kg<sup>-1</sup>·min<sup>-1</sup>) was similar across all conditions (Men: CON=66.6 (3.0), AG100=65.5 (4.0), AG95=65.0 (5.4), AG90=65.6 (4.5) and AG85=65.0 (4.8). Women: CON=63.0 (4.6), AG100=61.5 (4.3), AG95=60.6 (4.7), AG90=61.4 (3.3) and AG85=62.8 (3.9)). Similar results were found for HRmax, excepted AG85 in men, AG100 and AG90 in women which were lower than CON. V<sub>peak</sub> (km·h<sup>-1</sup>) in men was 19.7 (0.9) in CON, which was lower than every other condition: AG100=21.0 (1.9) (p<0.05), AG95=21.4 (1.8) (p<0.01), AG90=22.3 (2.1) (p<0.01) and AG85=22.6 (1.6) (p<0.001). In women V<sub>peak</sub> (km·h<sup>-1</sup>) was similar between CON (17.8 (1.1)) and AG100 (19.3 (1.0)), but higher at AG95=19.5 (0.4) (p<0.05), AG90=19.5 (0.8) (p<0.05) and AG85=21.2 (0.9) (p<0.01). SL increased with the higher speeds in men, from CON=96.8 (5.8), AG100=99.6(6.5), AG95=99.6(6.2), AG90=99.1(4.9) and AG85=100.8(4.9). Only SL increased in women with higher speeds.

**CONCLUSIONS:** The AG can be used to elicit maximal exercise intensities at BW of 85 to 95%, reaching faster running speeds than normally feasible, and higher stride rate in men only. This could be potentially used for overspeed training in distance runners. The AG can help maintain aerobic conditioning during rehabilitation at lower BW.

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2422 Board #97 MAY 31 2:00 PM - 3:30 PM

**Assessment Of Carotid Versus Radial Heart Rate Palpation Accuracy Following A Submaximal 3-min Step Test**

Nathan C. Winn, Andy Bosak, Thomas Andre, Felisa Glover, David Porley. *Georgia Southwestern State University, Americus, GA.*

(No relationships reported)

Previous studies have evaluated the accuracy of subjects palpating their carotid heart rate (HR) post-submaximal exercise. But, very few studies have assessed the accuracy of palpating HR at different artery sites. Post-exercise recovery HR has a critical and symbiotic relationship with step tests and accurate palpation of post-exercise recovery HR is extremely important for more precise exercise prescription.

**PURPOSE:** To evaluate subjects' ability to accurately palpate their step test post-exercise recovery HR at the carotid and radial sites.

**METHODS:** Above averagely fit male subjects (n = 31) were connected to an Electrocardiogram (EKG) and completed two 3-min step tests at a cadence of 24 steps/min, separated by 48-72 hours, in a counterbalanced order. Upon completion of stepping activity, subjects palpated their HR at the carotid and/or radial sites within 5 secs and then counted their post-exercise recovery HR for the next 15 secs.

**RESULTS:** The post-exercise recovery EKG HR (CAREkg and RADEkg) was compared with their respective post-exercise recovery palpated carotid (CARpal) and radial (RADpal) HR using MANOVA statistical methods with significant differences considered at p ≤ 0.05. Differences between CAREkg vs CARpal and RADEkg vs RADpal were significant.

**CONCLUSIONS:** Despite the results suggesting that subjects palpated their CARpal (± 2.48 bts off) more accurately than RADpal (± 4.12 bts off), subjects were not 100% accurate at palpating their post-exercise recovery HR when compared to the post-exercise recovery HR EKG recording. Future research may be required to determine whether longer familiarization trials of pre-exercise HR palpation are needed to ensure greater accuracy in palpating post exercise recovery HR.

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2423 Board #98 MAY 31 2:00 PM - 3:30 PM

**Metabolic And Hormonal Responses to Modality Of Exercise and Sequence of Aerobic and Resistance Exercise in College Aged-women**

Dong-Ho Park<sup>1</sup>, Do-Yun Kim<sup>1</sup>, Chang-Sun Kim<sup>2</sup>. <sup>1</sup>Inha University, Incheon, Korea, Republic of. <sup>2</sup>Dongduk Women's University, Seoul, Korea, Republic of.

(No relationships reported)

**PURPOSE:** This study compared the effects of 4 different exercise programs [Aerobic exercise only (A), Resistance exercise only (R), Aerobic-Resistance exercise (A-R), and Resistance-Aerobic exercise (R-A)] on metabolic factors and hormones in untrained college aged-women.

**METHODS:** Eight females (18.5±0.76 years) completed Aerobic exercise Only (A, 65% VO<sub>2</sub>max), Resistance exercise only (R, 65% of 1-RM with an interset rest period of 105s), Aerobic-Resistance exercise (A-R), and Resistance-Aerobic exercise (R-A) experimental conditions. Aerobic exercise consisted of 25 minutes of treadmill exercise. VO<sub>2</sub> was determined during treadmill exercise and after each exercise treatment. Resistance exercise consisted of 7 lifts with 3 sets. Blood was obtained pre-, post-, 30 min after- and 60 min after exercise.

**RESULTS:** There were significant interaction effects on Growth hormone (p=.030), cortisol (p=.021) and testosterone (p=.007) by exercise mode (R and A) and exercise sequence (A-R and R-A). No significant difference was seen in the levels of estradiol between exercise mode (p=.071), but just showed the significant increase after R-A exercise (time, p=.001) which maintained

the highest concentration among the exercises mode and sequence. Glucose( $p=0.007$ ), free fatty acids( $p=0.000$ ) and lactic acid( $p=0.000$ ) had significant interaction effect by exercise mode and sequence respectively, especially glucose showed higher concentration of R-A than A-R, but lower than R only at post-exercise. EPOC and RER had significant interaction effects by exercise mode and sequence ( $p=0.000$  and  $p=0.000$ , respectively), particularly EPOC in R-A was higher than R only and A-R ( $p=0.014$ ,  $p=0.000$ , respectively). During R-A, rating of perceived exertion (RPE) during treadmill exercise was significantly increased ( $p=0.001$ ) above that of A-R and A only.

**CONCLUSIONS:** Either aerobic or resistance exercise alone increases the levels of estradiol and testosterone, but the increases are greatest with R-A exercise. Therefore, the R-A exercise might be more beneficial to increase bone density by the secretions of estradiol and testosterone, whereas the A-R exercise might be suitable for elderly people or a beginner because of relatively lower exercise intensity in regard to the RPE.

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**2424** Board #99 MAY 31 2:00 PM - 3:30 PM

**Combining Heart Rate And Accelerometer Data To Estimate Physical Fitness**

Thijs M. Tönis, Miriam M.R. Vollenbroek-Hutten, Hermie Hermens. *Roessingh Research and Development, Enschede, Netherlands.*

(No relationships reported)

Monitoring changes in physical fitness is relevant in many conditions and groups of patients, but its estimation demands substantial effort from the person, personnel and equipment. Besides that, present (sub) maximal exercise tests give a momentary fitness score, which depends on many (external) factors. Obtaining a fitness score based on measures gathered during longer periods of time and in natural conditions, like in daily life, would be an attractive alternative for the present methods. We performed an explorative lab-experiment to study the feasibility of fitness estimation during an activity commonly encountered in daily life; walking.

**PURPOSE:** To investigate the feasibility of physical fitness estimation from combined heart rate and accelerometer data obtained during treadmill walking.

**METHODS:** Forty-one subjects (23m, 18f) aged between 21 and 29 walked at three speeds on a treadmill (4, 5.5 and 6  $\text{kmh}^{-1}$ ) wearing a heart rate monitor and a hip mounted 3D accelerometer. The acceleration signal was converted into activity counts per 10 seconds. Stepwise linear regression analysis to estimate  $\text{VO}_{2\text{max}}$  was performed on the *slope* and *intercept* of the linear relation between heart rate and activity counts during steady state exercise ( $> 3\text{min}$ ), together with *age*, *gender*, *weight*, *length* and *BMI*. Reference  $\text{VO}_{2\text{max}}$  was obtained by performing a sub-maximal single stage treadmill walking test.

**RESULTS:** The model with the highest percentage of explained variance ( $R^2=0.93$ ) combined the slope and intercept parameter of the relation between heart rate and activity counts, together with gender. The model had a standard error of the estimate of  $1.78 \text{ ml O}_2\text{kg}^{-1}\text{min}^{-1}$ .

**CONCLUSION:** Results of the model are comparable with commonly used sub-maximal laboratory tests to estimate  $\text{VO}_{2\text{max}}$ . Fusing heart rate and accelerometer data during steady state activities seems promising for ambulant estimation of  $\text{VO}_{2\text{max}}$  and would not require the subject to carry out a high performance test.

This research was supported by the Dutch Alpe d'HuZes foundation.

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**2425** Board #100 MAY 31 2:00 PM - 3:30 PM

**Effects of Time of Day for Exercise on 24-hour Ambulatory Blood Pressure in Normotensive Female Adults**

Chia-Hua Chu, Chien-Yu Pan. *National Kaohsiung Normal University, Kaohsiung, Taiwan.*

(No relationships reported)

Time of day for exercise may influence blood pressure reduction in hypertension because of the diurnal variation of blood pressure and the duration of blood pressure reduction following a single bout of exercise (Park, Jastremski, & Wallace, 2005). However, knowledge about the response of blood pressure following at different time of day for exercise is limited and often were not be disclosed by study investigators.

**PURPOSE:** To compare different time of day for aerobic exercise on 24-hour ambulatory blood pressure (ABP) in normotensive female adults.

**METHODS:** Fifteen nonobese ( $\text{BMI } 23.07 \pm 3.38 \text{ kg}\cdot\text{m}^{-2}$ ) and normotensive middle-aged women ( $45.40 \pm 5.40$  years) volunteered to participate. They underwent a single bout of aerobic exercise (30 min, 60% heart rate reserve) 2 times in random fashion on separate days: (a) in the morning (between 0630-0800 hours, AMex), (b) in the afternoon (between 1630-1800 hours, PMex), and (c) a control (no exercise) session. Each participant's 24-hour ABP was measured after AMex, PMex, and control treatments using SpaceLabs model 90217. The dependent variables used for analysis were average 24-hour, daytime, and night time blood pressure. A repeated measure analysis of variance (ANOVA) was used to assess the effect of varied time of day for aerobic exercise on 24-hour ABP. In the case of a significant F-value, a Tukey *post hoc* test was used to identify differences under various time of day.

**RESULTS:** The 24-hour systolic (SBP), diastolic (DBP), mean arterial blood pressure (MAP) and daytime SBP were significantly lower after PMex than after AMex and control sessions (all  $p<0.05$ ). After PMex, 24-hour SBP was reduced an average of  $4.46 \pm 2.86$  and DBP by  $2.6 \pm 0.4 \text{ mmHg}$ ; and daytime SBP by  $3.1 \pm 0.2 \text{ mmHg}$ .

**CONCLUSION:** The post-exercise ABP reduction observed in normotensive middle-aged women depends on time of day for exercise; that is, the PMex significantly decreased daytime and 24-hour ABP. Supported by Taiwan NSC grants 99-2410-H-017-035.

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**2426** Board #101 MAY 31 2:00 PM - 3:30 PM

**A New Method For Determining Exercise Intensity To Meet Cardiovascular Needs**

Ronald Garner<sup>1</sup>, Jessica Gengler<sup>2</sup>, Brandon Lynn<sup>2</sup>, Jeremy Rindlisbacher<sup>2</sup>, Cassidy Robertson<sup>2</sup>, Natalie Schreher<sup>2</sup>, Eli Lankford<sup>2</sup>. <sup>1</sup>Utah State University, Logan, UT.

<sup>2</sup>BYU-Idaho, Rexburg, ID.

(No relationships reported)

**PURPOSE:** The purpose of the study was to determine whether work at lactate threshold (LT) or ventilatory threshold (VT) is optimal for improvements in cardiovascular fitness.

**METHODS:** 27 college-aged students (7 females, 20 males) participated in the study. Subjects were separated into groups based on fitness levels, sedentary (SED), average (AVG) and fit (FIT). Subjects participated in a graded exercise test (GXT) to determine LT followed by a  $\text{VO}_{2\text{max}}$  test.  $\text{VO}_2$  at LT was used to determine work rate for a final run where time to exhaustion (TTE) was recorded.

**RESULTS:** No differences ( $p = 0.079$ ) in TTE were found between groups SED, AVG, and FIT, therefore all groups were combined for further analysis. TTE =  $33.96 \pm 10.97 \text{ min}$ ; HR at LT =  $167.77 \pm 9.12 \text{ bpm}$ ; RPE at LT =  $13.19 \pm 1.36$ ;  $\text{VO}_{2\text{max}} = 53.35 \pm 7.67 \text{ ml/kg/min-1}$ ;  $\text{VO}_2$  at LT =  $39.46 \pm 6.02$ ;  $\text{ml/kg/min-1}$ . Percent  $\text{VO}_{2\text{max}}$  at LT =  $74.04 \pm 5.26\%$  TTE was not related to  $\text{VO}_{2\text{max}}$  ( $p=0.9$ ;  $r = -0.009$ ). Additionally, TTE was not related to  $\text{VO}_2$  at LT ( $p = 0.24$ ;  $r = .06$ ). The study determined no correlation between TTE and fitness level measured as both  $\text{VO}_{2\text{max}}$ , and  $\text{VO}_2$  at LT.

**CONCLUSIONS:** General guidelines typically recommend between 30-60 min of exercise most days of the week. Other guidelines use RPE, %  $\text{VO}_{2\text{max}}$ , or HR to determine exercise intensity. The varying recommendations can cause confusion as to proper exercise prescription. We found that by exercising at LT, total exercise time fell within the recommended guidelines of the ACSM and the CDC for both duration and intensity. Exercise at LT or VT fell within the recommended guidelines for duration of exercise regardless of fitness level. We recommend using LT or VT as the guideline for determining exercise intensity.

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**2427** Board #102 MAY 31 2:00 PM - 3:30 PM

**Relationship Of Vo2 Max And Ratio Of Total Co2 And O2 During Testing**

Keisuke Ida<sup>1</sup>, David Bellar<sup>2</sup>, Ellen L. Glickman, FACSM<sup>3</sup>. <sup>1</sup>Active Recovery, Sacramento, CA. <sup>2</sup>University of Louisiana at Lafayette, Lafayette, LA. <sup>3</sup>Kent State University, Kent, OH.

(No relationships reported)

Maximum oxygen uptake ( $\text{VO}_2 \text{max}$ ) is commonly studied among both recreational and athletic populations and is widely held to be the criterion measure by which to judge cardiovascular fitness. Although the results of a high level of fitness after a  $\text{VO}_2 \text{max}$  test are complete, there is little information about differences that explain fitness outcomes during the assessment other than the termination point.

**PURPOSE:** The purpose of the present investigation was to examine the ratio between total accumulated CO<sub>2</sub> expiration and O<sub>2</sub> consumption and examine the relationship to VO<sub>2</sub> at the point of test termination or oxygen consumption plateau.

**METHODS:** Twenty male (age: 20.0±1.0yrs, weight: 71.3±9.7kg, VO<sub>2</sub> max: 56.6± 8.6 ml O<sub>2</sub>/kg\*min) and eighteen female male (age: 21.1± 0.6yrs, weight: 55.8±7.2kg, VO<sub>2</sub> max: 44.8± 9.9 ml O<sub>2</sub>/kg\*min) college aged students who were recreationally active volunteered for the present investigation. The participant underwent a custom ramped treadmill protocol with expiratory gases monitored via computerized metabolic measurement system. After the testing third order polynomial regression was undertaken for the VO<sub>2</sub> and VCO<sub>2</sub> by time ( $r>0.950$ ). Regression equations were then integrated from 60seconds after the start of the test (to negate any initial hyperventilation) until the point at which maximum oxygen consumption was determined to have occurred. This area under the curve calculation was equal to the total accumulated expired CO<sub>2</sub> and consumed O<sub>2</sub> during this time period. The values for carbon dioxide were then divided by the values for Oxygen and a ratio score was created (AOC ratio). This ratio was then compared against the results of the VO<sub>2</sub> max test.

**RESULTS:** Data analysis examining the relationship between the AOC ratio and VO<sub>2</sub> max was undertaken utilizing partial correlation analysis (controlled for gender). The results of the analysis showed a significant negative correlation between AOC ratio and VO<sub>2</sub> max ( $r=-0.602$ ,  $p<0.001$ ).

**CONCLUSION:** Based upon these results it would appear that during the course of the test of maximum aerobic capacity, individual who are more fit produce less carbon dioxide over the course of the test per unit of oxygen utilized.

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## D-22 Free Communication/Poster - Health Equity

MAY 31, 2012 1:00 PM - 6:00 PM

ROOM: Exhibit Hall

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2428 Board #103 MAY 31 3:30 PM - 5:00 PM

### Does Physical Activity Explain Racial/Ethnic Differences in Cardiorespiratory Fitness among Young U.S. Adults?

Tyrone Ceaser, Eugene Fitzhugh, Dixie Thompson, FACSM. *University of Tennessee-Knoxville, Knoxville, TN.*

(No relationships reported)

**PURPOSE:** Cardiorespiratory fitness (CRF), an outcome of regular physical activity (PA), decreases the risk of heart disease in adults. Expressed as maximal oxygen uptake (VO<sub>2</sub>max), previous research has shown differences in CRF levels among racial groups. However, it is unclear how much of these differences in fitness can be explained by physical activity. Thus, we sought to answer this question.

**METHODS:** A total of 3115 adults (18-49 years) completed a submaximal graded treadmill exercise test from NHANES (1999-2004) to estimate VO<sub>2</sub>max, the dependent measure. Independent variables included demographics (race, education, gender, partner status, and waist circumference), behavioral measures (smoking and alcohol consumption), self-reported PA from three different domains: leisure-time, domestic, and transportation PA (MET-min/week), and the proportion of PA of a vigorous intensity (VMET). Multiple linear regression was performed using SUDDAN statistical software.

**RESULTS:** Results indicated that VO<sub>2</sub>max was significantly higher for Mexican Americans (40.9 ± 0.5 ml/kg/min), and Non-Hispanic Whites (40.2 ± 0.3 ml/kg/min) compared to non-Hispanic Blacks (37.9 ± 0.6 ml/kg/min) ( $P = 0.01$ ). Demographics including race explained 18.5% of the variance in VO<sub>2</sub>max, with race being significant ( $P < 0.01$ ) in the model. When PA was added to the model, the variance in VO<sub>2</sub>max explained increased by 0.8% to 19.3% ( $P = 0.001$ ). VMET was more predictive of VO<sub>2</sub>max than overall PA, and the model including VMET explained 20.5% of the variance in VO<sub>2</sub>max. Race remained a significant, independent predictor of VO<sub>2</sub>max after VMET and overall PA were added to the model.

**CONCLUSIONS:** Race and VMET are important factors in explaining differences in CRF. However, after accounting for demographics, PA, and VMET, a large proportion of the variance in CRF remains unexplained by the models. This suggests that other factors should also be considered when examining racial/ethnic differences in CRF.

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2429 Board #104 MAY 31 3:30 PM - 5:00 PM

### Comparing Levels of Anti-Fat Bias Between Mexican and American Athletes and Undergraduate Physical Education and Exercise Science Students

Miriam M. Wood, James R. Whitehead, FACSM, Sandra E. Short, Martin Short. *University of North Dakota, Grand Forks, ND.*

(No relationships reported)

Anti-fat bias is "an obesity prejudice in which the attribute of being obese influences the expectations about the individuals, often in terms of negative character assessment such as laziness, lack of discipline, and incompetence" (Puhl & Brownell, 2001) displayed either in an implicit or explicit way.

**PURPOSE:** this study compared anti-fat bias ratings between American and Mexican athletes and undergraduate physical education and exercise science students (a replication and extension of Chambliss et al., 2004). It also investigated the possible that socially desirable response tendencies are threat to the validity of the explicit anti-fat bias measure.

**METHODS:** undergraduate students from the US ( $n = 63$ ) and Mexico ( $n = 40$ ) and Mexican athletes ( $n = 15$ ) filled out questionnaires to investigate their levels of anti-fat bias (Implicit Association Test (IAT) and Anti-fat Attitudes Test (AFAT). The BIDR-6 was used to measure socially desirable response tendencies.

**RESULTS:** for the AFAT, there were no statistically significant differences between the American and Mexican samples. On the IAT, when *good vs. bad* was paired with *thin vs. fat*, there was an effect revealing that American students scored higher than Mexican students ( $M = 4.68$  vs.  $2.63$ ,  $p < .01$ ). Similarly, when *smart vs. stupid* was linked to *thin vs. fat* the results revealed that the Mexican students ( $M = 6.76$ ) scored higher ( $p < .001$ ) than the Mexican athletes ( $M = 4.08$ ) and significantly higher ( $p < .05$ ) than the American students ( $M = 3.62$ ), and when *motivated-lazy* was paired with *fat vs. thin*, there was a significant interaction effect ( $F [2, 111] = 3.66$ ,  $p < .05$ ). Most IAT sub-sample scores were significantly different from zero indicating implicit anti-fat bias. There were no significant correlations between the BIDR-6 scales and the AFAT. Only 6% of the variance in the AFAT items was explained by socially desirable response tendency, indicating no substantive threat to validity.

**CONCLUSION:** the results suggested that anti-fat bias is an issue with future exercise science professionals, and thus, further research on incidence levels and prevention strategies is warranted. Also, given the lack of association between measurement methods, further research should investigate if implicit bias does, or does not affect an individual's explicit bias.

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2430 Board #105 MAY 31 3:30 PM - 5:00 PM

### Understanding Cultural Perspectives On Physical Activity Among Older Mexican Women Through Visual Research Methods

Andiara Schwingel, Wojtek Chodzko-Zajko, FACSM, Salva Najib. *University of Illinois at Urbana Champaign, Champaign, IL.*

(No relationships reported)

Older Latina women are a particularly vulnerable group for physical inactivity for whom public health messages and interventions appear to be less effective.

**PURPOSE:** The purpose of this study was to evaluate the benefits of using visual and participatory research techniques with this population.

**METHODS:** Perceptions of physical activity were assessed using a visual research method known as photo-elicitation from a sample of 37 older women of Mexican background living in Illinois.

**RESULTS:** Following analyses of photographs and interviews, we collected a number of prominent themes emerging from the qualitative data. Categorized according to the Social Ecological Model, major themes representing factors that may influence physical activity choices were: (1) Individual Level: health status; beliefs about physical activity, health and wellness; previous physical activity behavior (2) Social Environment: family influence and support; support from social networks and friends; community involvement and activity (3) Physical Environment: availability of physical activity resources and opportunities; weather; neighborhood safety (4) Cultural and Social Norms: cultural values and perceptions on physical activity and being healthy; perceptions on the role of women in the household; the role of religion in everyday life.

**CONCLUSIONS:** Findings suggest that this method may be a valuable tool in extracting rich and meaningful data from target audiences while fostering a sense of partnership between researchers and community members. Innovative interdisciplinary research techniques may present improved ways to reach and impact underserved populations.

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**2431** Board #106 MAY 31 3:30 PM - 5:00 PM

**Development And Evaluation Of A Culturally-responsive Fitness Instructor Training Program For Underserved Latinos.**

Ermilia Medina, Elizabeth Booen-Mejia, Megan P. Duesterhaus, Susana Moral Gonzalez, Jeanne Nichols, FACSM, Todd Galati, Simon Marshall. *San Diego State University, San Diego, CA.*

(No relationships reported)

Few opportunities exist for Spanish-speaking community members to become certified exercise and fitness professionals.

**PURPOSE:** Adapt, implement and evaluate a culturally-responsive, Spanish-language training program for community members to become certified fitness instructors.

**METHODS:** A print-based English-language self study course for group fitness instructors (the ACE® Group Fitness Instructor self study course) was culturally adapted using principles of Culturally Responsive Teaching for delivery as a Spanish-language, 14-week face-to-face course. Bilingual, bicultural exercise scientists and group fitness instructors were part of the expert panel that completed the cultural adaptation of the curriculum. Live training was delivered by public health background certified fitness professionals.

**RESULTS:** The 14-week training program comprised of 4 distinct modules with pedagogical emphasis on diverse instructional strategies such as lecture, small class discussion, case studies, role playing, peer mentoring, and shadowing. Twenty-seven Spanish-speaking community members were recruited to a training Academy (Academia Fit) for Latino fitness professionals. Twenty-six participants (mean age = 40 yr, 70% female) completed the 14-week course with a mean training exposure of 104.5 hours ( $\pm 35.97$ ) per candidate (54% in class). Eighteen candidates sat the certification exam, with a pass-rate of 61% (37% first time). Adherence to training was 87% (% classes attended), and a mean of 3.57 ( $\pm 2.8$ ) hours per week was reported as self-study outside of class, 60% of that recommended by the instructor. After adjusting for age and education level, the correlation between attendance (# classes attended) and out-of-class study time with exam score was  $r = 0.19$  and  $r = 0.63$ , respectively.

**CONCLUSION:** A culturally responsive Spanish-language training program that helps Latino community members become certified fitness professionals helps build capacity to offer culturally sensitive quality opportunities for physical activity.

Funded by research grant (1R18DP002138-01) from Centers for Disease Control and Prevention.

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**D-23 Free Communication/Poster - Landing, Jumping, Cutting**

MAY 31, 2012 1:00 PM - 6:00 PM

ROOM: Exhibit Hall

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**2432** Board #107 MAY 31 3:30 PM - 5:00 PM

**The Effects of Hydration and Fatigue in Mild and Hot Environments on Landing Technique**

Jessica C. Martinez, Lindsay J. DiStefano, Rachel Karslo, Megan VanSumeren, Robert A. Huggins, Rebecca L. Stearns, Julie K. DeMartini, Carl M. Maresh, FACSM, Douglas J. Casa, FACSM. *University of Connecticut, Storrs, CT.*

(No relationships reported)

Improper landing technique increases the risk of lower extremity injury. Fatigue has been shown to impair landing technique but it is unknown if hypohydration and hyperthermia have a similar negative effect.

**PURPOSE:** To examine the effects of hydration and fatigue in mild and hot environments on landing technique.

**METHODS:** Twelve healthy, physically active males (age=20 $\pm$ 2 yrs, height =182 $\pm$ 8 cm, body mass=74.0 $\pm$ 8.2 kg, body fat=9 $\pm$ 3%, VO<sub>2</sub>max = 57.0  $\pm$  6.0 mL·kg<sup>-1</sup>·min<sup>-1</sup>) completed 4 test sessions in randomized hydration and environmental conditions: Euhydrated Temperate (EUT), Euhydrated Hot (EUH), Hypohydrated Temperate (HYT), Hypohydrated Hot (HYH). Temperate and hot condition sessions were performed in 18 $\pm$ 0.2°C, 50 $\pm$ 3.5% relative humidity (RH), and 34  $\pm$ 0.3°C, 45 $\pm$ 4.5% RH, respectively. Subjects completed a 90-min treadmill exercise protocol wearing a 20.5 kg backpack (5% incline, 1.34-1.78 m·s<sup>-1</sup>). Landing technique was evaluated 3 times a session (before exercise (PRE), after exercise (POST), after 60-min recovery session (REC)). One rater evaluated the landings using the Landing Error Scoring System (LESS), which is a valid and reliable movement screening tool. A high LESS score indicates a greater number of errors committed and poor technique. Change scores between time points (PRE, POST, REC) were calculated. Separate within-subjects ANOVAs evaluated differences in LESS change scores (POST-PRE, REC-PRE, REC-POST) between conditions.

**RESULTS:** Body mass loss differed across sessions (HYT:-3.80  $\pm$  1.22%, HYH:-5.66  $\pm$  1.57%, EUT:0.10  $\pm$  0.90%, EUH:-1.30  $\pm$  0.85%). HYH (POST-PRE Change Score: 0.69, 95% CI: 0.13, 1.26)) resulted in a greater increase in LESS scores between PRE and POST than HYT (-0.19, 95% CI: -0.55, 0.16), EUH (-0.56, 95%CI: -1.15, 0.02), EUT (-0.03, 95%CI: -0.60, 0.54)( $p=0.002$ ). HYH (REC-PRE Change Score: 0.67, 95%CI: 0.21, 1.13) also resulted in a greater increase in LESS scores between PRE and REC than HYT (-0.03, 95%CI: -0.53, 0.48), EUH (-0.31, 95% CI: -0.93, 0.31), EUT (-0.67, 95% CI: -1.08, -0.25)( $p=0.001$ ).

**CONCLUSION:** Landing technique is impaired when an individual is hypohydrated and in a hyperthermic environment, regardless of acute fatigue. Hypohydration in hot environments needs to be prevented to protect individuals from a possible increase in lower extremity injury risk.

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**2433** Board #108 MAY 31 3:30 PM - 5:00 PM

**Leg Extension Strength Effects Plantar Loads While Landing from a Drop Jump**

David Hudson, Chris Wilson, Lauren Parker, Mary Ann Pascutti. *Western Carolina University, Cullowhee, NC.*

(No relationships reported)

**PURPOSE:** To determine if there are differences in structure and function in the lower limb among groups that load plantar force more medially, centrally, or laterally when landing from a drop jump.

**METHODS:** A pedobarograph mat measured the force under the right foot of thirty-three subjects when landing from a 30cm drop jump. Proprietary software was used to extract data for 15 frames before and 15 frames after the peak vertical force. The pressure map was then divided into medial and lateral halves; a Plantar Force Index (PFI) was calculated from the ratio: medial force / whole force. Each subject was also measured for the following structural and functional measurements: calcaneal eversion excursion (subtalar joint neutral to relaxed standing); navicular drop normalized to foot length; knee valgus; hip depth normalized to body height; repetitions of single leg squats and calf raises performed in 30 seconds. Subject data were stratified into three groups based on PFI (lateral pressure, mid-pressure, and medial pressure). A MANOVA with Tukey's post-hoc test was used to determine if differences existed among the three groups for the variables measured.

**RESULTS:** Significant differences were found in the PFI among all three groups (lateral pressure; 46.3%; mid-pressure 53.1%; medial pressure 60.2%;  $p \leq 0.001$ ). Compared to subjects that landed with more medial pressure, subjects that loaded the foot more laterally had significantly greater normalized hip depth (13.2% vs. 10.6%;  $p < 0.03$ ) and were able to perform significantly more repetitions of squats (38.6 vs. 31.2;  $p < 0.03$ ).

**CONCLUSIONS:** Subjects with greater strength in the large lower limb extensors and greater gluteal size landed more laterally on the foot, which was interpreted as a more stable landing pattern than landing those that landed more medially. These results indicate that proximal strengthening should be part of the management of hyperpronation.

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2434 Board #109 MAY 31 3:30 PM - 5:00 PM

**Knee Position And Loading Is Influenced By Foot-Landing Technique**

Nelson Cortes<sup>1</sup>, Steven Morrison<sup>2</sup>, Bonnie Van Lunen<sup>2</sup>, Eric Greska<sup>2</sup>, James Onate<sup>3</sup>. <sup>1</sup>George Mason University, Fairfax, VA. <sup>2</sup>Old Dominion University, Norfolk, VA. <sup>3</sup>The Ohio State University, Columbus, OH.  
(No relationships reported)

Noncontact anterior cruciate ligament (ACL) injuries have been reported to occur with the ankle in a dorsiflexed position (rearfoot landing) during cutting maneuvers. Few studies have attempted to quantify the knee position and loading during a cutting task when performed with different landing techniques.

**PURPOSE:** To evaluate the effects of two landing techniques (rearfoot and forefoot) on lower extremity biomechanics while performing a sidestep cutting task (SS).

**METHODS:** Lower extremity biomechanics of nineteen healthy female collegiate soccer athletes (20±0.9 years; 1.67±0.1m; 63.2±10.1kg) were obtained while performing a SS with forefoot (FF) and rearfoot (RF) landing techniques. Subjects performed five trials of each landing technique which were verified by video and counterbalanced between subjects. Kinematic measures of the lower extremity were captured using an eight-camera high-speed motion capture system, and ground reaction force data were obtained through two force plates sampling at 500 Hz. Repeated measures ANOVAs were conducted to assess differences between foot-landing techniques in knee flexion and abduction angles and moments at initial contact and peak stance. Alpha level set *a priori* at  $p \leq .05$ .

**RESULTS:** Knee flexion (KF) angle at initial contact was higher for FF (-42±10°) than RF (-33±6°,  $p < 0.05$ ). The knee was in a more abducted position with the RF (-3±9°) than with the FF (-0.6±11°,  $p < 0.05$ ), and had a higher adductor moment with the FF (0.034±0.06Nm/kgm) than with the RF (0.0013±0.03Nm/kgm). At peak stance, KF was significantly higher for the RF than FF (-56±5° vs. -53.7±7°,  $p < 0.05$ ). No significant difference was found for knee abduction angle and adductor moment at peak stance between landing techniques ( $p > 0.05$ ).

**CONCLUSION:** There are essential differences in lower extremity biomechanics between landing techniques. The rearfoot landing technique increasingly affects knee position and loading at initial contact (e.g., less flexion, greater abduction angle and moment), which can potentially place a higher strain on the ACL. This study supports the observational findings that rearfoot landing technique may increase the likelihood of ACL injury. Intervention programs should address foot-landing technique as a preventive measure to decrease ACL loading.

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2435 Board #110 MAY 31 3:30 PM - 5:00 PM

**Influence of Hip Strength and Flexibility on Qualitative Jump-Landing Performance in Adolescent Males and Females**

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(No relationships reported)

Strength and flexibility of the hip musculature are thought to influence lower extremity movement patterns that potentially increase the risk of knee injury in adolescent athletes. A method to identify faulty movement patterns is through the use of qualitative lower extremity movement screens. Understanding the influence of hip strength and flexibility on lower extremity motion is needed to appropriately develop effective injury prevention strategies.

**PURPOSE:** To determine the influence of hip muscle strength and flexibility on qualitative jump-landing performance in adolescent males and females.

**METHODS:** Fifty-four (27 females, 27 males; 16±1yrs, 64±12kg, 172±11cm) adolescent athletes participated in this investigation. Frontal and sagittal plane views were recorded with video cameras as participants performed three trials of a jump-landing task. Isometric strength of the hip abductors, extensors, internal rotators, and external rotators was assessed over two trials using a hand-held dynamometer. Hip abduction, internal rotation, and external rotation range of motions (ROM) were assessed with a digital inclinometer over three trials. Jump-landing trials were later evaluated by a trained rater using the Landing Error Scoring System (LESS), a valid and reliable tool for assessing lower extremity movement patterns. The average of total LESS scores (higher score indicates poor jump-landing performance), hip strength (normalized to body mass (%BM)), and hip ROM were used for data analysis. Separate regression analyses were performed to determine the influence of hip strength and ROM on total LESS score in males and females.

**RESULTS:** Strength and flexibility of the hip musculature did not influence total LESS score in females ( $P > 0.05$ ). In males, strength of the hip extensors (0.37±0.09%BM) significantly influenced total LESS score (4.53±1.20) ( $R^2 = 0.16$ ,  $P = 0.04$ ). No other strength or flexibility measures were found to influence total LESS score in males ( $P > 0.05$ ).

**CONCLUSION:** Decreased strength of the hip extensors appears to influence poor jump-landing performance in adolescent males. The lack of additional significant findings indicates that more research needs to be performed to understand the intrinsic factors influencing lower extremity movement patterns in adolescent males and females.

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2436 Board #111 MAY 31 3:30 PM - 5:00 PM

**Residual Compromised Knee Performance During Single Leg Landings in People with ACL Reconstruction**

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(No relationships reported)

Patients with ACL reconstruction are at above normal risk for development of early knee osteoarthritis and re-injury. A growing body of evidence suggests that the ACL reconstructed knee exhibits compromised ability to accept weight during demanding activities. Diminished ability to flex under load may be a contributing factor etiology of early knee OA and re-injury. The performance of the ACLR knee during a single leg land (SLL) is still relatively under studied. Single leg lands are interesting as most ACL injuries occur during deceleration of SLL.

**PURPOSE:** To identify significant differences between limbs during SLL in active patients who have had unilateral ACLR.

**METHODS:** Participants included 17 subjects with unilateral ACLR (age= 22±4 years, BMI=24.6 ± 2.5, 7 males) who were physically active ( $\geq 4$  on the Tegner Physical Activity Scale) and good clinical results (IKDC score =85% ± 0.10). Subjects participated in a onetime session where each limb's performance was analyzed using a 3D Vicon system with force plates during a SLL off a 20 cm platform. The variables of interest included peak knee flexion angle and moment during weight acceptance of landing, peak vertical ground reaction force (VGRF), and the knee's contribution to the total support moment. The VGRF and joint moments were normalized to body weight. We compared the mean values between limbs using paired t-tests ( $\alpha = 0.05$ ).

**RESULTS:** Peak knee moments were statistically less in the involved ( $p = 0.004$ , mean=2.53±0.47) compared to the uninvolved limb (mean= 2.81±0.31). The knee's percentage of the total support moment was significantly less ( $p = 0.003$ ) in the involved limb as well (mean inv=36% ± 5%, mean unin= 40% ± 5%). No significant differences were found between limbs in VGRF ( $p = 0.192$ , mean inv= 3.55±0.29, mean unin= 3.49±0.33) or in peak knee flexion ( $p = 0.081$ , mean unin=56.61 ± 13.03 mean inv=53.23 ±12.43).

**CONCLUSION:** There were significant deficits in weight acceptance between limbs during a SLL task in an active population with good clinical outcome scores. Compromised ability to utilize the operated knee to decelerate body weight is concerning in light of the repetitive stresses placed on the limb during these patients' daily life. The findings of this study have potential implications for the high risk for early degeneration and re-injury.

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2437 Board #112 MAY 31 3:30 PM - 5:00 PM

**Hip Abduction Strength and Its Relationship with Landing Mechanics**

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(No relationships reported)

Lower extremity neuromuscular training programs are effective in improving performance and biomechanics, and it is known that increased knee valgus increases the risk of ACL injury. With hip abduction strength being of neuromuscular concern, it is questioned if hip abduction strength would affect landing mechanics?

**PURPOSE:** To examine the relationship between hip abduction strength and landing mechanics.

**METHODS:** Sixteen, graduate students (23.1 ± 1.1 years; 169.8 ± 9.1 cm; 69.5 ± 15.9 kg) volunteered. Kinematic data were collected using electromagnetic sensors attached to the following locations: (1) S1; (2-3) bilateral distal/posterior upper leg; (4-5) bilateral proximal/posterior lower leg; and (6-7) superior proximal foot bilaterally. Participants performed 5 drop jump landings (47cm) onto a force plate. Following drop landings, hip abduction strength was measured with a hand held dynamometer.

**RESULTS:** Pearson correlation revealed a significant relationship between hip strength and knee abduction,  $r = -.513$ ,  $p < .05$ , and ground reaction forces,  $r = .636$ ,  $p < 0.01$ . [Table 1].

**CONCLUSIONS:** These data suggest greater hip strength may decrease knee valgus, but does not contribute to decreased ground reaction forces. Thus other components in landing mechanics may have an effect on ground reaction forces. However, improved hip strength incorporated with neuromuscular training programs may decrease knee valgus loads and likely decrease the risk of ACL injury resulting from poor landing mechanics. Programs emphasizing hip strength should be examined in future research to determine the effect on landing mechanics.

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**2438** Board #113 MAY 31 3:30 PM - 5:00 PM

**Relationship Between Knee Extensor Strength And Knee Angle At Landing: Implications For ACL Injury Risk**

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*(No relationships reported)*

Anterior cruciate ligament (ACL) injury is common, costly, requires a lengthy rehabilitation, and results in increased risk of osteoarthritis. For these reasons, prevention of ACL injury is critical. While the mechanism for non-contact ACL injury is unclear, injuries normally occur with the knee near full extension. Therefore, increasing knee flexion at ground contact may dramatically reduce ACL injury rates. One factor that may contribute to landing with an extended knee is knee extensor weakness, as an extended knee reduces demand on knee extensors.

**PURPOSE:** To determine the relationship between knee extensor strength and knee flexion angle at landing.

**METHODS:** Healthy, active participants (10M 11F) were asked to perform landings from 64cm. 3D kinematic data was recorded and knee flexion angle was calculated at the instant of ground contact. Knee extensor strength was measured during maximum, 60°/s isokinetic contractions. Correlations were calculated between strength and knee angle at landing.

**RESULTS:** Strength was significantly related ( $p < 0.05$ ) to knee angle at landing in male subjects. In female subjects a similar trend existed between the two variables. However, the relationship was not significant.

**CONCLUSION:** A relationship exists between knee extensor strength and knee flexion angle at landing in male subjects. Additional testing is needed to confirm this finding in female subjects. A significant relationship between these variables does not prove a causal relationship. However, knee extensor weakness is a logical cause for landing with an extended knee. If additional testing confirms this relationship, knee extensor strengthening should be tested as a simple intervention for ACL injury prevention.

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**2439** Board #114 MAY 31 3:30 PM - 5:00 PM

**Fear and Muscle Strength are Correlated to Knee Kinetics During Jump Landings after ACL Reconstruction**

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*(No relationships reported)*

Patients with unilateral anterior cruciate ligament reconstruction (ACLR) can exhibit a hesitancy to accept load through the involved limb that could impact long-term outcomes. Impaired thigh muscle strength, high fear of re-injury, and decreased standing balance can also linger after surgery.

**PURPOSE:** To assess the interaction between the independent variables of muscle strength, fear of re-injury, and diminished standing balance to the performance variables of the operated knee kinetics during a single leg landing (SLL).

**METHODS:** Seventeen (7 males) physically active ( $\geq 4$  on Tegner Physical Activity Scale) subjects, ages 16-31 with unilateral ACLR participated. A one-time testing session was used to assess peak knee flexion moment and the knee's contributions to the total support moment during the weight acceptance phase of a SLL off a 20 cm platform. A Kin Com dynamometer assessed quadriceps and hamstring strength (MVIC). The ACL-Return to Sport Index (ACL-RSI) questionnaire was completed which quantifies the emotional response to injury (e.g. fear), confidence in the operated knee, and re-injury risk appraisal. Standing balance was quantified using the area contained by sway of the center of pressure during unilateral standing balance. The relationship between the impairments and landing performance was assessed using Pearson Correlation Coefficients (alpha: 0.05).

**RESULTS:** Quadriceps strength was related to both the knee flexion moment ( $r = 0.57, p = 0.018$ ) and the knee's contribution to the total support moment ( $r = 0.74, p = 0.001$ ). The ACL-RSI questionnaire score was significantly correlated to both peak knee flexion moment ( $r = 0.70, p = 0.002$ ) and the knee's contribution to the total support moment ( $r = 0.68, p = 0.002$ ). The hamstring muscle strength was only related to the knee's contribution to the support moment ( $r = 0.69, p = 0.002$ ) and the standing balance assessment was not significantly correlated to either knee kinetic assessment ( $\leq 0.398, p > 0.114$ ).

**CONCLUSION:** Muscle strength along with fear and a lack of confidence in the operated knee were related to a reduced amount of knee loading during the weight acceptance phase of jump landing. Future assessments should consider both of these variables as part of post-operative care to insure optimal knee performance during jump landing tasks.

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**2440** Board #115 MAY 31 3:30 PM - 5:00 PM

**Landing Patterns in Subjects with Chronic Ankle Instability**

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*(No relationships reported)*

The most common symptoms after ankle sprains were chronic ankle instability, proprioception defect and probable neuromuscular adaptation.

**PURPOSE:** The purpose of this study was to identify the normal landing pattern using detailed biomechanical analysis including analysis of the kinematics and ground reaction force, and to compare the landing pattern in the subjects with recurrent ankle sprain and normal subjects.

**METHODS:** 20 male adults were recruited in this study (10 subjects with recurrent lateral ankle sprains group, 10 subjects with normal control group). All subjects would be asked to perform maximal standing jumps and drop landing from 3 platforms with different heights (0.37 m, 0.67 m, & 0.97 m, respectively). Those movements were collected by VICON 512 (Oxford Metrics, UK) motion analysis system and the kinematics was analyzed using self making software with MATLAB. The ground reaction force of both lower limbs was recorded by two AMTI force platforms, and the kinetic data were calculated with inverse dynamics.

**RESULTS:** In the different landing height, the main differences of kinematics were the maximum flexion angles of hip and knee joints in normal landing patterns and the flexion angles increased with the landing height, as well as the flexion of pelvis, hip abduction, and knee external rotation in the subjects with recurrent ankle sprains. When compare those two groups, the landing pattern in the subjects with recurrent ankle sprain was significant smaller than normal subjects in knee flexion ( $65.71^\circ \pm 6.43^\circ$  vs.  $70.19^\circ \pm 13.76^\circ$ ) and hip flexion ( $34.15^\circ \pm 5.42^\circ$  vs.  $42.54^\circ \pm 10.07^\circ$ ). The time to maximum angles in ankle dorsiflexion and foot pronation were also quite different between these two groups. The maximum vertical ground reaction force in sprain group was significant smaller than normal group.

**CONCLUSION:** In this study, we have revealed the adaptation of performing drop landing in the individuals with recurrent ankle sprains. It could be considered as a recommendation of the rehabilitation.

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**2441** Board #116 MAY 31 3:30 PM - 5:00 PM

**Landing on Inverted Surface Increased Frontal Plane Loading to Ankle and Knee Joints**

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*(No relationships reported)*

Landing on inverted surface (IS) has been shown to introduce smaller medial ground reaction force (GRF) and greater ankle inversion compared to normal landing on flat surface (FS). It is, however, still unknown if the surface would also introduce greater mechanical loading to the ankle and more proximal lower extremity joints.

**PURPOSE:** To examine effects of inverted surface and ankle brace on lower extremity joint kinetics during a drop landing movement.

**METHODS:** Eleven healthy subjects performed five drop landing trials from a 0.45m on FS and IS without (NB) and with (BR) a semi-rigid ankle brace. Simultaneous collection of three-dimensional kinematic and GRF data were performed. The internal moments were computed and normalized to body mass (Nm/kg) using Visual 3D. A 2 x 2 (brace x surface) repeated measures ANOVA was used ( $p < 0.05$ ).



**RESULTS:** In sagittal plane, the peak ankle plantarflexion moment was smaller in IS (-1.28 vs -1.46 Nm/kg,  $p = 0.045$ ) and NB (-1.22 vs -1.52 Nm/kg,  $p = 0.012$ ) landing conditions compared to FS and BR conditions, respectively. The peak knee extension moment for the IS landing was also increased compared to FS (2.50 vs 2.75 Nm/kg,  $p = 0.001$ ) but no brace effect was observed. For peak hip extension moment, it was smaller in IS landing compared to FS ( $p = 0.001$ ) but greater in BR compared to NB ( $p = 0.001$ ). The peak eversion moment was significantly increased only in IS (-0.92 vs -0.28 Nm/kg,  $p = 0.001$ ) conditions compared to FS. The peak knee adduction moment (0.93 vs 0.27 Nm/kg,  $p = 0.001$ ) was increased while the peak hip abduction moment (-0.92 vs -0.44 Nm/kg,  $p = 0.01$ ) were reduced in IS landing only.

**CONCLUSION:** The results indicate that the landing on IS reduced the extensor's effort of ankle, knee and hip. This is in line with the reduced vertical GRF previously reported for IS landing and increased lateral GRF. In the frontal plane, the IS landing increases loading on ankle and knee joints reflecting increased frontal plane demands, due to the increased peak lateral GRF and downward momentum in IS landing. This contradiction may be related to the increased friction in IS landing, which in turn requires greater ankle eversion and knee adduction moments to prevent the body from moving more laterally. The ankle brace application does not seem to cause any significant changes of frontal plane loading to the lower limb joints.

**2442** Board #117 MAY 31 3:30 PM - 5:00 PM

**The Different Landing Strategy in Chronic Isolated Posterior Cruciate Ligament Injury Patients**

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(No relationships reported)

**PURPOSE:** After Posterior Cruciate Ligament (PCL) injuries, some patients, copers, are capable of returning to normal activities. Other patients, non-copers, remain symptomatic and often require surgeries. The purpose of this study is to investigate the landing strategy between copers and non-copers, in order to have a better understanding of the functional adaptation strategy in asymptomatic PCL injured patients.

**METHODS:** Twenty isolated posterior cruciate ligament injured patients and ten normal subjects were recruited in this study. These subjects were divided into three groups, copers, non-coper and control group respectively. The kinematic and kinetic parameters of landing were recorded. One-way analysis of variance was used to compare the differences between three groups.

**RESULTS:** There were no significant differences in age, height, and weight between three groups. The average injury time were 23.36 and 35.80 months for copers and non-copers respectively. At the moment of landing, there were no significant differences in joint angle and moment between the three groups, neither than two limbs of copers and non-copers. The loading rate and ground reaction force (GRF) were significantly different among the three groups. Copers had greater loading rate and ground reaction force than non-copers. (Table 1.) There were also significantly lesser loading rate ( $p=0.0079$ ) and ground reaction force ( $p=0.0117$ ) of the involved side in non-coper group.

**CONCLUSIONS:** Non-copers attempted to decrease the impact when landing by lower loading rate and GRF to protect the injury limb. These findings may be helpful for clinicians to design a proper rehabilitation program for patients with PCL deficiencies.

Table 1. Landing rate and ground reaction force among the three groups.

|                     | coper                   | non-coper               | control                 | p value | post hoc                   |
|---------------------|-------------------------|-------------------------|-------------------------|---------|----------------------------|
| loading rate (BW/s) | 22.30<br>( $\pm 2.18$ ) | 18.91<br>( $\pm 2.11$ ) | 19.80<br>( $\pm 3.10$ ) | 0.0413* | coper > non-coper          |
| MaxGRF (Nm/kg)      | 31.63<br>( $\pm 2.45$ ) | 24.45<br>( $\pm 4.64$ ) | 30.15<br>( $\pm 4.85$ ) | 0.0139* | control, coper > non-coper |

**2443** Board #118 MAY 31 3:30 PM - 5:00 PM

**Effect of Decision Making on Frontal Plane Hip Muscle Co-activation Patterns During Landing**

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(No relationships reported)

ACL injuries pose serious concerns and one possible contributor to these injuries is the use of more generalized muscle activation patterns when decision making (DM) is required, as is seen during cutting tasks. Whether DM similarly affects muscle activation during 2-footed landing tasks is unknown.

**PURPOSE:** To examine the effects of DM during 2-footed landing tasks on muscle co-activation at the hip as a function of task and sex.

**METHODS:** Twenty-nine young adults (22+3 years; 13 women) with no history of knee injury completed 3 randomized blocks of trials: 7 preplanned (PP) drop landings (DL), 7 PP drop-jumps (DJ), and 14 randomized DM trials consisting of 7 DL and 7 DJ. Surface EMG activity of the gluteus medius and adductor longus was sampled at 1080 Hz. From the rectified, normalized EMG, average proactive and reactive activation of each muscle was computed over 100 ms before and 120 ms after ground contact, respectively. Proactive and reactive co-contraction ratios (CCR) were computed, as was average activation of the less active muscle. Comparisons were made using 3-way, condition x task x sex, repeated-measures ANOVA.

**RESULTS:** Despite a significant 3-way interaction ( $p = .046$ ), post hoc analysis revealed no effect of condition, task, or sex on the proactive CCR (0.54+0.17). However, the reactive CCR was greater under DM than under PP conditions (0.65+0.17 vs. 0.60+0.18,  $p < .001$ ), independent of task and sex. This increase in reactive CCR was not due to greater activation of the less active muscle. In the post-hoc analysis of a significant 3-way interaction ( $p = .006$ ), men were found to perform DJ with lesser reactive activation of the less active muscle under DM than under PP conditions (6.5+2.0 vs. 9.0+3.0 %MVIC,  $p = .002$ ), whereas reactive activation of the less active muscle did not differ between conditions for DL or in women.

**CONCLUSIONS:** During 2-footed landing tasks, both women and men exhibit greater hip muscle co-activation in the frontal plane after ground contact under DM compared to PP conditions. This appears to be due to lesser activation of the more active muscle under DM conditions. These findings suggest a more generalized muscle activation strategy, that may provide lesser control of hip and knee frontal-plane motion, is used when DM is required. These results could have implications for ACL injury during landing.

**2444** Board #119 MAY 31 3:30 PM - 5:00 PM

**Electromyography Analysis Of Lower Body Muscle Mechanics During Maximal Vertical Jumps On Rigid and Sand Surface**

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(No relationships reported)

**PURPOSE:** The aim of this study was to analyze electromyography activity of lower extremity muscles while jumping on rigid versus sand surfaces.

**METHODS:** Healthy, physically active males and females ( $n=26$ ) (age=26.9 $\pm$ 6.5 yr., ht. 177.2 $\pm$ 10.6, cm, wt.=79.1 $\pm$ 15.1kg) participated in this study. All subjects performed three short step countermovement jumps on a sand and rigid surface. A 4-channel electromyography (EMG) system recorded output from the rectus femoris (RF), vastus lateralis (VL), biceps femoris (BF) and gastrocnemius (GN) muscles of the right leg. A wireless waist belt accelerometer obtained subject jump height. Mean peak EMG data from lower extremity muscles were compared between the two surfaces.

**RESULTS:** Repeated measures ANOVA was conducted between the two surfaces. Males jumped significantly higher than females on both sand (35.3 $\pm$ 7.6cm; 24.9 $\pm$ 3.4cm) and rigid (34.8 $\pm$ 7.2cm; 23.5 $\pm$ 3.9cm) surfaces respectively ( $F=21.1$ ,  $p \leq .05$ ). There was no significant difference in jump height between sand (31.3+8.1cm) and rigid (30.5+8.3cm) jumping conditions for male and females combined ( $F=1.1$ ,  $p \geq .05$ ). There was a significant difference between jumping surfaces on normalized mean peak percentage EMG output measures with subjects RF (62.99 $\pm$ 16.91Hz; F12.7,  $p \leq .05$ ) and VL (62.76 $\pm$ 16.88 Hz; F4.6,  $p \leq .05$ ) from a sand surface. The BF (60.89 $\pm$ 9.76Hz; F4.7,  $p \leq .05$ ) and GN muscles (62.63 $\pm$ 11.41Hz; F=9.4,  $p \leq .05$ ) were significantly higher on a rigid surface for normalized mean peak percentage EMG output measures.

**CONCLUSIONS:** Jumping from a sand surface requires more output from the RF and VL of the quadriceps muscles than jumping from a rigid surface. This may be due to a longer duration of activity from knee extensor muscles that are stabilizing the center of mass prior to jump takeoff. The results from this study demonstrate that jumping in sand is not as mechanically efficient for lower extremity muscles as jumping on a rigid surface.

2445 Board #120 MAY 31 3:30 PM - 5:00 PM

**The Single-Leg Squat: Kinematics of Good and Poor Performance in Healthy Young Adults**

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(No relationships reported)

Poor lower limb stability during dynamic movement is thought to increase the risk of musculoskeletal injury. Biomechanically, stability is determined by a number of factors including the external load and contributions from passive and active tissues. One approach for studying lower limb stability is the single leg squat (SLS) test, which requires coordinated lower limb movement across a range of joint motions under external load. Although clinicians typically assess SLS quality from a single point of view (i.e. frontal plane), a 3D investigation of SLS kinematics would help to determine factors that differentiate clinician-defined "good" from "poor" quality performance.

**PURPOSE:** To determine the kinematic parameters that characterise a good or a poor SLS performance in young adults.

**METHODS:** 22 healthy young adults (13 male, 9 female; age: 23.8 ±3.1 years; height: 1.73 ±0.07 m; mass: 69.4 ±12.7 kg) free from musculoskeletal impairment were recruited. Video footage was collected in the frontal plane as participants performed three SLSs on each leg. SLS quality was assessed by a panel of physiotherapists using a ten-point ordinal scale. Performances were subsequently divided into tertiles corresponding to poor, intermediate and good SLS technique. 3D trajectories of 28 reflective markers attached to the pelvis, and lower limbs were simultaneously recorded at 200 Hz using a 10-camera, motion capture system (Vicon Motion Systems, Oxford, UK). Pelvis, hip and knee angles were calculated using a validated lower limb biomechanical model that incorporated functional identification of hip and knee joint centres.

**RESULTS:** Mean rating of SLS quality as assessed by the panel of physiotherapists was 6.3±1.9 (range: 2.4 - 9.1). 3D analysis of SLS performance revealed that poor squatters had increased hip adduction (22.4 ±6.1 vs 14.7 ±4.7 deg, *p*<0.01), reduced knee flexion (73.1 ±8.7 vs 90.1 ±12.1 deg, *p*<0.01) and increased medial-lateral displacement of the knee joint centre (53.7 ±16.8 vs 38.4 ±14.3 mm, *p*=0.02) compared to good squatters.

**CONCLUSION:** In healthy young adults a poor SLS is characterised by inadequate knee flexion and excessive frontal plane motion at the knee and hip. It is recommended that clinicians standardise knee flexion angle when using the SLS test as it might confound the perception of SLS quality.

2446 Board #121 MAY 31 3:30 PM - 5:00 PM

**A Comparison of Lower Extremity Kinematic Sequence between Female Dancers and Female Athletes**

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(No relationships reported)

The propulsive phase of a stretch-shortening cycle movement is characterized by a proximal to distal transfer of joint velocities, with peak hip velocity preceding peak knee velocity, which in turn precedes peak ankle velocity. Due to their extensive training in jumping activities, dancers are considered experts in these tasks. Analysis of their performance of such tasks may give insight into optimization of jumping technique.

**PURPOSE:** To compare lower extremity kinematic sequence during a single-leg countermovement jump between female dancers and female athletes.

**METHODS:** Twenty female dancers and twenty female athletes performed single-leg countermovement jumps to 50% of their max height. Joint kinematics were measured with eight infrared cameras and 22 markers. For each subject, the velocity profile of each joint was normalized to the maximum velocity achieved by that joint. Repeated-measures ANOVA (Group x Joint) were used to compare the timing of peak joint velocities as well as the percentage of peak velocity of each joint when the other two were maximal.

**RESULTS:** Peak joint velocities occurred later in the dancers compared to the athletes (Main Effect: Group, *P* = 0.037) (see table). Additionally, a Joint by Group interaction was found for hip and knee velocities at peak ankle velocity (*P* = 0.024). Post-hoc t-test revealed that dancers had lower relative hip velocities at peak ankle velocity than the athletes (72% vs. 79%, *P* = 0.031).

**CONCLUSIONS:** The delayed peak velocities seen in female dancers may indicate a strategy to maximize storage of elastic energy prior to takeoff and result in a less ballistic, more esthetically pleasing takeoff. It also appears that dancers utilize the ankle more than the hip at the final phase of takeoff.

Percent of propulsive phase at which peak joint velocities occurred. \* = grp diff, *P* < 0.05

|                | Hip        | Knee         | Ankle        |
|----------------|------------|--------------|--------------|
| Female Dancer  | 70.3 ± 5.3 | 77.0 ± 4.0   | 86.1 ± 2.6   |
| Female Athlete | 67.7 ± 8.6 | 72.6 ± 7.5 * | 82.0 ± 4.8 * |

2447 Board #122 MAY 31 3:30 PM - 5:00 PM

**Analysis Of Jumping Technique Via Functional Principal Components Data Analysis Versus Peak Ground Reaction Force**

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(No relationships reported)

Analysis of the force curves during jumping is typically done using a single point, often the peak of the ground reaction force (GRF), or rate of force development to describe the performance. A weakness of this discrete data point (DPA) technique is that changes in the entire curve are not analyzed. Conversely techniques using functional principal component analysis (FPCA) assess differences throughout the entire curve.

**PURPOSE:** To evaluate jump technique by assessing GRF via DPA and FPCA.

**METHODS:** Twenty recreationally active college students (Mean ± SD Age = 23.1 ± 4.8 years; Height = 1.76 ± .09 m; Weight = 72.1 ± 13.6 kg) performed a maximal counter-movement jump, with arm swing, from a force platform sampling at 1000 Hz. The jumps studied were single leg jumps using the left leg (LCMJ), right leg (RCMJ), and a jump with both legs simultaneously (BCMJ). GRF curves were analyzed via Repeated Measures ANOVA using DPA of the peak GRF and via FPCA to analyze the entire curve and test for differences between jump conditions. Steps to identify FPC were continued until they described 95 % of the variability in the data set and were VARIMAX rotated to increase reliability. The resulting FPCA scores were then compared between the jump conditions via ANOVA.

**RESULTS:** Peak GRF did not differ (*p*= 0.126) between the three jump conditions: BCMJ = 2533 ± 466 N; LCMJ = 2193 ± 593 N; RCMJ = 2158 ± 603 N. Seven functional principal components were needed to describe 95% of the variability in the data; of these, FPC scores of components 1, 2, and 4 differed between the jump conditions (BCMJ < LCMJ, RCMJ; *p* < 0.05). Principal component 1 explained 40% of the variability while components 2 and 4 explained 24% and 8% respectively.

**CONCLUSION:** FPCA identified differences in the curves of the three jump conditions that were not apparent when comparing peak GRF. Specifically, statistical analyses of the functional principal component scores showed that components 1, 2, and 4 for the BCMJ were different from either of the single leg jumps. These components were analogous to the following temporal aspects of the force curve: 1) the rapid increase in force, 2) just after the minimal force during the counter-movement, and 4) the rapid drop in force just prior to takeoff from the ground.

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2448 Board #123 MAY 31 3:30 PM - 5:00 PM

**Hip and Knee Mechanics During a Sidestep Cutting Task Unaffected by Limb Dominance**

Eric Greska<sup>1</sup>, Nelson Cortes<sup>2</sup>, Stacie Ringleb<sup>1</sup>, Ashley Spear<sup>1</sup>, Alysia Jordan<sup>1</sup>, Bonnie Van Lunen<sup>1</sup>. <sup>1</sup>Old Dominion University, Norfolk, VA. <sup>2</sup>George Mason University, Fairfax, VA.

(No relationships reported)

Previous studies have demonstrated that dissimilarity between the dominant and non-dominant legs with relation to noncontact anterior cruciate ligament injuries; the non-dominant leg being the involved side in 48-67% of reported incidents.

**PURPOSE:** To evaluate lower extremity biomechanical differences in leg dominance during an unanticipated sidestep cutting task.

**METHODS:** Twenty-nine female collegiate soccer players (19.3±1.0 years, 1.66±0.1m, 63.2±6.3Kg) completed trials of an unanticipated sidestep cutting task. Subjects were required to complete three valid trials for both the dominant and non-dominant leg, with the dominant leg being defined as the leg the subject would use to kick a soccer ball furthest. Trials were performed in a randomized order, with task cues graphically projected in front of the subject through a custom-designed computer program. An 8-camera motion capture system, and two force plates, captured data at rates of 250Hz and 2000Hz, respectively. A MANOVA was used to determine the effect of leg dominance on hip and knee mechanics at initial contact (IC) and peak knee abduction moment (PKABM). Dependent variables consisted of hip and knee flexion, abduction, and rotation joint angles and moments. The alpha level was set *a priori* at 0.05, with a Bonferroni adjustment applied.

**RESULTS:** No significant differences ( $p < 0.05$ ) were found at initial contact or peak knee abduction moment for joint angles and moments of the hip and knee. Though not significant ( $p > 0.05$ ), at IC the knee abduction angle was comparable between the dominant and non-dominant legs (-1.35±4.23 and -1.86±4.21), yet demonstrated a divergence at PKABM (-0.88±4.84° and -2.10±4.42°), with the non-dominant leg shifting to a more abducted position.

**CONCLUSION:** As no significant differences for the biomechanics of the hip and knee were demonstrated between limbs at IC or PKABM, it is believed that the discrepancy between involved limbs in noncontact anterior cruciate ligament injuries may stem from other neuromechanical characteristics. Such neuromechanical characteristics can include muscular strength, rate of force development, muscular activation amplitude and timing, and cortical activation patterns that can differ between limbs, yet still demonstrate similar mechanical outcomes.

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2449 Board #124 MAY 31 3:30 PM - 5:00 PM

**Assessing Single-Leg Squat Quality: Kinematic Predictors for Experienced and Inexperienced Clinicians**

Sean A. Horan, Benjamin K. Weeks. Griffith Health Institute, Griffith University, Gold Coast campus, Australia. (Sponsor: Belinda R. Beck, FACSM)

(No relationships reported)

The single-leg squat (SLS) is commonly used by physical therapists (PTs) in the clinical assessment of the lower limb. SLS performance is associated with hip muscle function, knee loading patterns and risk of musculoskeletal injury. The kinematic parameters relating to clinician observations of SLS quality, however, are yet to be illuminated. Furthermore, it is unknown if such parameters are related to clinician experience.

**PURPOSE:** To reveal the pelvis, hip and knee kinematic parameters used to determine SLS quality by experienced and inexperienced clinicians.

**METHODS:** Eight student and eight post-graduate level musculoskeletal PTs agreed to rate each SLS. Twenty-two healthy, young adults (23.8 ± 3.1 years) were videoed while performing three SLSs on each leg. 3D motion of the pelvis, hip and knee was recorded using a 10-camera optical motion analysis system (Vicon, Oxford, UK). Quality of each SLS performance was rated from video data using a 10-point ordinal scale (i.e. 1 = lowest, 10 = highest). SLSs were re-scored two weeks later by all assessors. Stepwise multiple regression analysis was performed to determine kinematic predictors of stability scores for experienced PTs and student PTs. Inter- and intra-rater reliability was determined using a two-way mixed model to generate intra-class correlation coefficients (ICC) of consistency.

**RESULTS:** The second SLS on each side was analyzed for each participant, providing 44 SLSs for analysis. Experienced PT scores were greater than student PT scores (6.4 ± 1.8 vs 6.1 ± 1.5;  $p = 0.02$ ). Variance in experienced PT scores was predicted by peak knee flexion, peak hip adduction, and knee medio-lateral displacement ( $R^2 = 0.64$ ,  $p = 0.01$ ). Variance in student PT scores was predicted by peak knee flexion, and knee medio-lateral displacement ( $R^2 = 0.57$ ,  $p = 0.01$ ). Inter-rater reliability was good for PTs (ICC = 0.71) and students (ICC = 0.60). Intra-rater reliability was excellent for PTs (ICC = 0.81) and good for PT students (ICC = 0.71).

**CONCLUSION:** Experienced PTs and student PTs are both capable of reliable assessment of SLS stability; however experienced PT assessments bear somewhat stronger relationships to lower limb kinematics. PT ratings were related to hip and knee motion, while student PT ratings were specific to the knee.

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2450 Board #125 MAY 31 3:30 PM - 5:00 PM

**Differences in Muscle Activation Following Drop Jump Landing Biofeedback Intervention**

Hillary Plummer, Gretchen D. Oliver, Alyssa Romasco, Taylor Holt. University of Arkansas, Fayetteville, AR. (Sponsor: Heidi Kluess, FACSM)

(No relationships reported)

Neuromuscular training has been proven effective in injury prevention, however it has yet to be determined if immediate landing feedback interventions are effective.

**PURPOSE:** The purpose of this study was to examine the effects of a landing intervention program on lower extremity muscle activation.

**METHODS:** Eighteen (12 females, 6 males) graduate students volunteered to participate (22.94 ± 1.03 years; 169.47 ± 8.78 cm; 69.31 ± 15.13 kg). Surface electrodes were placed on gluteus medius, gluteus maximus, rectus femoris, and biceps femoris. sEMG data were collected and expressed as percent maximum voluntary isometric contraction (%MVIC). Participants were instructed to perform three drop jump landings from a height of 47 cm. Following the initial landings participants were given a 5 minute intervention that included verbal and visual feedback on landing strategies. Immediately following the intervention, they performed three more drop landings.

**RESULTS:** Paired samples t test revealed significantly greater activation, post intervention, of the biceps femoris ( $p = 0.047$ ) and the gluteus maximus ( $p = 0.001$ ). Biceps femoris activity increased by 52.11 %MVIC and the gluteus maximus by 73.57 %MVIC. No statistically significant differences were observed in the gluteus medius and rectus femoris muscles. However, while not significantly different, the gluteus medius decreased by 14.9 %MVIC and the rectus femoris by 8.23 %MVIC.

**CONCLUSIONS:** The biceps femoris and gluteus maximus function to flex the knee and extend the hip respectively. The intervention focused on increasing posterior chain activation by increasing knee flexion in order to land softly. Further analysis is needed to understand the kinematics utilized post intervention.

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2451 Board #126 MAY 31 3:30 PM - 5:00 PM

**Intra-rater Reliability and Between-leg Deficits in Unilateral Jump Performance and Muscle Strength in Healthy Controls**

Anders Holsgaard-Larsen<sup>1</sup>, Tanja Andersen<sup>1</sup>, Carsten Jensen<sup>1</sup>, Per Aagaard<sup>2</sup>. <sup>1</sup>Orthopaedic Research Unit, Institute of Clinical Research, Odense C, Denmark.

<sup>2</sup>Institute of Sports Science and Clinical Biomechanics, Odense C, Denmark.

(No relationships reported)

Assessing the ratio between the affected and unaffected leg is traditionally used in the clinical setting to distinguish between normal or abnormal test scores (1,2). Knowledge about the reliability in outcome measures and the extent of asymmetry in healthy subjects is crucial.

**PURPOSE:** To investigate *i*) intra-rater reliability of unilateral jump performance and isometric knee extensor and flexor strength (MVC) and *ii*) between-leg asymmetry in healthy men.

**METHODS:** Test-retest measurements were performed in 13 healthy men (mean age: 27.1 ± 6.1 years, BMI: 24.5 ± 2) separated by ~7 days. Subjects performed maximal counter movement jumps (CMJ) with each leg positioned on a separate force plate. Kinematic data were recorded using a 6 camera Vicon<sup>MX</sup> system. Subsequently, center of mass jump height (JH), unilateral range of motion (ROM), and unilateral peak and mean sagittal knee moment in the concentric phase were analyzed. Also, one-legged maximal hop for distance (HD) was recorded (1), along with unilateral knee extensor and flexor MVC (3). Within-subject coefficient of variation (CV<sub>ws</sub>), 95% confidence interval for test-retest differences, and asymmetry ratios were calculated according to previous procedures (1,4,5).

**RESULTS:** **CMI:**  $CV_{ws}$  was 4.8% for center of mass JH. For unilateral measures,  $CV_{ws}$  was 8.7%-12.6%. **Hop for distance:**  $CV_{ws}$  was 3.1% - 4.3%. **MVC:**  $CV_{ws}$  was 7.7%-14.1%. HD increased at retest (95% CI: [-8.1 ; -0.1] and [-11.5 ; -2.0]) in both legs. Asymmetry ratios in unilateral CMJ were 100%, 80%, 80% for ROM, peak and mean knee moment, respectively, and 96% for HD and 73% and 85% for isometric knee flexor and extensor MVC, respectively.

**CONCLUSION:** Good to moderate reliability was observed for all measured variables. However, a small but systematic increase was observed for hop for distance. Signs of between-leg asymmetry were observed in healthy males. Future research should investigate accuracy before this test battery can be applied to determine when/if an injured subject is fully recovered.

- (1) Gustavsson et al, *Knee Surg Sports Traumatol Arthrosc*, 2006
- (2) Itoh et al, *Knee Surg Sports Traumatol Arthrosc*, 1998
- (3) Jensen et al, *Osteoarthr and Cartil*, in press 2011
- (4) Larsen et al, *Scand J Med Sci Sports*, 2007
- (5) Lexcell & Downham, *Am J Phys Med Rehabil*, 2005

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**2452** Board #127 MAY 31 3:30 PM - 5:00 PM

**Electromyographic Analysis of the Biceps Femoris During Conventional and Rubber-Based Band Squats**

Ty B. Palmer<sup>1</sup>, Kevin W. McCurdy<sup>2</sup>, James S. Williams, FACSM<sup>2</sup>, John L. Walker, FACSM<sup>2</sup>. <sup>1</sup>Oklahoma State University, Stillwater, OK. <sup>2</sup>Texas State University, San Marcos, TX.

(No relationships reported)

Recently, several variable resistance methods of attaching bands to the power rack during the back squat exercise have been established.

**PURPOSE:** To compare the electromyographic (EMG) output of the long head of the biceps femoris (BF) muscle amongst 3 resistance conditions on the back squat exercise. The no band (NB) condition used only the barbell plus weighted-plates. The bottom band (BB) and top band (TB) conditions combined weighted-plates with bands attached to the barbell originating from the bottom and tops of the power rack, respectively.

**METHODS:** Twenty-two healthy, physically active collegiate males volunteered to participate (age =  $22.4 \pm 2.6$  yr; height =  $177.8 \pm 9.7$  cm; weight =  $87.0 \pm 19.0$  kg). Initial 1-repetition maximum (1RM) testing was conducted in order to assess each subject's maximal strength for each resistance condition. Eighty percent (%) of each 1RM was used as the external load during EMG testing. To compare EMG activity across the entire range of motion (ROM), both the eccentric and concentric phases of movement were divided into % intervals based upon the time it took each subject to complete the measured repetition. A pair of disposable bipolar surface electrodes (2-cm interelectrode distance, 1-cm<sup>2</sup> circular conductive area) was placed along the longitudinal axis of the BF (50% of the distance from the ischial tuberosity to the lateral epicondyle of the tibia), connected to an amplifier, and continuously streamed through an analog to digital converter using an EMG telemetry system. The EMG signals (gain = 500, bandwidth frequency = 10-500 Hz, CMRR = 110 dB) were sampled at 1000 Hz, smoothed using root mean square, and averaged in millivolts (mV) over the durations of the 90 and 10% intervals (top and bottom portions of the ROM, respectively).

**RESULTS:** At the 90% interval there was significantly higher EMG output in the TB ( $0.039 \pm 0.029$  mV) condition than the NB condition ( $0.033 \pm 0.023$  mV,  $p < 0.05$ ). At the 10% interval there was significantly higher EMG output in the NB condition ( $0.020 \pm 0.013$  mV) than both the BB ( $0.016 \pm 0.008$  mV) and TB ( $0.017 \pm 0.010$  mV) conditions ( $p < 0.05$ ).

**CONCLUSION:** The TB condition elicited greater BF EMG activity at the top of the ROM when compared with the NB condition. However, at the bottom of the ROM, the NB condition elicited greater BF EMG activity than both the BB and TB conditions.

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**2453** Board #128 MAY 31 3:30 PM - 5:00 PM

**Gender Differences in Lower Extremity Kinematics during an Unanticipated Side-Cut**

Donald E. Fowler, III, Robert J. Butler, Wesley Oglesby, Claude T. Moorman, III, William E. Garrett, Jr, FACSM, Robin M. Queen. *Duke University, Durham, NC.*

(No relationships reported)

Female athletes have a higher incidence of anterior cruciate ligament (ACL) injury compared to men playing the same sports. The majority of these injuries are attributed to a non-contact pivoting mechanism, as seen in cutting and jumping tasks. Gender differences in lower extremity kinematics are documented in the literature, with most of these studies being conducted in the laboratory setting, which do not simulate in-game competition.

**PURPOSE:** To compare differences in lower extremity kinematics between males and females when completing an unanticipated side-cut on FieldTurf, wearing a firm ground cleat.

**METHODS:** Twenty-nine subjects (13 males, 16 females) were included in the study. All participants were skilled soccer players with no history of lower extremity or ACL injury within the last 6 months. Eight infrared cameras (Motion Analysis, Inc) were positioned around the FieldTurf field and used to record the trajectories of the retro-reflective markers. A single firm ground cleat was used for every trial. Each subject completed 45 degree unanticipated cuts to the right or left depending on which light flashed in front of them while running until 7 acceptable trials were recorded.

**RESULTS:** Males demonstrated larger peak hip abduction at 25.71 degrees, versus 20.23 degrees in females ( $p < 0.03$ ). Females exhibited greater peak hip adduction ( $p < 0.03$ ). No other dependent variables were statistically different. Females had greater hip flexion at heel-strike when cutting compared to males (57.4 vs. 51.4 degrees). Men demonstrated larger peak knee flexion (54.2 vs. 51.8 degrees). Women had slight knee abduction (2.0 degrees) at heel-strike when cutting, compared to men who exhibited slight knee adduction (1.3 degrees).

**CONCLUSIONS:** Minor gender differences in joint kinematics were demonstrated during an unanticipated side-cut on FieldTurf in cleats, which better recreates in-game activity. The lack of statistically significant differences similar to those that have been reported between genders in recreational athletes is most likely the result of testing highly skilled soccer players. As a result of this study it appears that assessing multiple domains of movement may be important in examining an individual's injury risk.

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**2454** Board #129 MAY 31 3:30 PM - 5:00 PM

**Discrete Vs. Functional Based Data To Analyze Countermovement Jump Performance**

Chris Richter, Noel E. O'Connor, Kieran Moran. *Dublin City University, Dublin, Ireland.* (Sponsor: Randall Jensen, FACSM)

(No relationships reported)

While discrete point analysis (DPA) (e.g. peak power) is by far the most common method of analyzing movement data, it may have significant limitations because it ignores the vast majority of a signal's data. In response, there has been a small but growing use of methods, such as functional data analysis (FDA), which allow an investigation of the underlying structure of the continuous signal and may therefore provide a more powerful analysis. However, a direct comparison between DPA and FDA has not been previously reported.

**PURPOSE:** To directly compare DPA and FDA for the identification of performance determining factors for the countermovement jump (CMJ).

**METHODS:** Twenty-five male participants performed 15 CMJs, and the highest jump was selected for further analysis. Joint and whole body kinematic and kinetic measures were determined using position data (Vicon, 250 Hz) and force plate data (AMTI, 1000Hz). Participants were divided into good (n=10) and poor (n=10) groups based on jump height. A t-test ( $\alpha = 0.05$ ) was performed on the timing and magnitude of key variables (DPA) and functional derived points (FDA) during the propulsion phase to examine differences between the groups.

**RESULTS:** Both techniques found differences ( $p < 0.05$ ) in knee angular peak velocity, CoM peak velocity, CoM peak power and CoM work done. However, the FDA alone found significant higher ( $p < 0.05$ ) ankle moment (79 - 83%, peak at 67%), ankle power (54 - 67%, peak at 81%), knee angular velocity (28 - 100%), CoM velocity (56 - 100%), CoM power (49 - 91%) and a delay in CoM position (10 - 90%) and CoM velocity (10 - 60%) for the good performance group. Finally, the DPA alone found differences in ankle peak moment, ankle peak power and hip peak angular velocity.

**CONCLUSIONS:** In contrast to FDA, DPA found three events which were not detected by FDA. However, only FDA was able to identify important differences in phases of the CMJ and explains differences between good and poor performance better than DPA. Finally, the ability to examine data with continuous techniques appears to provide a deeper insight into human movement than DPA.

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2455 Board #130 MAY 31 3:30 PM - 5:00 PM

**Assessing Muscular Power with a Portable Device in a Clinical Setting**

Cengiz Akalan<sup>1</sup>, Robert Scales<sup>2</sup>, Kathryn A. Cornella<sup>2</sup>, Susan Halli<sup>2</sup>, Robert T. Hurst<sup>2</sup>. <sup>1</sup>Ankara University, ANKARA, Turkey. <sup>2</sup>Mayo Clinic, Phoenix, AZ  
(No relationships reported)

**PURPOSE:** An age-related decline in muscular power may have a detrimental effect on sports performance and tasks of daily living. This study assessed lower extremity muscular power in a group of middle-aged adults (40-59 yrs) who elected to participate in a cardiology-based prevention program.

**METHODS:** The study involved a single visit observation of the participants. Ninety-nine apparently healthy adults (70% male) were assessed for lower extremity muscular power with the Counter Movement Jump (CMJ) Test. Participants performed 5 consecutive vertical counter movement jumps with the hands on the hips. The jumps were performed in a medical exam room on a hard carpeted surface while wearing shoes. None of the participants reported a physical limitation or injury at the time of testing. A Myotest accelerometer was attached to the waist and it instantly calculated the average height jumped, force produced, velocity and power from the best 3 jumps.

**RESULTS:** The mean age of the participants was 50.8 yrs (SD= 5.4). The overall mean height, force, velocity and power scores for men (n=69) and women (n=30) were 24.2 cm (SD= 5.8) Vs 15.0 cm (SD= 4.1), 19.3 N/Kg (SD= 2.2) Vs 17.5 N/Kg (SD= 1.9), 162.6 cm/s (SD= 31.1) Vs 142.4 cm/s (SD= 25.3) and 25.6 W/Kg (SD= 7.4) Vs 20.6 W/Kg (SD= 5.0) respectively. The mean scores on the same measures for men 40-49 yrs (n=30) and 50-59 yrs (n=39) were 26.3 cm (SD= 6.4) Vs 22.6 cm (SD= 4.8), 20.1 N/Kg (SD= 2.1) Vs 18.7 N/Kg (SD= 2.2), 169.6 cm/s (SD= 35.4) Vs 157.1 cm/s (SD=26.6) and 27.6 W/Kg (SD= 8.6) Vs 24.0 W/Kg (SD= 6.1) respectively. The mean scores for women 40-49 yrs (n=9) and 50-59 yrs (n=21) were 17.7 cm (SD= 4.1) Vs 13.8 cm (SD= 3.7), 17.4 N/Kg (SD= 1.1) Vs 17.5 N/Kg (SD= 2.1), 153.2 cm/s (SD=18.1) Vs 137.7 cm/s (SD=26.9), 22.2 W/Kg (SD= 3.2) Vs 19.9 W/Kg (SD= 5.5) respectively.

**CONCLUSIONS:** The Myotest accelerometer is a small user friendly portable device that can be used to assess muscular power in a clinical setting. This type of technology may assist in the design of exercise programs to improve muscular fitness. A larger, more representative sample is needed to determine age, gender and race norms for CMJ Test scores using the Myotest accelerometer.

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2456 Board #131 MAY 31 3:30 PM - 5:00 PM

**Does Higher Anterior Knee Joint Laxity Alter Landing Biomechanics in Pubescent Girls?**

Catherine Y. Wild, Julie R. Steele, Bridget J. Munro. University Of Wollongong, Wollongong, Australia.  
(No relationships reported)

From the onset of puberty females are at a greater risk of sustaining a non-contact anterior cruciate ligament (ACL) rupture compared to males. Increased anterior knee laxity (AKL) in females has been proposed as a possible mechanism for increased ACL injury risk, due to the associated decrease in knee joint stability during landing movements. Despite this association, there is a dearth of literature investigating the effects of increased AKL on lower limb landing biomechanics in adolescent girls.

**PURPOSE:** To investigate whether adolescent girls with higher AKL displayed altered landing biomechanics compared to adolescent girls with lower AKL.

**METHODS:** Forty-six healthy girls (10-13 yr), confirmed as Tanner stage II-III, were recruited and tested at their time of peak height velocity (PHV; peak growth in height). Passive AKL was quantified and used to classify participants into a higher (peak displacement > 4 mm) and a lower (peak displacement < 3 mm) AKL group (n = 15/group), with the 16 middle participants removed to ensure a significant between-group difference in AKL. Strength testing of the quadriceps and hamstring muscles was carried out using an isokinetic dynamometer. Participants then performed a functional, single-limb landing movement, during which three-dimensional lower limb kinematics (100 Hz), ground reaction forces and muscle activation patterns (1,000 Hz) were assessed. Independent samples t-tests were applied to the data to determine any significant ( $p \leq 0.05$ ) differences in lower limb landing biomechanics displayed by the higher AKL group relative to their lower AKL counterparts.

**RESULTS:** Girls with higher AKL displayed significantly ( $p = 0.018$ ) greater height velocity compared to girls with lower AKL ( $12.3 \text{ cm}\cdot\text{y}^{-1}$  vs  $9.5 \text{ cm}\cdot\text{y}^{-1}$ ), as well as similar leg strength, thought to decrease knee joint stability. However, girls with higher AKL demonstrated significantly earlier hamstring muscle activation ( $p < 0.05$ ) compared to girls with lower AKL.

**CONCLUSION:** We speculate that earlier hamstring activation displayed by girls with higher AKL may be an attempt to impart sufficient posterior tibial drawer to protect the ACL upon landing, due to their decreased knee joint stability. Further research, however, is warranted to longitudinally track landing mechanics throughout the adolescent growth spurt.

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**D-24 Free Communication/Poster - Lower Extremity**

MAY 31, 2012 1:00 PM - 6:00 PM

ROOM: Exhibit Hall

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2457 Board #132 MAY 31 3:30 PM - 5:00 PM

**The Three-Dimensional Passive Support Characteristics of Ankle Braces on Combined Talocrural-Subtalar Joint Motions**

John E. Kovaleski<sup>1</sup>, Larry R. Gurchiek<sup>1</sup>, Robert J. Heitman<sup>1</sup>, Wei Liu<sup>1</sup>, J. Marcus Hollis<sup>2</sup>, Mitchell L. Cordova, FACSM<sup>3</sup>. <sup>1</sup>University of South Alabama, Mobile, AL. <sup>2</sup>Blue Bay Research, Navarre, FL. <sup>3</sup>Florida Gulf Coast University, Fort Myers, FL.  
(No relationships reported)

Studies of the passive support provided by ankle braces have focused primarily on inversion motion. Our goal was to develop a technique to measure support provided by ankle braces in all rotational directions and to use this technique to compare two common braces. Brace effectiveness in combination with a shoe has never been evaluated in vitro.

**PURPOSE:** To compare the effects of a rigid-hinge brace (Active Ankle™) and a lace-up brace (ASO™) on rotary foot displacement.

**METHODS:** A 6 degrees-of-freedom linkage was used to measure ankle-complex rotation in 6 cadaver ankles. Each ankle was mounted to a jig proximally via a tibial rod cemented into the tibial medullary cavity and distally via an athletic shoe fixed to a mounting plate of the testing machine. The specimens were loaded to 2 Nm in internal-external rotation at 0° plantar-flexion (PF), as well as 4 Nm inversion-eversion (I-E) rotation at 15° PF. Exercise consisted of dorsi-plantar flexion cycling to  $\pm 1.5$  Nm for 10 minutes. Ankles were tested with no brace (NB) and both pre- and post-exercise braced. Comparisons of total ankle-complex internal-external rotation and I-E rotation (degrees ROM) were made using separate two-way ANOVA with repeated measures.

**RESULTS:** A significant condition main effect was found for I-E rotation ( $P < .001$ ). Before exercise, application of either brace produced a significant reduction in I-E ROM (rigid:  $37.9 \pm 8.4^\circ$ ,  $P = .002$ ; lace-up:  $39.5 \pm 10.3^\circ$ ,  $P = .006$ ) when compared to NB ( $62.5 \pm 17.4^\circ$ ). No I-E ROM differences ( $P > .05$ ) were found between pre-post exercise for either the rigid ( $39.7 \pm 7.9^\circ$ ) or lace-up ( $43.8 \pm 12.8^\circ$ ), despite the rigid brace demonstrating greater restriction ( $-4.1^\circ$ ). A significant condition main effect ( $P < .044$ ) was found for internal-external rotation. Brace application showed no significant rotation decrease ( $P > .05$ ) for either the lace-up ( $36.2 \pm 13.3^\circ$ ) or rigid brace ( $33.5 \pm 14.6^\circ$ ) from the NB condition ( $43.1 \pm 18.4^\circ$ ). Pre-post exercise comparisons showed internal-external rotation significantly increased  $1.4^\circ$  for the lace-up ( $37.6 \pm 13.9^\circ$ ,  $P = .007$ ) but not for the rigid brace ( $34.3 \pm 14.4^\circ$ ,  $P = .11$ ).

**CONCLUSION:** Data indicate that both braces are similarly effective in restricting inversion-eversion rotation before and after exercise but neither was significantly effective in restricting internal-external rotation.

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2458 Board #133 MAY 31 3:30 PM - 5:00 PM

**The Effect of Serial Acupuncture Treatment on Hamstring Muscle Flexibility and Strength**

Kevin J. Curley, MD<sup>1</sup>, Mariel Wenzel<sup>2</sup>, Karl Zierman, DO<sup>1</sup>, Cory Whitmer<sup>2</sup>, Michele Aquino<sup>2</sup>, Raymond Peralta<sup>2</sup>, Shannon Isom<sup>2</sup>, Robert M. Otto, FACSM<sup>2</sup>, John W. Wygand<sup>2</sup>. <sup>1</sup>Winthrop University Hospital, Mineola, NY. <sup>2</sup>Adelphi University, Garden City, NY.

(No relationships reported)

Modern acupuncture is a technique of inserting small, thin, thread-like (filiform), single use needles into specific points (acupoints or energy meridians) on the body for therapeutic purposes. The use of acupuncture is known to reduce discomfort/pain sensation and may permit improvements in strength or flexibility.

**PURPOSE:** This study was designed to evaluate the effect of serial acupuncture treatment (8 treatments) on hamstring strength and flexibility.

**METHODS:** 15 subjects (7 male, 8 female, age 21.9±1.6 yr, ht 173±9.9 cm, body mass 74.9±13.7 kg) volunteered to perform a unilateral hamstring strength assessment (Cybex 6000 isokinetic seated knee flexion) and a unilateral flexibility assessment (modified Wells Sit and Reach test). Following the baseline trials, subjects served as their own control with one leg assigned as the placebo (P) and the other leg as the acupuncture intervention (A). In this double blind design, subjects entered the lab blindfolded, assumed a prone position on a plinth, and eight acupuncture needles were inserted inferior to the gluteal fold and superior to the popliteal fossa in the intervention leg. In addition, needles were inserted at the same locations and removed within 2 sec in the control leg. The points in the intervention leg included UB36, UB37, UB38 and UB40, as well as 5 additional Ashi points that were placed at areas of particular tightness in the hamstring muscle. The thirty minute treatments were separated by a minimum of 48 hours and conducted twice each week for four weeks. Statistical analysis by paired t test was applied to these data (p<.05).

**RESULTS:** The following data were obtained for treatment A and P, pre- and post-treatment, respectively: Peak Torque 118.5 & 114.2 vs 119.4 & 112.4 ft/lbs, mean work/rep 128.1 & 122.2 vs 128.2 & 122.1 ft/lbs, and hamstring flexibility 46.2 & 48.5 vs 46.7 & 47.9 cm, respectively. Hamstring flexibility evidenced significant improvement in the treated limb.

**CONCLUSION:** Four hours of accumulated acupuncture treatment significantly improved limb flexibility, which may, in part, be attributed to change in tension within the muscle, allowing for relaxation and elongation.

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2459 Board #134 MAY 31 3:30 PM - 5:00 PM

**The Effect of a Strength-training Prehabilitation Intervention on Postoperative Outcomes of Total Knee Arthroplasty**

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(No relationships reported)

Pre-operative function has been shown to be the greatest overall predictor of post-operative function for those undergoing total knee arthroplasty (TKA), and quadriceps strength is one of the greatest contributors to function in this population. Although pre-surgical interventions (prehabilitation) aiming to increase quadriceps strength have recently been investigated, their effects on post-operative outcomes are not clear.

**PURPOSE:** This pilot study aimed to examine the effect of a six-week, pre-surgical strength training program on post-operative quadriceps strength, mobility, pain, self-reported function, health-related quality of life, and arthritis self-efficacy for patients undergoing TKA.

**METHODS:** Participants who were booked for TKA (n = 22) were randomized to either a lower body strength-training program or a placebo upper body strength-training program for six weeks before TKA. Measures included the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), Medical Outcomes Study Short Form 36 (SF-36), Arthritis Self Efficacy Scale, a flat surface walking test, a stair ascent/descent test, and an isometric quadriceps strength assessment. Measures were taken at baseline, before surgery, and 6 and 12 weeks post-operatively. Between-group comparisons were made using repeated measures ANOVAs.

**RESULTS:** The effect sizes associated with the lower body training program were large for quadriceps strength,  $F(3,18) = 0.89$ ,  $p = 0.47$ ,  $\eta^2 = 0.13$ , and walking speed,  $F(3,18) = 1.47$ ,  $p = 0.26$ ,  $\eta^2 = 0.20$ , with clinically meaningful differences emerging before TKA. These benefits were not evident after surgery, however. Although there were no significant time x treatment interactions for pain  $F(3,18) = .35$ ,  $p = 0.54$ ,  $\eta^2 = .054$ , self-reported function  $F(3,18) = .52$ ,  $p = 0.67$ ,  $\eta^2 = 0.08$ , or self efficacy  $F(3,18) = .51$ ,  $p = 0.08$ ,  $\eta^2 = 0.08$ , the effect sizes were in the moderate to large range, and in the expected direction.

**CONCLUSIONS:** The intervention was effective at increasing pre-operative strength and walking speed, but this study was underpowered to detect statistically significant benefits after surgery. Replication with a larger sample size is recommended.

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**Muscle Imbalance, Functional Loading and Cartilage Composition at the Knee**

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(No relationships reported)

Functional muscle imbalance at the knee is a cause and consequence of numerous injuries and diseases. Coordinated muscular contraction is critical to dynamic control of knee segments during functional activities and loading during functional activities impacts cartilage morphology and composition. Relationship of muscle imbalance with functional loading and cartilage composition is unknown.

**PURPOSE:** To investigate the relationship between muscle imbalance, functional loading and cartilage composition in young healthy adults using quantitative MRI.

**METHODS:** 33 young healthy subjects (20-35 years, BMI < 28 kg/m<sup>2</sup>) had 3-T knee MRI to calculate T1 $\rho$ - and T2 relaxation times for articular and meniscal cartilage. T1W MRI was used to calculate mid-thigh muscle cross-sectional area (CSA) for the quadriceps (Q) and hamstrings (H). 3-D motion analysis during self-selected walking speed was used to calculate peak kinetic and kinematic variables during stance phase in sagittal and frontal planes. Pearson's correlations were used to correlate medio-lateral (M:L) and Q:H muscle CSA ratios with qMRI and gait variables followed by multiple linear regression.

**RESULTS:** Greater Q:H ratio was related with greater Tibiofemoral T1 $\rho$  ( $r = 0.327$ ,  $p = 0.035$ ) and T2 ( $r = 0.401$ ,  $p = 0.009$ ). Greater M:L Q ratio was associated with greater M:L ratio of meniscus T1 $\rho$  ( $r = 0.337$ ,  $p = 0.029$ ). Greater M: L Q ratio was associated with greater knee adduction moment (KAM) peaks ( $r = 0.357$ ,  $p = 0.024$ ) and impulse ( $r = 0.461$ ,  $p = 0.003$ ), and greater frontal rate of loading ( $r = 0.303$ ,  $p = 0.057$ ). Greater Q:H ratio was associated with greater peak frontal ( $r = 0.645$ ,  $p = 0.000$ ) and sagittal moments ( $r = 0.360$ ,  $p = 0.023$ ) and greater dynamic frontal malalignment ( $r = 0.330$ ,  $p = 0.038$ ).

**CONCLUSION:** Results show for the 1st time that muscle imbalance (high Q:H and M:L CSA ratios), is related to high T1 $\rho$ - and T2 relaxation times for articular and meniscal cartilage indicating loss of proteoglycans and collagen disruption. Muscle imbalance is also related to high KAM peak/ impulse, high dynamic varus, all of which are known risk factors for cartilage degeneration. These novel findings suggest that people with greater muscle imbalance might be at risk for developing knee degeneration. Hence, muscle balance training would be a critical component of preventive programs.

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**EMG And MMG Responses In Individuals With A History Of ACL Injury**

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(No relationships reported)

It has been suggested that residual quadriceps femoris weakness may continue to exist following completion of prescribed rehabilitation for anterior cruciate ligament (ACL) surgery. The

underlying, if any, impact that this residual weakness has on submaximal electrical and mechanical aspects of function, as measured by electromyography (EMG) and mechanomyography (MMG), has not been previously investigated.

**PURPOSE:** To examine the EMG and MMG responses of the vastus lateralis (VL) during isometric muscle actions in individuals with a history of ACL surgery.

**METHODS:** The participants included 6 healthy individuals (control) with no history of ACL injury (age  $21.8 \pm 1.3$  yrs, BW  $73.5 \pm 12.1$  kg) and 6 individuals who were post ACL reconstruction from 6 months to 18 months (age  $20.2 \pm 1.2$  yrs, BW  $66.2 \pm 6.0$  kg) and fully cleared to return to recreational activities. Each participant performed three, 6-second maximal and three, 20-second sub-maximal (15%, 30%, 45 %MVC) isometric leg extensions at angles of 15° and 60° below the horizontal plane on a Humac Dynamometer. EMG ( $\mu$ V) and MMG (mV) amplitude was measured from the VL. Independent T-tests examined group (control, ACL) differences in maximal torque and EMG and MMG amplitude at each %MVC for both angles. An alpha of 0.05 was used to determine statistical significance.

**RESULTS:** The ACL group was weaker than then control group at 15° ( $50.8 \pm 25.7$  Nm vs.  $76.1 \pm 25.1$  Nm) and significantly weaker at 60° ( $106.8 \pm 36.9$  Nm vs.  $190.8 \pm 61.0$  Nm). In comparison to the control group at 15 and 60°, the EMG amplitude for the ACL group was greater at 100%MVC and less at each submaximal level, but these differences were not significant. The MMG amplitude at 15° was similar for each group. At 60°, however, the MMG amplitude for the ACL group was greater at 100%MVC and significantly less than that of the control group at each submaximal %MVC.

**CONCLUSION:** The group differences in EMG and MMG amplitudes suggested that the apparent strength deficit the ACL group may manifest in the inability to control submaximal force outputs, particularly at the larger joint angle of 60°. These findings indicate that residual strength deficits in individuals who have recently undergone ACL reconstruction may be associated differences in motor unit recruitment strategies to control a submaximal force.

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2462 Board #137 MAY 31 3:30 PM - 5:00 PM

**Proprioceptive And Strength Comparison Of Remnant Preserved Versus Conventional Anterior Cruciate Ligament Reconstruction.**

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(No relationships reported)

**PURPOSE:** Reconstruction of the anterior cruciate ligament (ACL) restores knee stability. The remnant preserving technique was developed to preserve mechanoreceptor function, promote revascularization and facilitate ligamentation. The purpose of this study was to analyze the clinical results of ACL reconstruction with remnant preserving.

**METHODS:** From August in 2009 to July in 2010, 40 patients underwent ACL reconstruction using auto graft-hamstring tendon. On the basis of the ACL's condition patients were divided into 2 groups. In the trial group (preserved remnant group; PRG, n=20), there were 20 males with an average age of 26.2 years. In the control group (no remnant group; NRG, n=20) were 20 males with an average of age 27.1 years. We measured concentric peak torque measurements of the knee extensors and flexors at 60°/sec and 180°/sec on an Isokinetic dynamometry. Proprioceptive functions has been assessed using Joint position sense and threshold to detection of passive motion. Dynamic postural stability was measured as a stability index in the anterior-posterior and medial-lateral planes with the Biodex Stability System. All tests were measured post-operative 1year.

**RESULTS:** We found significant difference between the PRG and NRG for Joint position sense at 15° ( $2.40 \pm 1.00^\circ$  vs  $3.36 \pm 0.95^\circ$ ,  $p=0.0145$ ) and threshold to detect passive motion at 45° ( $2.02 \pm 0.59^\circ$  vs  $3.12 \pm 0.94^\circ$ ,  $p=0.0213$ ). But, we found no significant difference between the groups for the test results of the dynamic postural stability and knee strength.

**CONCLUSIONS:** We thought that the presence of the proprioceptive nerve fibers in the remnant of the ACL may provide a source for the reinnervation of the graft and restoration of normal proprioception. Therefore, preservation of the remnant ACL reconstruction is helpful in preserving the proprioception and function to stabilize the knee.

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2463 Board #138 MAY 31 3:30 PM - 5:00 PM

**Infrapatellar Strap Reduces Pain In Athletes With Patellar Tendinopathy (Jumper's Knee)**

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(J. Zwerver: Contracted Research - Including Principle Investigator; NEA International, The Netherlands provided the straps for this study but was not involved in study design and analysis.)

Athletes with patellar tendinopathy (jumper's knee) often use an infrapatellar strap to reduce their pain during knee loading activities like jumping and landing. However, no studies have been performed to investigate the effectiveness of this orthosis.

**PURPOSE:** To determine if an infrapatellar strap reduces pain in athletes with patellar tendinopathy during functional loading of the patellar tendon.

**METHODS:** 47 adult male (n=33) and female (n=14) athletes (mean age 28.0 (range 18-48) years) with patellar tendinopathy (mean VISA-P  $52.7 \pm 19.6$ ; median duration of symptoms 24 (range 3-300) months) performed ten single leg decline squats with and without an infrapatellar strap. Pain during this functional patellar tendon loading test was recorded on a visual analogue scale. The athletes also practiced one training session without and one with the strap and were asked for satisfaction with and side effects of the strap.

**RESULTS:** Pain reported by the athletes differed significantly when performing ten single leg decline squats without and with a strap,  $4.0 \pm 2.3$  and  $3.1 \pm 2.1$  respectively ( $p < 0.001$ ). Two thirds of the athletes reported that the strap was beneficial in reducing the pain during their sporting activities. 30% of the athletes reported a feeling of compression in the popliteal fossa and/or at the painful spot in the patellar tendon.

**CONCLUSION:** An infrapatellar strap can reduce pain experienced by athletes with patellar tendinopathy who perform patellar tendon loading activities.

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**The Effects Of Therapeutic Modalities On Hamstring Range Of Motion And Flexibility**

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(No relationships reported)

Adequate hamstring flexibility is important for athletic performance. Healthcare professionals are always searching for innovative methods to increase flexibility. This study compares the changes in hamstring length after the use of three different therapeutic modalities (ice bag, heat pack, and therapeutic massage).

**METHODS:** Six female University of West Florida softball players (18-21 years) were tested on three non-consecutive days. The players' right leg was passively stretched into hip flexion three times, each stretch was held for 30 seconds, and a fourth passive stretch was measured with a goniometer. A therapeutic modality was given randomly (ice pack, heat pack, or massage) for 15 minutes. A final measurement was then taken with a goniometer after the use of the therapeutic modality.

**RESULTS:** The results were assessed using repeated measures ANOVA (pretest and posttest x 3 therapeutic modalities: ice bag, heat pack, and therapeutic massage). The ice bag modality had a mean increase of  $7.7^\circ$  ( $115.3^\circ \pm 7.1^\circ$  vs.  $123.0^\circ \pm 5.1^\circ$ ). The heat pack modality had a mean increase of  $1.3^\circ$  ( $199.8^\circ \pm 6.9^\circ$  vs.  $121.1^\circ \pm 7.1^\circ$ ). Therapeutic massage had a mean increase of  $10.1^\circ$  ( $115.5^\circ \pm 4.0^\circ$  vs.  $125.6^\circ \pm 2.3^\circ$ ).

**CONCLUSION:** Therapeutic massage was significantly greater in each participant with one athlete having a 19 point increase in their flexibility. The heat pack modality gave the participants the least amount of increase in their flexibility.

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2465 Board #140 MAY 31 3:30 PM - 5:00 PM

**Standing Flexion Angle Characteristics in Patients Following Ipsilateral Hamstring Tendons Autograft Anterior Cruciate Ligament Reconstruction**

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(No relationships reported)

Standing flexion angle is used to assess joint excursion following ipsilateral hamstring tendons anterior cruciate ligament (ACL) reconstruction. However, limited evidence exists detailing clinical implications for this measure pertaining to knee health-related quality of life (HRQL).

**PURPOSE:** Our primary aim was to profile standing flexion angle responses to ipsilateral hamstrings tendons autograft ACL reconstruction in physically active patients. We hypothesized autograft harvest would yield related deficits. A secondary aim was to explore associations among subjective outcome measures and standing knee flexion angle.

**METHODS:** A retrospective cohort of 15 patients (age =  $21.2 \pm 2.6$  years, height =  $1.7 \pm 0.1$  m, mass =  $68.7 \pm 12.6$  kg, Tegner =  $6.9 \pm 1.6$ ) 27.5  $\pm$  10.9 months post-surgery were matched to 15 healthy control participants (age =  $21 \pm 1.1$  years, height =  $1.6 \pm 0.1$  m, mass =  $67.4 \pm 10.3$  kg, Tegner =  $6.3 \pm 1.3$ ) and assessed in a laboratory setting. The independent variable was the operative technique. Dependent variables included standing flexion angle, using a reliable technique, and subjective subscale scores for the reliable Knee Outcome Survey (KOS) and Knee Injury and Osteoarthritis Outcome Score (KOOS). Group means and standard deviations were calculated. Respective one-tail dependent and independent t-tests were calculated. Correlation coefficients were computed among the KOS and KOOS to standing flexion angle.  $P < 0.05$  denoted statistical significance.

**RESULTS:** Data were normally distributed. A lesser standing flexion angle was demonstrated for the involved ( $113.3 \pm 7.0^\circ$ ) compared to uninjured ( $116.7 \pm 6.7^\circ$ ) leg ( $P = 0.019$ ). Significant correlations existed among subjective subscale scores and standing flexion angle (KOS-ADLS Symptoms:  $r = 0.578$ ,  $P = 0.024$ ; KOS-ADLS Function:  $r = 0.578$ ,  $P = 0.024$ ; KOOS Symptoms:  $r = 0.553$ ,  $P = 0.033$ ; KOOS Pain:  $r = 0.785$ ,  $P = 0.001$ ; KOOS Function:  $r = 0.683$ ;  $P = 0.005$ ; KOOS Sports:  $r = 0.520$ ;  $P = 0.047$ ) for the involved leg.

**CONCLUSIONS:** Decreased standing knee flexion angle may be attributed to hamstrings deficits. Linear associations among subjective and objective data indicate better clinical outcomes with greater standing knee flexion angle. Our findings advocate continued investigation for determining factors associated with knee HRQL post-ACL-reconstruction.

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**Normative Serum Cartilage Oligomeric Matrix Protein (sCOMP) Levels in an Uninjured, Physically Active Population**

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(No relationships reported)

Serum cartilage oligomeric matrix protein (sCOMP) is a biomarker primarily associated with cartilage degradation. Elevations in sCOMP have been exhibited following acute knee injury and bouts of exercise. To further explore and better understand sCOMP elevations following acute knee injury and exercise, baseline values for an uninjured, physically active cohort are necessary.

**PURPOSE:** To establish normative sCOMP values for physically active patients ages 18-40 with no reported history of lower extremity surgery and to determine if differences exist between males and females.

**METHODS:** A total of 70 physically active subjects (28 males age:  $21.1 \pm 4.0$  years, height:  $178.2 \pm 7.3$  cms, weight:  $77.7 \pm 12.1$  kgs and 42 females age:  $22.1 \pm 4.9$  years, height:  $168.3 \pm 6.4$  cms, weight:  $65.4 \pm 8.6$  kgs) with no history of lower extremity surgery participated. Following 30 minutes of seated rest, a maximum of 10cc of blood was collected from the antecubital vein. Once the serum was collected the samples were centrifuged, separated, and placed into a  $-80^\circ\text{C}$  freezer. Once all samples were collected, ELISA tests were run (IBL Euro-Diagnostica, Malmo, Sweden) for human sCOMP. The average sCOMP value and associated standard deviation (SD) was calculated. In addition, the average sCOMP value and SD were calculated for each sex and an independent samples t-test was employed to determine if a significant difference was present. Serum COMP values are expressed as ng/mL.

**RESULTS:** The average normative sCOMP value for all participants was  $1493.3 \pm 409.1$  ng/mL. A statistical difference between sexes was determined, with males having higher baseline levels ( $1767.5 \pm 479$  ng/mL) when compared to females ( $1317.1 \pm 225.4$ ,  $p < 0.0001$ ).

**CONCLUSIONS:** The results indicate normative sCOMP values for a physically active cohort ages 18-40 with no history of lower extremity surgery are  $1493.3 \pm 409.1$  ng/mL, and that males have higher levels than females. These normative values are important in understanding differences following acute knee injury or bouts of exercise for future research investigations.

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2467 Board #142 MAY 31 3:30 PM - 5:00 PM

**Preoperative Quadriceps Strength is Associated with Postoperative Quadriceps Strength Following Anterior Cruciate Ligament Reconstruction**

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(No relationships reported)

Quadriceps activation failure is considered, in part, to contribute to the quadriceps weakness that lingers following anterior cruciate ligament reconstruction (ACLR). Higher levels of preoperative quadriceps activation, therefore, may be associated with improved recovery of quadriceps strength following ACLR. Understanding this association could help improve ACL rehabilitation programs.

**PURPOSE:** To determine if quadriceps activation and strength prior to ACLR are related to postoperative quadriceps strength.

**METHODS:** Twenty-eight individuals post-ACL injury (12 male, 16 female; age  $18.46 \pm 4.2$  yrs; height  $1.72 \pm 0.01$  m; mass  $70.32 \pm 13.33$  kg) reported for testing on two occasions: prior to ACLR ( $2.14 \pm 2.34$  mo) and upon return to activity post-ACLR ( $7.23 \pm 0.44$  mo). Quadriceps activation was assessed preoperatively using the burst superimposition technique and quantified via the central activation ratio (CAR). Quadriceps strength was assessed at both time points and quantified via an isokinetic dynamometer at  $60^\circ/\text{second}$ . Three maximal knee extension trials were averaged and normalized to subject body mass (Nm/kg). Linear regressions were used to examine the relationship between preoperative CAR and postoperative quadriceps strength and preoperative strength and postoperative strength.

**RESULTS:** Greater preoperative quadriceps strength was associated with greater postoperative quadriceps strength ( $R^2 = 0.157$ ,  $P = 0.037$ ). Preoperative quadriceps activation was not associated with postoperative quadriceps strength ( $R^2 = 0.032$ ,  $P = 0.363$ ).

**CONCLUSION:** These results suggest that ACLR patients with better preoperative strength recover quadriceps strength better than those with lower preoperative strength. Preoperative quadriceps activation failure may be mediated by other factors such as pain and effusion. Rehabilitation programs for ACL patients should focus on maximizing quadriceps strength prior to surgery.

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2468 Board #143 MAY 31 3:30 PM - 5:00 PM

**Back To Competitive Soccer After ACL Surgery: Functional Tests Are Needed For Safe Medical Consensus**

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(No relationships reported)

Return to full sport activity after Anterior Cruciate Ligament (ACL) reconstruction is a controversial topic. As suggested by many studies, allowance to full return should be given after functional assessment tests.

**PURPOSE:** Aim of the study is to evaluate some functional and technical aspects of performance of reconstructed-ACL soccer players once the orthopaedic surgeon gave them consensus for going back to play

**METHODS:** We evaluated 28 consecutive male soccer players after ACL reconstruction, 15 with hamstring graft (HG) and 13 with bone patellar tendon bone graft (BPTB) once they return to full playing, through functional tests on the soccer field. Players returned to sport  $168 \pm 69$  days after surgery, after a sport-specific rehabilitation protocol. We measured lengths of single (SHT) and triple (THT) one leg hop test, speed of shuttle run test (SRT), and soccer skill based on score in the long passing test (LPT). We compared results with those obtained in the same tests by 108 healthy soccer players of same level. Differences between groups and between HG and BPTB were assessed by Student's T-test assuming  $P < 0.05$  as significance value.

**RESULTS:** When compared to healthy players, operated players showed significant strength deficit of the operated limb in both leg hop tests (SHT:  $179 \pm 21$  vs  $192 \pm 15$  cm,  $P < 0.001$ ; THT:  $567 \pm 70$  vs  $627 \pm 49$  cm,  $P < 0.001$ ). Comparing the performances of both limbs, BPTB patients showed a significant deficit of the operated limb in SHT ( $-9\%$ ,  $P < 0.05$ ) and THT ( $-9\%$ ,  $P < 0.05$ ), while HG did not ( $-6\%$  and  $-3\%$  respectively, N.S.). Performance times in SRT did not show any significant difference between operated and healthy players, being respectively  $6.70 \pm 0.41$  and  $6.79 \pm 0.51$  s (N.S.). The scores in the LPT were significantly better ( $P < 0.05$ ) in the operated players compared to the control group ( $5.93 \pm 2.85$  pts vs  $4.75 \pm 2.52$  pts, respectively).

**CONCLUSIONS:** When soccer players with reconstructed ACL are allowed to return to play at competitive level on subjective basis, they seem to have gained full recovery of technique and shuttle run, but they did not completely recover strength of the operated limb. We suggest that clinicians should measure strength through field tests and should improve rehabilitation protocol to strengthen the injured limb in order to ensure safe return to competitive level.



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2469 Board #144 MAY 31 3:30 PM - 5:00 PM

**Biomechanical Characteristics Of The Jump And Change Direction In Women's With A History Of Stress Fracture Of The Tibia**

Fabio R. Jose, Bruno Mezencio, Daniel Lopes Capua, Alberto Carlos Amadio, Julio Cerca Serrao. *São Paulo University, São Paulo, Brazil.*

(No relationships reported)

**PURPOSE:** Data available in literature about stress fractures are scarce, even though it is often disabling and presents a high recurrence rate. These conditions can cause disruption of activity and total involvement of bone cortical structure. The aim of this study was to analyze the biomechanical characteristics of locomotion of volunteers with history of tibial fracture caused by stress.

**METHODS:** In this study we analyzed 24 volunteers, professional athletes aged  $18 \pm 1$ . The experimental group was formed by 7 professional athletes who had previous primary or relapsed stress fractures. The control group was formed by 17 professional athletes who had not had any type of musculoskeletal injury in the last 6 months. The volunteers were evaluated in terms of specific movements of the practiced sport (basketball or volleyball) such as: vertical jump, horizontal jump, and changes of direction. The volunteers were monitored bilaterally by surface electromyography on the medial gastrocnemius and anterior tibial muscles. The electromyography rated RMS with 50ms windows before and after the subject had contact with the force platform in conditions of anterior-posterior displacement, medial-lateral displacement and horizontal and vertical jumps. The piezoelectric platform rated the peak force, time to peak, growth gradient and momentum in 50ms during mass transition, load control, propulsion control and charge.

**RESULTS:** The results showed statistically significant differences between groups under conditions of anteroposterior displacement. In this condition, the experimental group showed a decreased time to peak force ( $0.20 \pm 0.09$ s -  $0.15 \pm 0.09$ s) and an increased growth gradient ( $12.63 \pm 10.04$ s to  $20.7 \pm 18.31$ s) when compared to the control group. The parameters related to muscle activation in the same condition were different for the control and experimental groups. At the time of transition from anterior to posterior displacement, the medial gastrocnemius muscle's electromyographic activity showed a greater than 50 ms window prior to contact with the ground ( $1.19 \pm 0.84$  -  $1.43 \pm 0.62$ ).

**CONCLUSIONS:** The results show that there were significant changes in muscle activation of the volunteers with history of stress fracture, these changes may explain the dynamic behavior observed in the group.

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2470 Board #145 MAY 31 3:30 PM - 5:00 PM

**Anterior Cruciate Ligament (ACL) Reconstruction in Obese Patients**

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(No relationships reported)

**PURPOSE:** To characterize the unique features of ACL injury and reconstruction in obese patients.

**METHODS:** We conducted a retrospective cohort analysis of 131 patients with an ACL injury treated with ACL reconstruction at a single university-affiliated hospital from November, 2007 to March, 2011. Thirty-two obese patients (BMI greater than or equal to 30) were identified (Group 1) and compared with 99 non-obese control patients (Group 2). Fisher's exact test, Wilcoxon test, and multivariate logistic regression analyses were performed with respect to various parameters including mechanism of injury, frequency of instability prior to reconstruction, and incidence of osteochondral injury.

**RESULTS:** The mean BMI was 35 (range 30 - 54) in Group 1 vs 24 (range 16 - 29) in Group 2. Forty percent of patients in Group 1 sustained a low energy mechanism of injury compared with 14% in Group 2 (OR = 4,  $p = 0.004$ ). Fifty-six percent of patients in Group 1 experienced at least two episodes of symptomatic instability prior to undergoing ACL reconstruction vs 32% of patients in Group 2 ( $p = 0.02$ ). The diagnosis of osteochondral injury (Outerbridge grade greater than or equal to 3) on arthroscopic evaluation was 56% in Group 1 vs 16% in Group 2 ( $p = 0.0001$ ).

**CONCLUSIONS:** Anterior cruciate ligament injury in obese patients is characterized by a lower-energy mechanism of injury, a greater degree of symptomatic instability with non-operative management, and a higher incidence of high-grade osteochondral lesions on arthroscopic evaluation. Although these individuals do not match the current or desired future activity level profile of the typical patient undergoing ACL reconstruction, we challenge the bias toward non-operative treatment and recommend surgical consideration providing other medical comorbidities are stable. In our experience, non-operative management in this sedentary cohort often leads to episodes of instability with activities of daily living and may predispose to the earlier onset of degenerative joint disease.

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2471 Board #146 MAY 31 3:30 PM - 5:00 PM

**Association Between The Stress Fracture And Bone Metabolism/quality Markers In Lacrosse Players**

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<sup>2</sup>Nippon Sport Science University, Tokyo, Japan. <sup>3</sup>Meiji Gakuin University, Tokyo, Japan.

(No relationships reported)

Overuse injury of the bone including stress fracture is a serious problem for athletes. Female athletes with low bone mineral density (BMD), an indicator of bone strength, and amenorrhea have a high risk of stress fracture. However, some athletes have achieved superior results in competitions without experiencing stress fractures despite low BMD, suggesting that it is difficult to predict the occurrence of stress fractures based on BMD alone. Recently, the importance of bone metabolism and quality is increasingly recognized as factors influencing bone strength. We sought to evaluate not only BMD but also bone metabolism and quality in overuse injury of the bone.

**PURPOSE:** This study was conducted to clarify the association of bone metabolism and quality markers with overuse injury of the bone in university lacrosse players.

**METHODS:** The subjects, elite university lacrosse players (35 males and 49 females), were divided into a stress fracture group and a control group. After the measurement of BMD, BAP, NTx, TRAP-5b, homocysteine, and pentosidine in blood samples were measured in both groups.

**RESULTS:** No significant differences were observed in the levels of BAP, NTx, and TRAP 5b between the stress fracture and control groups in all or male subjects. In the female players, no significant differences were observed in the levels of BMD, BAP, NTx, homocysteine, and pentosidine. On the other hand, TRAP 5b levels were  $409.9 \pm 209.3$  and  $318.6 \pm 81.6$  mU/dL in the stress fracture and control groups, respectively. A significant increase in TRAP 5b in female group levels was observed in the stress fracture group ( $p < 0.05$ ).

**CONCLUSION:** We suggest that TRAP 5b is a useful bone metabolism marker that reflects the dynamics of bone condition, particularly in female athletes.

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2472 Board #147 MAY 31 3:30 PM - 5:00 PM

**Differences between Attending and Resident Management of Acute Ankle Injuries in a Tertiary Care Emergency Department**

Karen Gustafson, James Borchers. *The Ohio State University, Columbus, OH.*

(No relationships reported)

**Objectives:** Management of acute ankle injury in the Emergency Department can vary by level of physician training. Variations occur in radiologic evaluation, documentation, medications given, immobilization techniques and follow up. This study evaluates the differences in care between Resident and Attending physicians with regards to acute ankle injury management.

**METHODS:** Retrospective chart review of all ankle injuries during a one year period at a tertiary care Emergency Department (January 1, 2010 through December 31, 2010). A sample of 637 patients greater than 18 years old presenting with acute ankle injury was included. Descriptive statistics and Chi-Square Tests were used in data analysis. Variables analyzed include narcotic medications, radiographs, immobilization, follow-up and documentation of Ottawa Ankle Rules.

**RESULTS:** Of the 637 patients evaluated with ankle injury, 55% were primarily cared for by a Resident with Attending supervision, with the remaining 45% cared for by an Attending only. 600 patients received x-rays, 283 were ordered by a registered nurse, 274 were ordered by a physician and 43 had multiple x-rays ordered by both a registered nurse and physician. Residents accounted for 69% of all x-rays ordered by a physician, however results were not statistically significant. Both Attendings and Residents were more likely to document incomplete Ottawa Ankle Rules as opposed to complete ( $p < 0.001$ ) and immobilize with an Aircast as opposed to an ACE wrap ( $p < 0.001$ ). Residents were more likely to provide narcotic pain medication in the ED ( $p < 0.001$ ) and write a prescription for narcotic pain medication ( $p < 0.003$ ).

**CONCLUSIONS:** Ankle injuries are a common ED presentation. In an academic medical center, variances in management between Residents and Attendings were identified specifically

related to medication choices. Residents were more likely to order and prescribe narcotic pain medications for ankle sprains in comparison to Attendings alone. Residents were also more likely to obtain radiographic confirmation, although not statistically significant. This study suggests Residents are less strictly supervised in the management of acute ankle injury as evidenced by statistically significant variations in practice from that of Attending physicians.

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**2473** Board #148 MAY 31 3:30 PM - 5:00 PM

**Risk Factors Of Stress Fracture Of The Fifth Metatarsal Bone In University Soccer Players**

Kohei Fujitaka<sup>1</sup>, Shingo Otuki<sup>2</sup>, Mamoru Okubo<sup>3</sup>, Masasjo Hashimoto<sup>4</sup>, Keiichi Kishimoto<sup>5</sup>, Shunsuke Fujitake<sup>6</sup>, Teruyuki Kita<sup>7</sup>. <sup>1</sup>Osaka Sangyo university of Graduate School, Osaka, Japan. <sup>2</sup>Osaka Sangyo university, Osaka, Japan. <sup>3</sup>Biwako Seikei Sports College, Shiga, Japan. <sup>4</sup>Yukioka School of Allied Health Professions, Osaka, Japan. <sup>5</sup>Graduate School of Human Development and Environment, Kobe University, Hyogo, Japan. <sup>6</sup>Department of Rehabilitation, Tachiiri Orthopedics, Kyoto, Japan. <sup>7</sup>Department of Rehabilitation, Toyonakawanabe Hospital, Osaka, Japan.

(No relationships reported)

**PURPOSE:** The purpose of this study was to investigate university soccer players with stress fracture of the fifth metatarsal bone regarding their physical factor, the relationship of such fracture with a history of sporting injuries, and the ground surfaces as well as shoes used.

**METHODS:** A total of 154 male soccer players from one university were evaluated between 2004 and 2010. The foot arch ratio, toe flexor muscle strength, Q-angle, leg-heel angle, one-leg standing time with eyes closed, range of motion (ROM) of the ankle joint, and general joint laxity were measured, and the Functional Reach Test was conducted at the time of admission to the university. We also evaluated the subjects' histories of sporting injuries to the foot and ankle joint, ground surfaces and shoes used at the time of injury, and whether tapes or supporters were used for the ankle joint. All subjects who developed a stress fracture of the fifth metatarsal bone during the investigation period presented to one of our medical centers. The subjects were divided into those with and without stress fracture of the 5th metatarsal bone (injured (11 players, 12 feet) and non-injured (143 players, 296 feet) groups), and each measurement as well as other investigated items were compared between the groups at the time of admission to the university.

**RESULTS:** The toe flexor muscle strength tended to be weaker in the injured (16.4±1.9 kg) than in the non-injured (17.3±4.9 kg) group (p=0.06). The Q-angle also tended to be smaller in the injured (13.9±2.0 degrees) than in the non-injured (15.1±4.9 degrees) group (p=0.07). The rate of using elastic bandages for the foot joint was higher in the injured group (p<0.05). There were no significant difference in any other measurement and survey items.

**CONCLUSIONS:** Stress fracture of the fifth metatarsal bone was suggested to be caused by excessive weight-bearing on the fifth metatarsal bone, which resulted from the difficulty of shifting the body weight to the hallux side due to a small Q-angle and toe flexor muscle strength. As the rate of using elastic bandages for the foot joint was higher in those with such fracture, the influence of elastic bandages on the fifth metatarsal bone needs to be evaluated.

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**2474** Board #149 MAY 31 3:30 PM - 5:00 PM

**Groin Wrapping And Its Effects On Skating Performance In Ice Hockey Players**

Howard W. Theberge, Julie Bigelow, Stacie Lee, Brittany Pelkey, Lara A. Carlson, FACSM. University of New England, Biddeford, ME.

(No relationships reported)

Groin injuries are a common overuse injury in ice hockey. Preventative groin wrapping is a technique that is used to accelerate return to play in the rehabilitative stage of injury treatment. However, it is unknown whether this treatment negatively impacts skating performance.

**PURPOSE:** To examine the effect of standard groin wrapping on sprint and agility performance in collegiate ice hockey players.

**METHODS:** Seven healthy male NCAA ice hockey players without lower limb pathology participated in this study (age, 25.7 ± 3.9 yr; weight, 85.2 ± 8.9 kg; height, 174.5 ± 10.0 cm; body fat, 14.3 ± 3.5%). Subjects took part in on-ice familiarization of tests 48 hours prior to data collection and were instructed not to engage in exercise 24 h prior to testing. Subjects then performed two on-ice skating testing sessions (randomly controlled) where either the dominant leg of each player was wrapped (TAPE) or not wrapped (CON). Testing sessions were separated by 24 hrs. During each testing session subjects performed 3 trials of both 40-yd sprint and agility tests while wearing full uniform and equipment. Mean sprint and mean agility times were compared via paired t-tests.

**RESULTS:** The % CV for both the sprint and agility tests were under 4%. There were no differences (p > 0.05) in mean 40-yd sprint times between TAPE (5.34 ± 0.23 s) and CON (5.25 ± 0.23 s). Mean times for the agility test were also not different (p > 0.05) between TAPE (38.74 ± 5.17 s) and CON (37.61 ± 3.43 s).

**CONCLUSION:** Findings suggest that preventative groin wrapping does not appear to negatively alter on-ice sprint and agility performance and may be considered an efficacious treatment for groin injuries that does not affect overall skating performance.

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**2475** Board #150 MAY 31 3:30 PM - 5:00 PM

**Developing a Functional Test for Athletes Following a Lower Extremity Injuries**

Rebecca K. Shultz, Melissa Hodgins, Karyn Haitz, Jessica Popish, Gordon O. Matheson. Stanford University, Stanford, CA.

(No relationships reported)

Knowing when to return an athlete to sport following an injury is a complex decision and should involve a standardized testing protocol. Few such protocols exist.

**PURPOSE:** To develop a lower extremity injury function evaluation and to assess its face validity.

**METHODS:** The Functional Lower Extremity Evaluation (FLEE) is a battery of 8 tests, including single leg (SL) squat, box jump and SL hop for distance, purported to assess an athlete's functional ability post injury. FLEE was developed by a committee of sports medicine clinicians based on their clinical experience and using data from a literature review. A survey distributed to Pac-12 physicians, physical therapists, and athletic trainers (over 200 recipients) assessed the face validity of the test. Respondents were asked to evaluate the level of importance (0-4, 4 being very important), frequency of clinical usage (0-100%), and the ability of a test to measure the clinical components of functional performance (0-4, with 4 being significant), such as balance and strength, for each test. The test's importance was calculated as the number of respondents who rated the test a 3 or 4 divided by the total number of respondents. The test was considered frequent if the respondent stated they used the test 70-100% of the time.

**RESULTS:** 73 clinicians with an average of 13 years and 30 hours per week of sports medicine experience responded. The top five sports for which respondents made return to play decisions were football, basketball, soccer, baseball, and volleyball. Given that lower extremity injuries are most common in field and court sports, this population was considered appropriate for assessing FLEE. 80% of respondents used functional testing (FT) as part of their RTP decision "Often" or "Always" and 70% used FT to follow an athlete through rehabilitation "Often" or "Always". The results of the survey showed that the level of importance for each test was rated considerably higher than the clinical usage. Sports medicine clinicians also agreed that FLEE assesses each of the 11 clinical components of FT, except for Range of Motion.

**CONCLUSION:** Results show that the FLEE is considered relevant and an important part of clinical decision making. Future research should assess the reliability and content validity of the FLEE and why the usage of the tests is lower than the relevance.

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## D-25 Free Communication/Poster - Musculoskeletal Mechanics

MAY 31, 2012 1:00 PM - 6:00 PM  
ROOM: Exhibit Hall

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**2476** Board #151 MAY 31 2:00 PM - 3:30 PM

**Effects Of Short-term Resistance Training And Subsequent Detraining On The Electromechanical Delay**

Pablo B. Costa<sup>1</sup>, Eric D. Ryan<sup>2</sup>, Trent J. Herda<sup>3</sup>, Ashley A. Walter<sup>4</sup>, Andrea M. Valdez<sup>4</sup>, Joel T. Cramer, FACSM<sup>5</sup>. <sup>1</sup>California State University – San Bernardino, San Bernardino, CA. <sup>2</sup>University of North Carolina – Chapel Hill, Chapel Hill, NC. <sup>3</sup>University of Kansas, Lawrence, KS. <sup>4</sup>University of Oklahoma, Norman, OK. <sup>5</sup>Oklahoma State University, Stillwater, OK.

(No relationships reported)

The time elapsed between the onset of electrical muscle activation and the onset of force development is termed the electrical mechanical delay (EMD). Resistance training adaptations can affect musculotendinous stiffness and force transmittal, possibly altering EMD.

**PURPOSE:** To examine and compare the effects of three days of dynamic constant external resistance (DCER) and isokinetic (ISOK) training and subsequent detraining on EMD.

**METHODS:** Thirty-one apparently-healthy untrained men (mean  $\pm$  SD age = 22.2  $\pm$  4.2 yrs; body mass = 77.9  $\pm$  12.9 kg; height = 173.9  $\pm$  5.4 cm) were randomly assigned to a DCER training group, ISOK training group, or control (CONT) group. Subjects visited the laboratory eight times, the first visit was a familiarization session, the second visit was a pre-training assessment, the subsequent three visits were for training (if assigned to a training group), and the last three visits were the post-training assessments (48 hrs, 1 wk, and 2 wks after the final training session). One training group performed ISOK leg extension exercise and the other performed DCER leg extension exercise for three sets of ten repetitions in each of the three days of training. A third group took part in a CONT condition and did not train. In each testing assessment visit, five, single, 200- $\mu$ s duration, square-wave, supramaximal transcutaneous electrical stimuli (each separated by 5 seconds) were delivered to the femoral nerve at rest in order to examine the EMD.

**RESULTS:** No significant changes were found for EMD from pre- to post-training assessments 1, 2, and 3 (mean SE = 4.5  $\pm$  0.2 ms, 4.7  $\pm$  0.2, 4.5  $\pm$  0.1, 4.5  $\pm$  0.2, respectively) ( $p > 0.05$ ). There was no significant interaction for time  $\times$  group (Table 1) ( $p > 0.05$ ). In addition, there were no significant main effects for time or group ( $p > 0.05$ ).

**CONCLUSION:** To our knowledge, this was the first study to investigate the effects of short-term resistance training on EMD. It can be hypothesized that increases in strength observed following a short-term resistance training program may not be attributed to stiffness changes in the series elastic component. Future studies should investigate the precise physiological components responsible for short-term training strength gains.

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**2477** Board #152 MAY 31 2:00 PM - 3:30 PM

**The Effect Of Graft Type On Joint Loading Following Acl Reconstruction**

Kurt Manal, Emily Gardinier, Lynn Snyder-Mackler, Thomas S. Buchanan, FACSM. University of Delaware, Newark, DE.

(No relationships reported)

The risk of developing knee osteoarthritis (OA) increases greatly after sustaining an anterior cruciate ligament (ACL) injury. Two common reconstruction procedures include the quadruple-bundled semitendinosus, gracilis (STG) autograft, and harvesting of cadaveric tissue (ie., allograft). In previous work we have shown the STG autograft results in profound morphological changes to the hamstrings muscle group, while minimal changes are seen in those after allograft reconstruction. This is relevant in the context of OA as muscle forces are the dominant contributor to joint loading, and altered loading is believed to be associated with the onset and progression of knee OA. These findings lead us to believe there will be differences in joint loading depending on graft type.

**PURPOSE:** To investigate if there is a differential effect in joint loading associated with graft type in a group of healthy, young active patients during natural cadence walking.

**METHODS:** Medial and lateral compartment contact forces for 5 individuals after STG autograft reconstruction and 5 subjects who had the allograft procedure were compared six months after surgery. EMG and motion analysis data were used as inputs to an EMG-driven musculoskeletal model to predict knee joint loading. The model included 10 lower extremity muscles crossing the knee, and all forces were normalized to bodyweight (BW). The interval of interest was limited to the stance phase of natural cadence walking.

**RESULTS:** Peak medial contact force for subjects with an allograft was 2.05 BW's (SD=0.25), while peak loading for the STG autograft group was 2.49 BW's (SD=0.37). Peak loading occurred at 24% and 22% of stance respectively. Peak lateral contact force for the autograft group (mean = 1.25 BW; SD = 0.44) coincided with the timing of peak medial loading; in contrast the allograft group had smaller lateral loading (1.09 BW's; SD=0.34) reaching a peak value earlier during stance (12%).

**CONCLUSION:** It is premature to draw strong conclusions given our small sample size, however our preliminary data suggest disrupting the hamstrings during the reconstructive process impacts joint loading in patients undergoing reconstruction.

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**2478** Board #153 MAY 31 2:00 PM - 3:30 PM

**Are The Patellar Tendon Stiffness And Joint Proprioception Of The Badminton Player Better Than Normal?**

Shao Ming Wu. Kaohsiung Medical University, Kaohsiung, Taiwan.

(No relationships reported)

As we know, most of the badminton players have better muscle strengths, agility, suddenly stop, and intermittent running abilities than the normal people. The resistance training of badminton players also focuses on the lower limb. Are the mechanical properties of the tendon and joint proprioception of the badminton players better than the normal?

**PURPOSE:** The purpose of this research is to investigate the difference of patellar tendon stiffness and knee joint proprioception between badminton players and normal subjects with similar age.

**METHODS:** Fourteen university badminton players and twelve university students without training were recruited in this study. All of them are healthy and without any lower extremity injuries within one year. Following the warm-up, the dynamometer was used for patella tendon stiffness and knee joint proprioception measurement. In the patellar stiffness measurement, the patella tendon length elongation at 100%, 75%, 50% 25%, and 0% (rest) of maximum isometric torque was detected by the ultrasound image. The slope of regression between tendon force and tendon elongation is defined as tendon stiffness. Joint position sense (JPS) was used as the index of joint proprioception in both passive and active movements. Two sample t-test was used to detect the difference of tendon stiffness and joint proprioception between players and normal.

**RESULTS:** In the knee joint proprioception test, badminton players have better performance than normal in the active JPS (8.58+5.85 degrees vs. 4.90+2.37 degrees,  $p < 0.05$ ). However, the tendon stiffness between badminton players and normal did not show significant difference (669.11+345.82 N/mm vs. 805.46+223.51 N/mm,  $p > 0.05$ ).

**CONCLUSIONS:** According to this study, the stiffness of patellar tendon in badminton players is not stronger than normal university students as expected. We also found that the badminton players have better joint proprioception than the normal university students. That may be the reason the players have better agility and movement ability. Moreover, the poor proprioception may also lead to injuries easily during exercise in untrained people.

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2479 Board #154 MAY 31 2:00 PM - 3:30 PM

**Automatic Determination Of A Morphology-based Anatomical Coordinate System Of The Human Patella**

Michael J. Rainbow<sup>1</sup>, Daniel L. Miranda<sup>2</sup>, Roy T.H. Cheung<sup>1</sup>, Braden C. Fleming<sup>2</sup>, Irene S. Davis, FACSM<sup>1</sup>. <sup>1</sup>Harvard Medical School, Cambridge, MA. <sup>2</sup>Brown University, Providence, RI  
(No relationships reported)

*In vivo* patellar kinematics can be determined using biplanar videoradiography. However, the proper interpretation of patellar kinematics requires a coordinate system that is both anatomically meaningful and repeatable.

**PURPOSE:** To determine an anatomical coordinate system (ACS) using the morphology of the patella.

**METHODS:** 3D patella surface models (PSM) were isolated from CT images (512x512, 0.625 slice thickness) of 10 subjects' knees (5 M, 25±4.2 yrs; 5 F, 26±2.3 yrs). The center of mass of the PSM defined the origin of the ACS. The 3rd principal axis of inertia served as the anterior/posterior (AP) axis. The proximal/distal (PD) axis was aligned with the posterior vertical ridge by rotating the 1st and 2nd inertial axes about the AP axis until the variation in the medial/lateral (ML) location of the ridge was minimized. We determined inter-subject ACS repeatability by registering all PSM's and their associated ACS to a single PSM, using a best-fit alignment algorithm. We computed a resultant AP, ML, and PD axis from the vector sum of all AP, ML, and PD axes. We then calculated the centroid (CO) from all ACS origins. We quantified differences between whole bone morphology and the ACS by computing the angle between the resultant axis and each subject's axis, and the distance between the CO and each origin.

**RESULTS:** The mean angle and 95% CI between the resultant AP, ML, and PD axis and each subject's axis was 1.3° (CI: 0.9° - 1.7°), 3.0° (CI: 1.8° - 4.2°), and 3.2° (CI: 2.1° - 4.3°) respectively. The mean distance between the CO and individual origins was 0.7 mm (CI: 0.5 mm - 0.9 mm).

**CONCLUSION:** The low inter-subject variability of the ACS suggests that this patellar morphology based method is robust.

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2480 Board #155 MAY 31 2:00 PM - 3:30 PM

**Estimating Anterior Cruciate Ligament Loading During a Randomly Cued Cutting Task Using a Musculoskeletal Model**

Joshua T. Weinhandl<sup>1</sup>, Jennifer E. Earl-Boehm<sup>2</sup>, Kyle T. Ebersole<sup>2</sup>, Wendy E. Huddleston<sup>2</sup>, Brian S.R. Armstrong<sup>2</sup>, Kristian M. O'Connor<sup>2</sup>. <sup>1</sup>Old Dominion University, Norfolk, VA. <sup>2</sup>University of Wisconsin-Milwaukee, Milwaukee, WI. (Sponsor: Robert Spina, FACSM)  
(No relationships reported)

To assess anterior cruciate ligament (ACL) injury risk, researchers commonly quantify kinematic, kinetic variables and muscle activation variables during cutting maneuvers. In an effort to more accurately represent typical sporting maneuvers, anticipatory actions have been included in many studies. Yet previous research has been unable to study the actual loading of the ACL during athletic maneuvers, making the identification of ACL injury mechanisms virtually impossible.

**PURPOSE:** To determine the influence of movement anticipation on ACL loading using a musculoskeletal model.

**METHODS:** Twenty healthy recreationally active females (21 ± 1 years, 61.8 ± 6.4 kg, 1.66 ± 0.05 m) completed a cutting tasks that consisted of four conditions: anticipated (AC) and unanticipated (UC) cutting, a straight run, and a stop. Three-dimensional kinematic and kinetic data were then input into a subject-specific musculoskeletal model created using OpenSim to estimate muscle forces during the AC and UC trials. The musculoskeletal model outputs were used in a three-dimensional model of the knee to calculate ACL force. Dependent t-tests were used to assess differences in ACL force between AC and UC trials. Other variables of interest included the timing peak ACL force, as well as the planar components (sagittal, frontal and transverse) of ACL loading. Significance for all tests was set at p<0.05.

**RESULTS:** Peak ACL loading significantly increased during UC trials (AC: 11.02 ± 4.65 N·kg<sup>-1</sup>, UC: 12.40 ± 3.79 N·kg<sup>-1</sup>, p=0.001). However, there was no difference in the timing of this peak. The sagittal plane component of ACL loading was significantly greater during UC trials (AC: 6.79 ± 3.43 N·kg<sup>-1</sup>, UC: 8.27 ± 2.68 N·kg<sup>-1</sup>, p<0.001) but there were no differences in frontal plane (AC: 2.89 ± 1.13 N·kg<sup>-1</sup>, UC: 2.96 ± 1.25 N·kg<sup>-1</sup>, p=0.059) or transverse plane (AC: 1.35 ± 1.19 N·kg<sup>-1</sup>, UC: 1.17 ± 0.84 N·kg<sup>-1</sup>, p=0.719) loading of the ACL.

**CONCLUSION:** The results of this study suggest that increases in ACL loading during UC maneuvers is primarily due to changes in sagittal plane loading. Furthermore, while peak knee adduction moment has been prospectively identified as an ACL injury risk factor, the current model supports the hypothesis that knee adduction loads in isolation may not large enough to injure the ACL.

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2481 Board #156 MAY 31 2:00 PM - 3:30 PM

**Muscle Damage And Sex: Implications of Rate of Torque Development on Velocity-dependent Power Loss**

Geoffrey A. Power, Brian H. Dalton, William J. Booth, Charles L. Rice, FACSM, Anthony A. Vandervoort, FACSM. *The University of Western Ontario, London, ON, Canada.*  
(No relationships reported)

Unaccustomed lengthening contractions result in muscle damage and velocity-dependent power loss (Power et al. 2010).

**PURPOSE:** This study investigated changes in neuromuscular properties of the dorsiflexors following high intensity lengthening contractions in men and women. We hypothesized a preferential loss of velocity-dependent power when tested at high versus low loads owing to strength loss via impaired rate of torque development (RTD) and a shift to longer muscle lengths for optimal angle of torque production (OPT<sub>TORQUE</sub>). We also investigated whether power loss was affected by an impaired rate of neural activation.

**METHODS:** In 8 men (27±3y) and 8 women (26±4y) we studied the dorsiflexors during and following 5 sets of 30 lengthening contractions performed on a Biodex. A 30°/s isokinetic shortening contraction was used to determine OPT<sub>TORQUE</sub>, and neural activation was calculated as the rate of rise in RMS of the EMG from onset to peak RTD of the dynamic contractions. Force-velocity and power relationships were determined from 8 shortening contractions (1Nm to 70% MVC) performed before and up to 48 h post task.

**RESULTS:** Men were stronger (~35%), faster (~13%), and more powerful (~48%) than women. Markers of muscle damage included a prolonged reduction in MVC torque, an increase in muscle soreness, and a shift in OPT<sub>TORQUE</sub> (2-8°) (p < 0.05) towards longer muscle lengths without changes in voluntary activation or rate of neural activation. Maximal RTD was impaired ~20% more in women than men during recovery (p < 0.05). Both groups had similar impairments in maximal shortening velocity (~4%) and peak power (~10%). However, women had a larger reduction in MVC than men throughout recovery (p < 0.05). Power was reduced preferentially at higher loads (i.e. ≥50%MVC) with a greater loss (~20-40%) in women than men (p < 0.05), whereas maximal shortening velocity was minimally affected in both groups.

**CONCLUSION:** Greater impairments in isometric RTD following muscle damage can explain the greater loss of power at higher loads in women than men. However, the similar change in OPT<sub>TORQUE</sub> and neural activation cannot explain the power loss difference between men and women. Thus, it seems, following muscle damage RTD is a critical component for dynamic muscle performance and the disparity between the sexes needs further elucidation.

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2482 Board #157 MAY 31 2:00 PM - 3:30 PM

**The Influence Of Hamstring Musculotendinous Stiffness On Biomechanical Mechanisms Of Anterior Cruciate Ligament Loading**

Troy Blackburn<sup>1</sup>, Marc Norcross<sup>2</sup>. <sup>1</sup>University of North Carolina at Chapel Hill, Chapel Hill, NC. <sup>2</sup>Oregon State University, Corvallis, OR. (Sponsor: Kevin M. Guskiewicz, FACSM)  
(No relationships reported)

Greater hamstring stiffness is associated with lesser anterior cruciate ligament (ACL) loading during controlled perturbations. However, it is unknown if hamstring stiffness influences ACL loading during dynamic tasks in which ACL injury commonly occurs. Landing biomechanics discriminate high vs. low ACL injury risk, thus an influence of hamstring stiffness on these factors may infer an influence on ACL injury risk.

**PURPOSE:** To evaluate the influence of hamstring stiffness on landing biomechanics.

**METHODS:** Thirty-six healthy volunteers (18 males, 18 females) participated in this investigation. Stiffness was assessed from the damping effect imposed by the hamstrings on oscillatory knee flexion-extension. Lower extremity biomechanics were captured during a double leg landing task via a motion capture system interfaced with a force plate. Simple bivariate correlations were used to evaluate relationships between hamstring stiffness and landing biomechanics. Stiffness data were also arranged into tertiles, and landing biomechanics were compared between the highest and lowest tertiles (i.e. High vs. Low stiffness groups) via independent t-tests.

**RESULTS:** Peak internal knee varus moment was negatively correlated with hamstring stiffness ( $r = -0.414, p = 0.006$ ) and was 4x smaller in the High stiffness group ( $0.049\text{WxH}$  vs.  $0.014\text{WxH}$ ;  $p = 0.019$ ). The High stiffness group also demonstrated greater knee flexion at the instants of peak anterior tibial shear force (62 vs. 77;  $p = 0.049$ ) and internal knee extension (56 vs. 69;  $p = 0.048$ ) and varus (45 vs. 62;  $p = 0.018$ ) moments.

**CONCLUSION:** Large frontal plane knee loading increases ACL injury risk. Additionally, greater knee flexion reduces ACL loading for given joint kinetics. Our data indicate that individuals with greater hamstring stiffness display landing biomechanics consistent with lesser ACL loading and injury risk. As muscle stiffness can be modified via training, exercises which enhance hamstring stiffness may be important additions to future ACL injury prevention programs.

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**2483** Board #158 MAY 31 2:00 PM - 3:30 PM

**Uniquely Processed Titanium Permeated Tape Increases Achilles Tendon Compliance and Short Latency Response following Running**

David S. Rowlands, *Massey University, Wellington, New Zealand.*

(D.S. Rowlands: *Contracted Research - Including Principle Investigator; Phiten Co Ltd, Japan.*)

Wadsworth *et al.* (MSSE, 2010, 42(12):2273) previously reported a small increase in joint range of motion (ROM) and a possible enhancement of running economy during recovery from simulated soccer play in response to wearing garments processed with microscopic titanium particles (Aquatitan). Possible mechanisms are increased tendon compliance or modulated peripheral nervous-system activity.

**PURPOSE:** To determine the magnitude of increase in ankle joint ROM, Achilles tendon compliance, and reflex response with Aquatitan tape 48-h following a 40-min intermittent treadmill run.

**METHODS:** In a double-blind crossover, 10 males performed two 3-d trials comprising: 1) baseline measures, randomly-allocated Aquatitan- or placebo-treated tape covering the triceps surae, treadmill run; 2), recovery; 3), post-treatment outcomes. Compliance was determined by isometric dynamometry during plantarflexion, utilising simultaneous real-time ultrasound imaging of the Achilles-medial-gastrocnemius muscle-tendon junction, and motion analysis of landmarks. Motor reflex latency was determined using tendon tap and electromyography. An exponential curve was fitted to force-length data to model tendon compliance. Data were log-transformed prior to mixed modelling and magnitude-based inference.

**RESULTS:** The application of Aquatitan tape during recovery resulted in a small 5.1% (90% CL:  $\pm 4.5\%$ ) increase in plantar-flexor ROM relative to placebo tape, but the impact on dorsiflexion ROM was unclear ( $-1.6\% \pm 15.2\%$ ). Placebo tape application had trivial impact on Achilles compliance ( $-5.8\% \pm 19.5\%$ ), but Aquatitan tape increased compliance ( $22\% \pm 25\%$ ) with the difference small ( $23\% \pm 18\%$ ). In the tendon-tap experiment, placebo tape had trivial impact ( $0.2\% \pm 3.0\%$ ) on reflex latency, while Aquatitan tape reduced latency ( $-6.7\% \pm 2.8\%$ ) with a moderate difference ( $-7.3\% \pm 4.6\%$ ).

**CONCLUSIONS:** Increased plantarflexor ROM and Achilles tendon compliance suggests that the application of Aquatitan tape to primary movers during and after high-intensity running reduces tendon stiffness and improves reflex reaction time. Increased compliance may enhance tendon function warranting further investigation on the effect of Aquatitan on running economy and to explore therapeutic applications relating to reduced tendon stiffness.

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**2484** Board #159 MAY 31 2:00 PM - 3:30 PM

**Reliability Of Transcranial Magnetic Stimulation-related Measurements Of Plantar Flexor Muscles In Healthy Subjects**

Olivier Girard, Sébastien Racinais, Abdulaziz Farooq, *ASPETAR - Qatar Orthopaedic and Sports Medicine Hospital, Doha, Qatar.*

(No relationships reported)

Despite the widespread use of transcranial magnetic stimulation (TMS), only few studies focusing on the elbow, wrist and quadriceps muscles have described the reliability of the measure(s) being used. To date, the applicability and reliability of a TMS twitch interpolation technique for measuring cortical voluntary activation of the plantar flexors is unknown.

**PURPOSE:** This study aimed at comprehensively evaluating the test-retest reliability of TMS-related measurements linked to the cortico-spinal control of the plantar flexor muscles in healthy subjects.

**METHODS:** Cortico-spinal responsiveness and cortical voluntary activation were assessed from the plantar-flexor muscle group in 15 healthy adults ( $32 \pm 4$  years) on two visits separated by 4 weeks - i.e. where they maintained their normal lifestyle - by measuring motor evoked potentials produced in the soleus, gastrocnemius medialis and gastrocnemius lateralis muscles, and the superimposed twitch torques evoked by TMS during isometric plantar flexions of varying intensity (50, 75 and 100% of maximal voluntary contraction). Reliability (average of three trials per session) was assessed using the intraclass correlation coefficient (ICC) with its 95% confidence interval (95% CI), along with standard error of measurement and minimal detectable difference.

**RESULTS:** We observed moderate to substantial-levels of between-sessions reliability (ICC range 0.41-0.88) in majority of the normalized motor evoked potential responses. The amplitude of TMS-evoked twitch forces decreased linearly between 50% and 100% of mean maximal torque ( $R^2 > 0.9$ ), and produced substantially reliable estimations of resting twitch ( $17.8 \pm 1.4$  versus  $17.0 \pm 1.2$  Nm; ICC = 0.74 with 95% CI: 0.50-0.89) and cortical voluntary activation ( $87.6 \pm 2.7$  versus  $89.2 \pm 2.5\%$ ; ICC = 0.68 with 95% CI: 0.39-0.86).

**CONCLUSIONS:** Assessment of cortico-spinal responsiveness and measurement of cortical voluntary activation of the plantar flexors using TMS present substantial levels of reliability when the testing sessions are separated by a relatively long duration of time (4 weeks). Reliability scores are generally lower than those obtained for elbow, wrist or quadriceps muscles with test sessions spaced 5-7 days apart.

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**2485** Board #160 MAY 31 2:00 PM - 3:30 PM

**Reliability of Cortical and Spinal Excitability During Muscle Lengthening and Shortening Contractions in Healthy Humans**

Jamie Tallent<sup>1</sup>, Stuart Goodall<sup>1</sup>, Tibor Hortobágyi, FACS<sup>2</sup>, Duncan N. French<sup>1</sup>, Alan St Clair Gibson<sup>1</sup>, Glyn Howatson, FACS<sup>1</sup>. <sup>1</sup>*Northumbria University, Newcastle, United Kingdom.* <sup>2</sup>*University of Groningen Medical Centre, Groningen, Netherlands.* (Sponsor: Glyn Howatson, FACS)

(No relationships reported)

Transcranial magnetic stimulation (TMS) and peripheral nerve stimulation (PNS) are methods commonly used in combination to assess plasticity of the central and peripheral nervous systems, respectively. Despite the continuous fluctuations within the central nervous system, studies using TMS and PNS have reported reliable cortical and spinal responses during isometric contractions. Plastic changes rapidly occur, even after one practice session (Selvanayagam *et al.*, 2011), thus, it is critical to assess the stability of such measures during dynamic contractions.

**PURPOSE:** To investigate the repeatability of corticospinal excitatory and inhibitory measures during muscle lengthening and shortening at a range of contraction intensities in the tibialis anterior (TA).

**METHODS:** 20 healthy males performed lengthening and shortening contractions of the TA at 15, 25, 50 and 80% of maximum voluntary contraction (MVC) over 3 consecutive days. Motor evoked potentials (MEPs) were recorded at rest and during the 4 contraction intensities. The corticospinal silent period was also analyzed during 80% MVC. PNS was used to evoke the H-reflex during an isometric (10% MVC) and at 25% of shortening and lengthening MVC. V-waves were also evoked during MVCs on each of the 3 days.

**RESULTS:** No significant differences were found between days for any of the variables, with the exception of MEPs at rest and during a 25% shortening MVC. MEPs significantly increased during a 25% shortening MVC from days 1 to 2 ( $P = 0.001$ ; 95% CI 0.05 - 0.15) and at rest from days 1 to 2 ( $P = 0.016$ ; 95% CI 0.00 - 0.04) and days 1 to 3 ( $P = 0.046$ ; 95% CI = 0.01 - 0.02). Confidence intervals revealed less variability between days 2 and 3 when compared to days 1 and 2. The H-reflex during dynamic contractions showed good reliability across the 3 days (ICC = 0.76-0.84), as did V-waves during shortening (ICC = 0.77). Conversely, isometric H-reflex (ICC = 0.66) and V-waves during lengthening (ICC = 0.54) was more variable.

**CONCLUSION:** Cortical and spinal excitability can be measured reliably during dynamic contractions of healthy young humans' TA. Cortical and spinal excitability associated with motor tasks can be highly variable after a single session; therefore, it may be more difficult to reliably detect rapid plastic changes, necessitating an initial familiarisation session.

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2486 Board #161 MAY 31 2:00 PM - 3:30 PM

**Influence of Lean Mass on Lower Extremity Biomechanics during a Prolonged Exercise Bout**

Melissa M. Montgomery<sup>1</sup>, Randy J. Schmitz<sup>2</sup>, Sandra J. Shultz, FACSM<sup>2</sup>. <sup>1</sup>California State University, Northridge, Northridge, CA. <sup>2</sup>University of North Carolina at Greensboro, Greensboro, NC.  
(No relationships reported)

The ability of the lower extremity (LE) musculature to maintain proper function and provide dynamic joint stability is likely a crucial factor in reducing injury risk during exercise. Possessing a greater relative proportion of LE lean mass (LELM) may delay the adoption of high risk biomechanics. However, little is known regarding the influence of body composition, specifically available LELM relative to total body mass, on resistance to deleterious changes in biomechanics during a prolonged exercise bout.

**PURPOSE:** To investigate the influence of LELM on LE biomechanics during a prolonged exercise bout designed to simulate a soccer match. We expected that a lower relative amount of LELM would predict high risk frontal and transverse hip and knee motions linked to ACL injury risk; further, that the strength of these relationships would increase with greater exercise duration.

**METHODS:** 26 females (1.7±0.1m, 61.7±9.5kg, 20.7±2.5yrs) and 28 males (1.8±0.1m, 75.1±7.1kg, 20.3±2.0yrs) were assessed for LELM using dual-energy x-ray absorptiometry (DXA) and completed a 90 minute intermittent over ground running protocol that was individualized to his/her fitness level to control for exercise intensity across participants. 3D biomechanical data were collected during drop jump landings performed every 15 minutes during the protocol. Linear regressions examined the extent to which LELM predicted frontal and transverse hip and knee kinematics collected at 4 time points during the exercise protocol (T1, T2, T3, T4), corresponding to measurements taken immediately before and after two 45-minute running intervals.

**RESULTS:** LELM was a significant negative predictor ( $p<0.05$ ) of peak hip adduction ( $R^2=0.08, 0.12, 0.10, 0.08$ ) and knee valgus ( $R^2=0.12, 0.11, 0.09, 0.12$ ) angles at T1-T4 and for knee valgus excursion at T2-T4 ( $R^2=0.13, 0.12, 0.08$ , respectively). LELM predicted increased knee external rotation excursion at T4 only ( $R^2=0.07$ ).

**CONCLUSIONS:** Lower amounts of LELM were related to various "at-risk" landing variables and in the case of knee rotation, became apparent as exercise duration increased. This implies that greater amounts of LELM may aid in avoidance of high risk LE mechanics, thus potentially reducing increased injury risk documented with longer exercise duration.

Supported by NFL Charities Medical Grant

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2487 Board #162 MAY 31 2:00 PM - 3:30 PM

**Unchanged Anconeus Motor Unit Recruitment Thresholds At Maximal Velocity In Response To Submaximal Velocity-dependent Fatigue**

Brad Harwood, In H. Choi, Charles L. Rice, FACSM. *The University of Western Ontario, London, ON, Canada.*  
(No relationships reported)

Motor unit (MU) discharge rates of the anconeus decrease during maximal velocities in response to submaximal velocity-dependent fatiguing elbow extensions, but the relative change of MU recruitment thresholds in this paradigm is undefined.

**PURPOSE:** To determine the effect of submaximal velocity-dependent fatiguing elbow extensions on anconeus MU recruitment thresholds recorded during a maximal velocity-dependent elbow extension.

**METHODS:** Motor units ( $n=5$ ) of the anconeus from 5 healthy young men were tracked throughout a series of submaximal and maximal velocity-dependent fatiguing elbow extensions performed over 60° joint range of motion. Subjects first performed 3 maximal voluntary contractions (MVCs) followed by 3-5 maximal velocity-dependent elbow extensions at a load of 40%MVC ( $V_{max40}$ ), each separated by 2 minutes rest. Subjects then performed a submaximal fatiguing task comprised of sets of 10 submaximal (60% $V_{max40}$ ) elbow extensions followed by 2 maximal ( $V_{max40}$ ) elbow extensions. The protocol continued until subjects failed to reach 60% $V_{max40}$ , and a single MVC was performed immediately following task failure. Motor unit recruitment thresholds were determined for each submaximal and maximal contraction as the relative force at which the first MU action potential began discharging consistently. The inclusion criteria required a MU to be active for greater than 90% of all contractions. Recruitment thresholds were expressed relative to MVC for individual comparison, and relative to the highest recorded threshold for group comparisons.

**RESULTS:** Recruitment thresholds ranged from 0%MVC to 65%MVC, with average thresholds of 13.0%, 15.1%, 13.1%, and 11.9%MVC at 25%, 50%, 75%, and 100% of time to task failure, respectively. When expressed relative to the highest recorded MU recruitment threshold for each subject, there was no change in recruitment threshold as subjects progressed to task failure for both submaximal and maximal elbow extensions. However, there were tendencies ( $p=0.07$ ) for an approximate 30% reduction in MU recruitment threshold for  $V_{max40}$  and for 60% $V_{max40}$  at task failure.

**CONCLUSIONS:** results support a maintenance of anconeus MU recruitment thresholds in response to submaximal fatiguing velocity-dependent elbow extensions when recorded at  $V_{max40}$ .

Supported by NSERC

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2488 Board #163 MAY 31 2:00 PM - 3:30 PM

**Anconeus Discharge Rates Are Associated With Recovery Of Velocity Following A Submaximal Velocity-dependent Fatiguing Protocol**

In Ho Choi, Brad Harwood, Charles L. Rice, FACSM. *University of Western Ontario, London, ON, Canada.*  
(No relationships reported)

In response to submaximal velocity-dependent fatigue, motor unit discharge rates (MUDRs) decline concurrently with the fatigue-induced reduction of power and velocity.

**PURPOSE:** To assess the short-term (10 mins) recovery profile of anconeus MUDRs following submaximal velocity-dependent fatiguing elbow extensions.

**METHODS:** Motor unit (MU) action potentials of the anconeus were tracked continuously in 5 healthy young men during baseline, fatiguing and recovery contractions using indwelling EMG wire electrodes. Subjects performed 3 maximal voluntary elbow extensions (MVCs) on a Biodex, followed by 3-5 maximal-effort velocity-dependent contractions at a load of 40%MVC ( $V_{max40}$ ). Subjects then performed a fatiguing protocol comprised of 10 submaximal contractions per set at a speed of 60% $V_{max40}$  followed by 2 elbow extensions at  $V_{max40}$  at the end of each set. Task failure occurred when the subjects could not reach 60% $V_{max40}$  at the end of a set. Subjects also performed a single MVC immediately following task failure, and a MVC and two  $V_{max40}$  elbow extensions were performed at 30s, 2min, 5min, and 10min post task failure. Global EMG signals were sampled from the inserted wires in the long and lateral heads of the triceps brachii and MU trains were recorded using more selective wires from the anconeus. Elbow extensor power, contraction velocity, root mean square (RMS) of the long and lateral heads of the triceps brachii and anconeus, and individual MUDRs were determined at six time points (pre- and post-fatigue; and at 30s, 2min, 5min, and 10min recovery).

**RESULTS:** Torque, power and contraction velocity were reduced to 55%, 75% and 65%, respectively, at task failure ( $p<0.05$ ). No significant differences in the global EMG of the long and lateral heads of the anconeus were observed during fatigue and recovery. Power and contraction velocity recovered within 5 min, but torque did not recover. Reduced (25%) MUDRs post-fatigue were restored to pre-fatigue MUDRs within 5 min ( $p>0.01$ ). Regression analysis determined the greatest amount of shared variance to be between MUDR and velocity ( $R^2=0.62$ ), and MUDR and power ( $R^2=0.58$ ).

**CONCLUSION:** Results indicate that the reduced anconeus MUDRs recorded at  $V_{max40}$  following submaximal velocity-dependent fatigue recover at a similar rate to that of velocity and power. Supported by NSERC

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2489 Board #164 MAY 31 2:00 PM - 3:30 PM

**Effects of Isometric Contraction on Stress Relaxation of the Plantar Flexors**

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(No relationships reported)

Muscle Energy Technique and Proprioceptive Neuromuscular Facilitation are techniques employed to increase flexibility. While these techniques are similar, they typically employ different contraction forces (% maximum). Previous studies have mainly investigated outcomes such as range of motion, but there has been little emphasis on physiological mechanisms of change.

**PURPOSE:** To explore the viscoelastic response (stress relaxation) during sub-maximal isometric contractions.

**METHODS:** Twenty-seven females (18-25y) began this study. The data from 13 subjects were used for final analysis. All subjects acted as their own control. Subjects attended a familiarization session and two test sessions (each two weeks apart). A Kin-Com dynamometer was used to maintain subjects' ankle at 80% of maximum dorsiflexion throughout the protocols. Subjects performed, in randomized order, either a sub-maximal protocol (20% MVIC) that consisted of three isometric contractions of five seconds, with five seconds rest between contractions, or a static stretch protocol in either test session. Stress (force) relaxation of the plantar flexor muscle-tendon unit and EMG activity were continuously recorded throughout both protocols.

**RESULTS:** A paired t-test between the initial peak passive force and final force indicated a substantial decline in both protocols (19.1%  $\pm$  5.5%,  $p = 0.002$ ; and 14.8%  $\pm$  4.1%,  $p = 0.002$  in the sub-maximal protocol and static stretch protocol respectively). The probability that the estimated difference between the protocols was clinically negative, trivial, or positive was 1%, 5%, and 93% respectively. Mean EMG activity was < 1% of maximum throughout.

**CONCLUSIONS:** Total stress relaxation revealed a trend towards greater decline in force during the sub-maximal protocol compared with the static stretch protocol. Negligible EMG activity lends support to a prominent viscoelastic adaptation.

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**2490** Board #165 **MAY 31** **2:00 PM - 3:30 PM**

### **Near-Infrared Spectroscopic Measurement of the Effect of Leg Dominance on Muscle Oxygen Saturation during Cycling**

Gwenn E.C. Ellerby<sup>1</sup>, Stuart M.C. Lee<sup>2</sup>, Lelia Adelina Paunescu<sup>1</sup>, Chelsea Pereira<sup>1</sup>, Charles P. Smith<sup>1</sup>, Babs R. Soller<sup>1</sup>. <sup>1</sup>Reflectance Medical, Westborough, MA. <sup>2</sup>Wyle Integrated Science and Engineering, Houston, TX.

(No relationships reported)

The effect of leg dominance on the symmetry of the biomechanics during cycling remains uncertain. Asymmetries have been observed in kinematics and kinetics, while symmetries were found in muscle activation. No studies have yet investigated the symmetry of muscle metabolism during cycling. Near-infrared spectroscopy (NIRS) provides a non-invasive method to investigate the metabolic responses of specific muscles during cycling.

**PURPOSE:** To determine whether there was an effect of leg dominance on thigh muscle oxygen saturation (SmO<sub>2</sub>) during incrementally loaded submaximal cycling using NIRS.

**METHODS:** Eight right leg dominant, untrained subjects (5 men, 3 women; 31 $\pm$ 2 yrs; 168.6 $\pm$ 1.0 cm; 67.2 $\pm$ 1.8 kg, mean  $\pm$  SE) volunteered to participate. Spectra were collected bilaterally from the vastus lateralis (VL) during supine rest and cycling. SmO<sub>2</sub> was calculated using previously published methods (Zou et al. 2010 Biomed. Opt. Express). Subjects pedaled at 65 rpm while resistance to pedaling was increased in 0.5 kp increments from 0.5 kp every 3 min until the subject reached 80% of age-predicted maximal heart rate. SmO<sub>2</sub> was averaged over 3 min for each completed stage. A two-way ANOVA was performed to test for leg differences. A priori contrasts were used to compare work levels to rest.

**RESULTS:** VL SmO<sub>2</sub> was not different between the dominant and non-dominant legs at rest and during exercise ( $p=0.57$ ). How SmO<sub>2</sub> changed with workload was also not different between legs ( $p=0.32$ ). SmO<sub>2</sub> at 0.5 kp (60.3 $\pm$ 4.0,  $p=0.12$ ) and 1.0 kp (59.5 $\pm$ 4.0,  $p=0.10$ ) was not different from rest (69.1 $\pm$ 4.0). SmO<sub>2</sub> at 1.5 kp (55.4 $\pm$ 4.0,  $p=0.02$ ), 2.0 kp (55.7 $\pm$ 5.0,  $p=0.04$ ), and 2.5 kp (43.4 $\pm$ 7.9,  $p=0.01$ ) was significantly lower than rest.

**CONCLUSIONS:** VL SmO<sub>2</sub> during cycling is not different between dominant and non-dominant legs and decreases with moderate workload in untrained cyclists. Assuming blood flow is directed equally to both legs, similar levels of oxygen extraction (as indicated by SmO<sub>2</sub>) suggests the metabolic load of cycling is not different between legs. This is in agreement with a recent study demonstrating symmetrical increase of muscle activation of the VL during cycling. Leg dominance did not influence VL SmO<sub>2</sub> during submaximal cycling, but may have an effect at higher loads or during other forms of exercise, such as walking and running.

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**2491** Board #166 **MAY 31** **2:00 PM - 3:30 PM**

### **Reliability Of Intensity Analysis Of MMG And EMG During Incremental Stimulation Of The Triceps Surae.**

W. Jeffrey Armstrong. Western Oregon University, Monmouth, OR.

(No relationships reported)

**PURPOSE:** The reliability of mechanomyography (MMG) and electromyography (EMG) during electrically-evoked muscle contraction was examined using the von Tscharnar "intensity analysis," which describes the power of a non-stationary signal as a function of both frequency and time. **METHOD:** Data for 9 college-aged participants (5 males; 4 females) with measurable H-reflexes were analyzed. MMG and EMG for the medial gastrocnemius (MG), lateral gastrocnemius (LG), and soleus (SOL) muscles of the dominant leg were elicited via percutaneous stimulation of the tibial nerve. Signals were sampled 5 times for each stimulus strength, recorded and later analyzed to determine total intensity (P). Peak total intensity (Pmax) and the time delay to Pmax (TTmax) were measured and analyzed for test-retest reliability (intraclass correlation coefficient, ICC). Repeated measures ANOVA analyzed for time effects (systematic error).

**RESULTS:** RM-ANOVA revealed no significant effects for time ( $p > 0.79, 0.99, 0.98, \text{ and } 0.99$  for EMG TTmax, EMG Pmax, MMG TTmax, and MMG Pmax, respectively). For EMG, ICC (range) for TTmax was 0.98 (0.97-0.98), 0.41 (0.31-0.51), and 0.96 (0.94-0.97); and ICC (range) for Pmax was 0.98 (0.98-0.99), 0.97 (0.96-0.98), and 0.97 (0.97-0.98) for MG, LG, and SOL, respectively ( $p < 0.001$ ). For MMG, ICC (range) for TTmax was 0.91 (0.88-0.93), 0.91 (0.88-0.94), and 0.95 (0.94-0.97); and ICC (range) for Pmax was 0.99 (0.99-0.99), 0.99 (0.99-0.99), and 1.00 (0.99-1.00) for MG, LG, and SOL, respectively ( $p < 0.001$ ).

**CONCLUSIONS:** Overall, reliability of Pmax and TTmax was strong. Lower reliability in the LG may have been due to electrode placement, as the location of the innervation zone was not determined. The intensity analysis provides insight into the frequency characteristics of the muscle responses not seen in traditional analysis of the H-reflex and may be a useful tool in studying individual variations and changes in the conduction and contraction velocities of skeletal muscle.

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**2492** Board #167 **MAY 31** **2:00 PM - 3:30 PM**

### **The Influence Of Aging On The Stretching-induced Force Deficit**

Eric D. Ryan<sup>1</sup>, Trent J. Herda<sup>2</sup>, Pablo B. Costa<sup>3</sup>, Ashley A. Walter<sup>4</sup>, Joel T. Cramer, FACSM<sup>5</sup>. <sup>1</sup>University of North Carolina at Chapel Hill, Chapel Hill, NC.

<sup>2</sup>University of Kansas, Lawrence, KS. <sup>3</sup>California State University - San Bernardino, San Bernardino, CA. <sup>4</sup>University of Oklahoma, Norman, OK. <sup>5</sup>Oklahoma State University, Stillwater, OK.

(No relationships reported)

**INTRODUCTION:** If a disrupted functional gamma loop is the cause of the neural decreases seen after prolonged passive stretching, it is possible that these decreases are not seen in the elderly who often exhibit a dysfunctional gamma loop.

**PURPOSE:** To examine the influence of aging on the stretching-induced force deficit.

**METHODS:** Twenty-one healthy young (22  $\pm$  2 yrs) and 21 healthy elderly (70  $\pm$  7 yrs) men performed an isometric maximal voluntary contraction (MVC) of the plantar flexor muscles on a modified custom-built load-cell apparatus connected to a calibrated Biodex System 3 dynamometer prior to and following nine 135-s passive stretches. Isometric force (N) values were sampled from the load cell, while electromyographic (EMG) amplitude values ( $\mu$ V) were recorded from the soleus (SOL) and medial gastrocnemius (MG) muscles. Percent voluntary activation (%VA) was assessed by tibial nerve stimulation and the twitch interpolation technique. A two-way mixed factorial ANOVA was used to analyze the MVC force, %VA, normalized EMG SOL, and normalized EMG MG. An ANCOVA was used to analyze the magnitude of change when baseline values were different. An alpha of  $P < 0.05$  was used to determine statistical significance.

**RESULTS:** Isometric MVC force decreased from pre- to post-stretching for the young group ( $P < 0.001$ ) but did not change in the elderly group ( $P = 0.193$ ). MVC force was also greater for the young compared to the elderly at both time points ( $P < 0.018$ ) and decreased significantly more for the young group when baseline values were adjusted ( $P = 0.006$ ). There was a non-significant decrease in %VA for the young group (-3.9%) and no change (0.02%) for the elderly group ( $P = 0.139$ ). There was no aging or stretching induced changes in EMG SOL ( $P > 0.05$ ). However, normalized post-stretching EMG MG values were significantly different ( $P = 0.043$ ) between the young (92.8%) and elderly group (104.0%).

**CONCLUSIONS:** These findings demonstrate that prolonged passive stretching results in significant decreases in MVC strength and are accompanied by changes in muscle activation (%VA and EMG MG amplitude) for the young group only. The lack of changes in MVC strength and muscle activation for the elderly group may suggest that the neural mechanism for the stretching-induced force deficit is gamma loop mediated.

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2493 Board #168 MAY 31 2:00 PM - 3:30 PM

**Influence Of Intensity Of Conditioning Contraction On The Extent Of Postactivation Potentiation Is Muscle Dependent**

Atsuki Fukutani<sup>1</sup>, Kosuke Hirata<sup>1</sup>, Naokazu Miyamoto<sup>1</sup>, Hiroaki Kanehisa<sup>2</sup>, Toshimasa Yanai<sup>1</sup>, Yasuo Kawakami<sup>1</sup>. <sup>1</sup>Waseda University, Tokorozawa, Japan. <sup>2</sup>National Institute of Fitness and Sports in Kanoya, Kanoya, Japan.  
(No relationships reported)

Twitch torque is increased after a high intensity voluntary contraction (conditioning contraction). This phenomenon is called postactivation potentiation (PAP). Because PAP occurs only in the muscle fibers that are activated by the conditioning contraction, it is likely that the extent of PAP is affected by the number of recruited muscle fibers. It is hypothesized therefore that the extent of PAP differs between muscles with different strategy of force increment (recruitment of muscle fibers and increasing firing frequency).

**PURPOSE:** To test the above hypothesis by comparing muscles with different recruitment patterns of muscle fibers (plantar flexor and adductor pollicis muscles).

**METHODS:** Eleven young adults (24.0 ± 1.4 years, 1.68 ± 0.08 m, 62.1 ± 8.8 kg) voluntarily participated in this study. Subjects performed plantar flexion and thumb adduction for 10-s as a conditioning contraction with an intensity set at each of 20, 40, 60, 80, and 100% of the maximal voluntary isometric contraction (MVC). Before and after each conditioning contraction, twitch torque was measured to evaluate the extent of PAP. The extent of PAP of each muscle was expressed with the normalized value with respect to the value of 100% MVC condition of each muscle.

**RESULTS:** For the plantar flexor muscles, the extent of PAP was significantly increased as the intensity of the conditioning contraction became higher (20% MVC: 6.7 ± 8.8%, 40% MVC: 20.4 ± 8.8%, 60% MVC: 44.8 ± 18.9%, 80% MVC: 81.4 ± 19.5%) (p < 0.05). For the adductor pollicis, while the extent of PAP was significantly increased up to 60% MVC condition (20% MVC: 25.6 ± 16.2%, 40% MVC: 63.1 ± 31.0%, 60% MVC: 111.0 ± 36.8%) (p < 0.05), there were no significant differences among 60%, 80% and 100% MVC conditions (80% MVC: 101.9 ± 34.5%).

**CONCLUSIONS:** The present study shows that the influence of intensity of conditioning contraction on the extent of PAP is different between plantar flexor and adductor pollicis muscles, suggesting that the extent of PAP is related to the amount of muscle fibers being recruited.

This study was supported by the Waseda University GCOE program.

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2494 Board #169 MAY 31 2:00 PM - 3:30 PM

**The Influence Of Stiffness And Stretch Tolerance On The Viscoelastic Responses To Stretch**

Eric Sobolewski<sup>1</sup>, Eric D. Ryan<sup>1</sup>, Brennan J. Thompson<sup>2</sup>, Doug B. Smith<sup>2</sup>. <sup>1</sup>University of North Carolina- Chapel Hill, Chapel Hill, NC. <sup>2</sup>Oklahoma State University, Stillwater, OK. (Sponsor: Joel T Cramer, FACSM)  
(No relationships reported)

**INTRODUCTION:** Skeletal muscle demonstrates properties of viscoelastic creep and stress-relaxation (SR) during passive stretching protocols and may be influenced by initial levels of passive stiffness and stretch tolerance.

**PURPOSE:** To examine the influence of passive stiffness and stretch tolerance on SR and creep during repeated passive stretching.

**METHODS:** Thirty-eight healthy participants (age = 24±3 yr) performed four 30-s constant torque passive stretches of their right plantar flexors on a calibrated Biodex System 4 dynamometer. All passive stretches were performed at a pre-determined torque threshold for the entire 30-s stretch. Prior to the 4 stretches, a maximal stretch tolerance test was performed to determine: (1) terminal passive stiffness, (2) common passive stiffness, and (3) maximal stretch tolerance. Position (°) and torque (Nm) signals were sampled at 2 KHz during each stretch and stretch tolerance assessment. Stress-relaxation was examined from the torque responses at 5-s intervals and creep was measured from the changes in position during subsequent stretches. Passive stiffness values were calculated from the slope of the angle-torque curve that was fit with a 4th order polynomial and normalized to corrected calf girth. The participants were then ranked by each of the three measures and the 10 highest and lowest participants were examined separately. A 4×2 mixed factorial ANOVA and independent t-test were used to examine the rate and relative change of SR and creep, respectively.

**RESULTS:** There was no difference (P>0.05) in the rate or relative change in SR between groups when ranked by terminal and common passive stiffness, except for stretch 3 (least stiff < most stiff) when ranked by common passive stiffness (P=0.005). There was also a main effect for stretch (1<2) when ranked by terminal stiffness (P=0.022). The group with the greatest stretch tolerance demonstrated a greater rate of change in SR (P=0.041), however the relative change in SR was similar between groups (P=0.576). There were no differences among any of the ranked groups (P>0.05) for the rate and relative change in creep.

**CONCLUSIONS:** These results indicated that differences in terminal stiffness, common passive stiffness, and stretch tolerance have little influence on the viscoelastic response to stretch.

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**D-26 Free Communication/Poster - Pain**

MAY 31, 2012 1:00 PM - 6:00 PM  
ROOM: Exhibit Hall

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2495 Board #170 MAY 31 3:30 PM - 5:00 PM

**Physical Activity is Related to Pain Sensitivity in Healthy Women**

Laura D. Ellingson, Lisa H. Colbert, FACSM, Dane B. Cook, FACSM. University of Wisconsin-Madison, Madison, WI.  
(No relationships reported)

There are many benefits associated with meeting current physical activity recommendations. At present, it is unknown whether a reduced sensitivity to pain is included among these benefits.

**PURPOSE:** To assess the relationship between pain sensitivity and physical activity and sedentary behaviors in a sample of healthy women.

**METHODS:** Self-reported and accelerometer measures of physical activity and sedentary behavior were collected and compared with pain intensity and unpleasantness ratings to noxious thermal stimuli in a sample of twenty-one healthy women (age 30.0 ± 5.8). Based on accelerometer data, participants were classified into two groups: meets recommendations (n=12) and insufficiently active (n=9). Independent samples t-tests were conducted to compare pain ratings and physical activity behaviors between groups and correlation coefficients (Spearman's ρ) were calculated between average minutes per day spent in moderate, vigorous, and sedentary behaviors and average intensity and unpleasantness ratings.

**RESULTS:** Participants who met physical activity recommendations had significantly lower unpleasantness ratings than their insufficiently active peers. Correlational analyses demonstrated a significant relationship between minutes spent in vigorous physical activity and both pain intensity and pain unpleasantness ratings. Relationships were not significant for moderate activity or sedentary behavior.

**CONCLUSIONS:** These results provide preliminary evidence that meeting current physical activity recommendations may be beneficial for pain in women. Moreover, participation in vigorous activity appears to account for the decreased pain sensitivity. In our sample, sedentary behavior did not appear to have a deleterious effect on pain. Results from this study have a number of potential applications including aiding our understanding of why exercise functions as a treatment for those with chronic pain conditions, and providing a rationale for including physical activity assessment in pain research.



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2496 Board #171 MAY 31 3:30 PM - 5:00 PM

**Pain Relief in Older Adults Following Static Contractions is Not Task-Dependent**

Kathy J. Lemley, Breanna Drewek, Lauren Miller, Sandra K. Hunter, FACSM, Marie Hoeger Bement. *Marquette University, Milwaukee, WI.*  
(No relationships reported)

Pain complaints increase with age. Exercise is frequently utilized for pain relief but the optimal exercise prescription to relieve pain is not clear. Following static contractions, young adults experience the greatest pain relief with low intensity, long duration contractions. The pain response to static contractions in older adults however is unknown.

**PURPOSE:** To compare pain reports in healthy older adults before and after static contractions of varying intensity and duration.

**METHODS:** Pain perception was assessed in 23 healthy older adults (11 men, 12 women;  $72.0 \pm 6.3$  yrs) using a pressure pain device consisting of a 10 N force applied to the right index finger through a Lucite edge (8 x 1.5mm) for two minutes. Subjects pushed a timing device when they first felt pain (i.e., pain threshold) and rated their pain intensity every 20 seconds using a 0-10 numerical rating scale. Pain threshold and pain ratings were measured before and immediately after static contractions of the left elbow flexors at the following three doses: 1) three brief maximal voluntary contractions (MVC); 2) 25% MVC sustained for 2 minutes; and 3) 25% MVC sustained until task failure. Experimental sessions were randomized and separated by one week.

**RESULTS:** Time to task failure for the 25% MVC contraction was  $11.8 \pm 5.1$  minutes. A reduction in pain was found following all three tasks with no difference between tasks (trial x task effect:  $p > 0.05$ ), despite the duration of the 2 minute low-intensity contraction being ~17% of the contraction held to task failure. Pain thresholds for all doses increased 20% from  $51 \pm 33$  to  $61 \pm 37$  seconds and pain ratings averaged over the six time points decreased 20% from  $3.3 \pm 2.8$  to  $2.6 \pm 2.5$  following static contractions (trial effect:  $p < 0.001$  and  $p < 0.001$ , respectively).

**CONCLUSION:** Low and high intensity static contractions of both long and short duration produce similar levels of pain reduction in older adults. These preliminary data suggest that several different types of static contractions can induce significant pain relief in older adults. Age-related changes in the pain response to static contractions must be taken into account when prescribing static exercise for the management of pain.

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2497 Board #172 MAY 31 3:30 PM - 5:00 PM

**Robustness of Pain Catastrophizing Scores During Isokinetic Testing of Anterior Cruciate Ligament Deficient Patients**

Elena D. Diaconescu, Sivan Almosnino, Dean Tripp, Davide D. Bardana, Joan M. Stevenson. *Queen's University, Kingston, ON, Canada.*  
(No relationships reported)

Measurements of isokinetic knee musculature strength and pain catastrophizing behavior prior to Anterior Cruciate Ligament (ACL) reconstruction may serve as a baseline to which post-operative patient status may be compared. To attain maximal voluntary contractions during isokinetic testing, clinicians routinely employ various patient targeted psychological interventions with the purpose of enhancing motivation as well as reducing apprehension. However, these regular clinical practices may also influence immediate pain catastrophizing behavior, and hence confound baseline measurements of this psychological construct.

**PURPOSE:** To assess the robustness of pain catastrophizing scores obtained during knee strength testing of unilateral ACL deficient patients.

**METHODS:** 12 men ( $26 \pm 4$  yrs) and 10 women ( $25 \pm 5$  yrs) with unilateral ACL deficiency performed bilateral isokinetic knee musculature strength testing. The healthy knee was tested first, and testing of each leg encompassed 2 sets of 6 concentric extension-flexion repetitions at angular velocities of  $60^\circ\text{sec}^{-1}$  and  $180^\circ\text{sec}^{-1}$ . During the warm-up phase and during testing, the examiner attempted to increase confidence and reduce possible fear of pain, or injury aggravation by providing targeted verbal and visual feedback on performance. Pain catastrophizing scores were obtained using the pain catastrophizing scale questionnaire prior to testing, between testing of the healthy and injured leg, and at completion of all efforts. Differences in pain catastrophizing scores within the testing session were assessed using one-way ANOVA with repeated measures.

**RESULTS:** Omnibus test results indicate nonsignificant statistical differences in pain catastrophizing scores as a function of questionnaire administration occurrence (mean pain catastrophizing scores 12.5, 11.9, and 11.2 for pre, mid, and post test occasions, respectively,  $p = 0.26$ ).

**CONCLUSION:** The construct of pain catastrophizing was not affected by psychological interventions regularly employed during muscle strength testing. From a practical perspective, the pain catastrophizing scale questionnaire can be administered at a time of convenience during pre-operative isokinetic testing in this specific patient population.

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2498 Board #173 MAY 31 3:30 PM - 5:00 PM

**Biopsychosocial Factors Influencing Physical Activity Participation Among People With Chronic Pain**

Jennifer Hulbert<sup>1</sup>, Angela Loucks-Atkinson<sup>1</sup>, Sandra LeFort<sup>1</sup>, LeAnne Petherick<sup>2</sup>. <sup>1</sup>Memorial University of Newfoundland, St. John's, NL, Canada. <sup>2</sup>University of Manitoba, Winnipeg, MB, Canada.  
(No relationships reported)

While it is known that a range of biological, psychological and sociological factors such as pain, perceived stress and exercise self-efficacy are associated with physical activity participation among people with chronic pain (CP), little is understood about the relationships among these variables and how they might impact physical activity participation in younger versus older adults with CP.

**PURPOSE:** To explore the relationships between pain, stress, exercise self-efficacy and physical activity participation among people with CP, and to examine the differences between older adults (50 years and older), and younger adults (under 50 years) in terms of the study variables.

**METHODS:** Self-administered surveys were collected from adults ranging in age from 19-79 years ( $N = 99$ ). The Brief Pain Inventory (Cleeland & Ryan, 1994), Perceived Stress Scale (Cohen, Kamarck, & Mermelstein, 1983), Baecke Questionnaire of Physical Activity (Baecke, Burema, Fritjers, 1982), and Exercise Self-Efficacy Scale (McAuley, 1993) were used to examine the relationships among pain (pain severity and pain interference), stress, physical activity (PA) participation (Sport PA, Work PA, and Leisure PA), and exercise self-efficacy. Hierarchical regression, mediation analyses, and independent t-tests were used to test the hypothesis that greater stress prompts people to be more physically active because it helps them to cope with stress, and that those who are more physically active experience less pain.

**RESULTS:** Pain interference was more significantly associated with Sport PA, stress, and exercise self-efficacy than pain severity. Mediation analyses confirmed the buffer effect of physical activity participation on the association between stress and pain among the oldest adults (i.e. 70+ years). More active participants versus less active participants reported lower pain severity, lower pain interference, and higher levels of exercise self-efficacy.

**CONCLUSION:** An individual's perception of the way pain interferes with their life and activities (e.g. mood, exercise, social relations, and work) is associated with their level of physical activity. People with CP, especially older adults, may reduce stress and pain in their lives by being more physically active.

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2499 Board #174 MAY 31 3:30 PM - 5:00 PM

**Physical Activity, Pain, And Functional Limitations In Older, Overweight And Obese Knee Osteoarthritis Patients**

Matthew J. Garver<sup>1</sup>, Brian C. Focht, FACSM<sup>2</sup>, Steven T. Devor, FACSM<sup>2</sup>, Justin Dials<sup>2</sup>, Charles F. Emery<sup>2</sup>, Alexander R. Lucas<sup>2</sup>, Kevin Hackshaw<sup>2</sup>. <sup>1</sup>Abilene Christian University, Abilene, TX. <sup>2</sup>The Ohio State University, Columbus, OH.  
(No relationships reported)

The pain and functional limitations accompanying knee osteoarthritis (KOA) are primary causes of age-related activity restriction and disability. Although it is well established that overweight individuals have significantly greater risk of developing KOA, it remains unclear if self-reported symptoms differ as a function of weight status among older KOA patients.

**PURPOSE:** The purpose of this investigation was to examine differences in pain and self-reported physical function in overweight, obese, and morbidly obese older adults with symptomatic KOA. A secondary purpose was to examine the relationship between physical activity (PA) participation, pain, and self-reported physical function.

**METHODS:** Seventy-one (58 women and 13 men;  $M$  age = 63 years) KOA patients classified as overweight ( $n=22$ ), obese ( $n=36$ ) or morbidly obese ( $n=13$ ) completed assessments of the WOMAC pain and physical function subscales and pedometer-determined PA.

**RESULTS:** Results of univariate ANCOVA analyses controlling for age revealed that morbidly obese participants reported significantly greater pain symptoms ( $p < 0.01$ ) and worse physical function ( $p < 0.01$ ) relative to overweight or obese participants. No differences in pain or self-reported physical function were observed between the overweight and obese participants ( $p > 0.05$ ). Results of partial correlation analyses controlling for age also revealed that pedometer-determined PA was inversely correlated with pain ( $r = -.31$ ;  $p < 0.01$ ) and physical function ( $r = -.30$ ;  $p < 0.01$ ).

**CONCLUSIONS:** The present results suggest that morbidly obese KOA patients report the highest pain symptoms and functional limitations. Additionally, higher levels of PA participation are associated with more favorable self-reported KOA symptoms. These findings underscore the potential importance of promoting successful weight management in the treatment of older KOA patients.

Supported by NIH/NIAMS Grant R21 AR054595

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## D-27 Free Communication/Poster - Perceived Exertion

MAY 31, 2012 1:00 PM - 6:00 PM

ROOM: Exhibit Hall

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### 2500 Board #175 MAY 31 2:00 PM - 3:30 PM

#### Session RPE Is Not Different When Estimated 15 Minutes Vs 30 Minutes Post-exercise.

Kyle R. Thompson<sup>1</sup>, Justin A. Kraft<sup>1</sup>, James M. Green, FACSM<sup>2</sup>. <sup>1</sup>Missouri Western State University, Saint Joseph, MO. <sup>2</sup>University of North Alabama, Florence, AL. (No relationships reported)

Session RPE is considered a valid and reliable measure at a period of 30 minutes (min) post exercise. Recent research which recorded session RPE every 5 min for a 30 min post-exercise period showed the possibility of session RPE's validity at all intervals 15 min through 30 min post exercise. However, the session RPE may have been influenced by the proximity of the previous rating.

**PURPOSE:** The purpose of this study was to corroborate previous research in order to confirm 15 min as an acceptable time for session RPE estimation.

**METHODS:** Participants performed three resistance training sessions (at 60% of their predetermined 1RM) consisting of the bench press, lat pull down, overhead press, upright row, triceps extension, and biceps curl according to the following protocols: a) 3 sets x 8 reps x 1.5 min rest, b) 3 sets x 8 reps x 3 min rest, c) 2 sets x 12 reps x 3 min rest. A standard 2 min rest was provided between all exercises. Session RPE and recovery HR were recorded 15 min and 30 min after exercise. Session RPE was gathered by asking the question "How difficult was the overall workout?" according to the 10-point omni scale for resistance training. Session RPE was analyzed with a 3 condition x 2 time point repeated measures ANOVA.

**RESULTS:** No significant difference was observed in session RPE based on time recorded 15 min post exercise ( $5.1 \pm 1.5$ ) vs. 30 min post exercise ( $5.2 \pm 1.6$ ). However, mean recovery HR was significantly higher ( $81 \pm 6$  bpm) at 15 min post exercise than 30 min post exercise ( $74 \pm 5$  bpm).

**CONCLUSIONS:** No observed difference in session RPE when recorded 15 min post exercise vs. 30 min post exercise confirms the results of Singh et al., 2007 indicating that 15 min after exercise is a sufficient passage of time for accurate measurement of session RPE. No change in session RPE despite a significant decrease in recovery HR indicated recovery HR had no effect on session RPE at 15 min post exercise.

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### 2501 Board #176 MAY 31 2:00 PM - 3:30 PM

#### Relative Intensity Oxygen Consumption at Criterion RPE in Trained and Untrained Men following Memory Anchoring

Randall F. Gearhart, Jr., FACSM<sup>1</sup>, Beth J. Patton<sup>1</sup>, David F. Vanata<sup>1</sup>, Bruce Mason<sup>2</sup>. <sup>1</sup>Ashland University, Ashland, OH. <sup>2</sup>University of Akron, Akron, OH. (No relationships reported)

It has been shown that memory anchoring is sufficient for monitoring ratings of perceived exertion (RPE) in recreationally trained men and women. It is unclear if memory anchoring would also be appropriate for those that may not be as familiar with sensations experienced during exercise and their placement in the effort-perceptual response continuum.

**PURPOSE:** The current investigation compared percent of maximal oxygen uptake in recreationally trained (RT) versus untrained (UT) men at selected criterion RPE during graded, treadmill exercise following memory anchoring to the Borg 15-category scale.

**METHODS:** Eight men were assigned to each group. The RT ( $23.88 \pm 6.03$  yrs.) and UT groups ( $19.5 \pm 1.77$  yrs.) each received memory anchoring instructions. The experimental trial consisted of a graded, treadmill exercise test with small increases in intensity between stages. Linear regression with RPE as the independent variable and oxygen consumption as the dependent variable was used to calculate percent  $\dot{V}O_{2max}$  for each criterion RPE (7, 9, 11, 13, 15, 17, and 19). An independent samples t-test was used to compare percent  $\dot{V}O_{2max}$  between RT and UT at each criterion RPE.

**RESULTS:** As expected,  $\dot{V}O_{2max}$  was higher for the RT than the UT. All other descriptive variables were similar between groups. Relative oxygen uptake at each criterion RPE was also similar.

**CONCLUSION:** The current results are similar to a previous investigation using trained and untrained young adult women. Memory anchoring saves time in estimation-production designs by allowing examiners to anchor participants and have them perform a follow-up experimental trial in a single laboratory session. Also, in the attempt to construct a prediction model using RPE as the independent variable, it is critical that memory anchoring instructions be presented before exercise. Pre-exercise memory anchoring yields similar relative  $\dot{V}O_2$  for young men independent of training status, further validating Borg's assumption for the application of a category scale that the perceptual range may be set equal for all individuals.

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### 2502 Board #177 MAY 31 2:00 PM - 3:30 PM

#### Accuracy Of Perceived Exertion In Older Adults Performing Common Daily Tasks

Torrance J. Higgins, Jeffrey Knaggs, Christopher M. Janelle, Todd M. Manini. University of Florida, Gainesville, FL. (No relationships reported)

**PURPOSE:** To examine the relationship between ratings of perceived exertion (RPE) and metabolic effort in older adults performing common daily tasks. Though metabolic responses to physical activity explain the majority of RPE variance among young adults, few studies have evaluated whether metabolic effort is associated with RPE in older adults.

**METHODS.** Forty-five community-dwelling older adults (70-90 years) performed 14 daily tasks in a laboratory setting at a self-selected pace. During testing, participants wore a portable metabolic unit to measure pulmonary gas exchange. Metabolic equivalents (MET) were calculated as ventilation of oxygen ( $\dot{V}O_2$ ) /  $3.5 \text{ mlkg}^{-1}\text{min}^{-1}$ . Each task was performed for 9.1 1.8 min to allow for a steady state metabolic rate to be reached. The RPE scale (CR-10) was administered using standardized instructions following the completion of each task.

**RESULTS.** Correlational analysis revealed a significant but weak association between RPE and METs ( $R^2 = 0.07$ ,  $p < 0.01$ ), indicating that physiological responses to physical activity only explains 7% of the variance in perceived exertion among older adults. Analyses to establish the directionality of the error revealed that of the 38% of participants demonstrating exertional error, 21% overestimated and 17% underestimated moderate/vigorous intensity exertion ( $>3$  METs). Polytomous logistic regression indicated that higher MET cost of activity [Odds Ratio (OR): 0.38, 95% Confidence Interval (CI): 0.22-0.64], lower physical function (OR: 0.78, 95% CI: 0.67-0.91), older age (OR: 0.77, 95% CI: 0.63-0.94), exercising 30 minutes per day (OR: 0.70, 95% CI: 0.51-0.97), and lower cognitive function (OR: 0.66, 95% CI: 0.53-0.84) were associated with underestimating RPE compared to measured MET level. Higher body mass index (OR: 1.28, 95% CI: 1.05-1.54) and experiencing non-exertion related fatigue (OR: 1.77, 95% CI: 1.15-2.71) were associated with overestimating RPE.

**CONCLUSION.** Older adults inaccurately estimate their exertion while performing daily tasks. Physiological, psychological, and demographic factors differentially affect the magnitude and direction of RPE error in rating moderate intensity physical activity. These inaccuracies might complicate prescribing the recommended physical activity intensity to older adults.

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2503 Board #178 MAY 31 2:00 PM - 3:30 PM

**Exertional Responses To Sprint Interval Training: A Comparison Of 30-Second and 60-Second Conditions**

Marcus Kilpatrick<sup>1</sup>, Samuel J. Greeley<sup>1</sup>, Elizabeth A. Hubbard<sup>1</sup>, Larry H. Collins<sup>1</sup>, Jamie L. Ohara<sup>2</sup>. <sup>1</sup>University of South Florida, Tampa, FL. <sup>2</sup>Villanova University, Villanova, PA. (Sponsor: John Bartholomew, FACSM)  
(No relationships reported)

Research investigating exertional responses to continuous aerobic exercise suggests that RPE increases over time during constant load work. Recent studies comparing predicted, momentary, and session RPE in response to continuous aerobic exercise suggest that RPE taken before and after exercise do not always match in-task assessments of effort. Predicted and session RPE values typically match peak exertion or exertion observed near the conclusion of the exercise session. One area not yet adequately addressed by the research literature relates to how sprint interval training impacts exertion.

**PURPOSE:** Determine the impact of sprint interval training on RPE responses obtained pre-exercise, during exercise (for work and recovery phases), and upon completion of exercise.

**METHODS:** Sixteen healthy participants (9 male, 7 female; mean age = 23 years) completed a maximal cycle ergometer test and two counterbalanced sprint interval training sessions. Each session utilized the same work-to-rest ratio (1:1), work intensity (90% max), recovery intensity (10% max), and session duration (16 minutes). Trials differed on work duration, with a 30-sec trial and a 60-sec trial. RPE was assessed before, during, and after sessions. Sessions required the same amount of total work over the duration of the trial, but the manner in which the effort was distributed varied.

**RESULTS:** Data were analyzed using ANOVA and pairwise comparisons. Predicted, momentary, and session RPE were higher for the 60-sec trial than the 30-sec trial ( $p < 0.05$ ) despite no difference in total work. Analyses also revealed that RPE increased significantly over time in the work and recovery phases of the interval, with greater increases occurring in the 60-sec trial ( $p < 0.05$ ).

**CONCLUSIONS:** Findings suggest that sprint interval trials utilizing the same total external work and work-to-recovery ratio but differing on interval length produce significantly different RPE responses. RPE is significantly greater for sessions of exercise that utilize longer work intervals. These findings have implications for individuals who utilize interval training as part of their fitness program and suggest that shorter intervals may produce less fatigue and exertional discomfort.

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2504 Board #179 MAY 31 2:00 PM - 3:30 PM

**Perception of Exercise Intensity Level in Recreationally Active Young Adults**

Kristofer Wisniewski, Alex Shafer, Monica Taylor, Elizabeth Nagle, FACSM, Robert Robertson, FACSM, Fredric Goss, FACSM. University of Pittsburgh, Pittsburgh, PA.  
(No relationships reported)

The American College of Sports Medicine (ACSM) defines moderate exercise intensity as 40% to < 60% oxygen uptake reserve ( $VO_2R$ ) that noticeably increases heart rate (HR) and breathing, and vigorous exercise intensity as  $\geq 60\%$   $VO_2R$  that results in substantial increases in HR and breathing. However, no previous studies have examined if individuals can identify these intensities as feeling moderate or vigorous.

**PURPOSE:** To determine how physically active young adults perceive moderate and vigorous exercise intensity based on ACSM definitions.

**METHODS:** Twenty (males,  $n=10$ ; females,  $n=10$ ) recreationally active adults ( $22.2 \pm 3.0$  yrs) performed a peak load-incremented cycle ergometer test. Subjects used a Perceived Intensity Level (PIL) scale with the following categories: 1-Light, 2-Light/Moderate, 3-Moderate, 4-Moderate/Vigorous, and 5-Vigorous. Subjects rated their PIL at the end of each 3 min stage. 40% and 60%  $VO_2R$  ( $l \cdot min^{-1}$ ) were calculated for each subject, and the stages these intensities occurred were identified. The PIL rated during the stages that 40% and 60%  $VO_2R$  occurred were taken as the subject's PIL at those intensities.

**RESULTS:** Paired Samples t-test showed the mean  $\pm$  SD PIL ratings at 60%  $VO_2R$  ( $2.7 \pm 0.7$ ) were significantly greater ( $p < 0.05$ ) than the ratings at 40%  $VO_2R$  ( $1.4 \pm 0.6$ ). At 40%  $VO_2R$ , 65% of subjects reported the intensity as Light, 30% reported the intensity as Light/Moderate, and 5% of subjects reported the intensity as Moderate. At 60%  $VO_2R$ , 45% of subjects reported the intensity as Light/Moderate, 40% reported the intensity as Moderate, and 15% reported the intensity as Moderate/Vigorous.

**CONCLUSION:** ACSM guidelines state individuals should exercise at a moderate and/or vigorous intensity for health benefits. The majority of subjects in this study perceived moderate intensity as Light to Light/Moderate, and only 15% perceived the border between moderate and vigorous intensity (60%  $VO_2R$ ) as Moderate/Vigorous. These results suggest that the majority of recreationally active young adults underestimate their exercise intensity. Therefore, when prescribing exercise intensity it is important that clear definitions of moderate and vigorous intensity be described to individuals who are currently active or wish to become physically active.

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2505 Board #180 MAY 31 2:00 PM - 3:30 PM

**Influence of Work Rate on Session RPE During Resistance Training.**

Justin A. Krafi<sup>1</sup>, James M. Green, FACSM<sup>2</sup>, Kyle R. Thompson<sup>1</sup>. <sup>1</sup>Missouri Western State University, St. Joseph, MO. <sup>2</sup>University of North Alabama, Florence, AL.  
(No relationships reported)

Estimating workload during weight training presents a challenge as traditional markers such as heart rate (HR) increase disproportionately to intensity. Session RPE is a global marker, integrating multiple perceptual and physiological cues, but may be mitigated by specific exercise parameters (i.e. intensity, volume (total work), average HR, and work rate).

**PURPOSE:** This study examined the influence of work rate (total work/unit time) on session RPE.

**METHODS:** Participants performed three resistance protocols at 60% of their predetermined 1RM with all trials equated for total work volume. Participants performed bench press, lat pull down, overhead press, upright row, triceps extension, and biceps curl according to the following protocols: a) 3 sets x 8 reps x 1.5 minute (min) rest, b) 3 sets x 8 reps x 3 min rest, c) 2 sets x 12 reps x 3 min rest. A standard 2 min rest separated each exercise. Session RPE was recorded 30 min after exercise.

**RESULTS:** Pre-set RPE was significantly lower with extended rest period when doing the same number of sets and repetitions per set ( $2.5 \pm 1.6$  vs.  $3.1 \pm 1.6$ ). Post-set RPE was significantly higher for the 2 x 12 x 3 min rest trial ( $5.9 \pm 1.4$ ) vs. 3 x 8 x 1.5 min rest trial ( $4.8 \pm 1.2$ ) despite matched work rates. Post-set RPE was significantly lower for 3 x 8 x 3 min rest trial ( $4.0 \pm 1.6$ ) vs. the 2 x 12 x 3 min rest trial and the difference approached significance ( $p = 0.07$ ) vs. 3 x 8 x 1.5 min rest trial. Pre-set HR for the 3 x 8 x 1.5 min rest trial ( $95 \pm 10$  bpm) was significantly higher than the 3 x 8 x 3 min rest trial ( $89 \pm 10$  bpm). No other significant differences in pre-set or post-set HR were observed. Session RPE results indicate the 3 x 8 x 3 min rest trial was perceived as significantly easier ( $4.2 \pm 1.8$ ) vs. 3 x 8 x 1.5 min rest ( $5.3 \pm 1.8$ ) and 2 x 12 x 3 min rest trials ( $6.2 \pm 1.7$ ). The difference approached significance for the 3 x 8 x 1.5 min rest vs. the 2 x 12 x 3 min rest trial ( $p = 0.08$ ) despite matched work rates.

**CONCLUSIONS:** Session RPE was responsive to changes in work rate. No difference was observed when work rate was matched indicating that session RPE may be linked more tightly with work rate than the number of sets or repetitions per set. However, the difference in session RPE approached significance ( $p = 0.08$ ) between work rate matched protocols indicating that potential mediating effects of this variable warrant further investigation.

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2506 Board #181 MAY 31 2:00 PM - 3:30 PM

**Validity of Three Alternative Versions of the Original OMNI Cycle Scale of Perceived Exertion**

George L. Panzak, Robert J. Robertson, FACSM, Fredric L. Goss, FACSM, Elizabeth F. Nagle, FACSM, Elaine N. Rubinstein, Tanya Shyrchenko, Alex B. Shafer. University of Pittsburgh, Pittsburgh, PA.  
(No relationships reported)

**PURPOSE:** To examine both the concurrent and construct validity of three Alternative Adult OMNI-Cycle Scale formats that eliminate the zero rating category.

**METHODS:** Sixteen young adult males performed four load incremented cycle ergometer tests. Concurrent validity was established by correlating RPE from the three alternative scales with corresponding  $VO_2$  and HR responses. Construct validity was established by correlating RPE from the three alternative scales with RPE from the original scale. Perceptual signal dominance and signal integration were examined by a within subjects three factor ANOVA.

**RESULTS:** Listed in Table 1 are the correlation/regression analyses for Concurrent Validity. Listed in Table 2 are the correlation/regression analyses for Construct Validity. ANOVA indicated signal dominance and signal integration for each of the three alternative scales.

**CONCLUSION:** Findings supported concurrent and construct validity of the three Alternative Adult OMNI-Cycle Scale formats where the zero category represented a resting state and not an exercise response.

TABLE 1. Concurrent Validity: RPE expressed as a function VO2 and HR.

|           |               | Alternative Scale I | Alternative Scale II | Alternative Scale III |
|-----------|---------------|---------------------|----------------------|-----------------------|
| Criterion | RPE Predictor | r*                  | r*                   | r*                    |
| VO2       | Overall       | 0.92                | 0.90                 | 0.90                  |
|           | Legs          | 0.92                | 0.89                 | 0.89                  |
|           | Chest         | 0.90                | 0.92                 | 0.86                  |
| HR        | Overall       | 0.83                | 0.89                 | 0.89                  |
|           | Legs          | 0.84                | 0.88                 | 0.92                  |
|           | Chest         | 0.80                | 0.88                 | 0.82                  |
| *P<0.01   |               |                     |                      |                       |

TABLE 2. Construct Validity: RPE from alternative scales vs RPE from original scale.

|                         | Alternative Scale I | Alternative Scale II | Alternative Scale III |
|-------------------------|---------------------|----------------------|-----------------------|
| Original -RPE Criterion | r*                  | r*                   | r*                    |
| Overall                 | 0.94                | 0.95                 | 0.92                  |
| Legs                    | 0.94                | 0.96                 | 0.93                  |
| Chest                   | 0.93                | 0.96                 | 0.92                  |
| *P<0.01                 |                     |                      |                       |

**2507 Board #182 MAY 31 2:00 PM - 3:30 PM**

**Validity of Borg Ratings of Perceived Exertion During Active Video Game Play**

Brandon S. Pollock<sup>1</sup>, Jacob E. Barkley<sup>1</sup>, Nick Potenzini<sup>2</sup>, Renee M. DeSalvo<sup>2</sup>, Stacey L. Buser<sup>2</sup>, Ronald Otterstetter<sup>2</sup>, Judith A. Juvancic-Heltzel<sup>2</sup>. <sup>1</sup>Kent State University, Kent, OH. <sup>2</sup>The University of Akron, Akron, OH. (Sponsor: Ellen L. Glickman, FACSM)

(No relationships reported)

**BACKGROUND:** Borg's rating of perceived exertion (RPE) scale has been shown to be a valid tool for predicting physiologic effort during differing modes of exercise (e.g. walking, running and cycling). However, an individuals' perception of their effort at a given exercise intensity can be altered with distracters such as listening to music while exercising. Increasingly, physically interactive video games (e.g. Nintendo Wii) have been studied as potential modes of exercise. RPE during game play is often assessed in these studies. However, during game play the user will be exposed to multiple potential distracters: the video of their interactive computer avatar, music and sound effects. These factors may reduce an individual's ability to accurately predict their physiologic effort during game play.

**PURPOSE:** To determine the association between RPE scores and heart rate during physically-interactive video game play.

**METHODS:** Thirteen healthy adults (51.5 ± 11.5 years old) participated in two separate, 40-minute exercise sessions using the Nintendo Wii Fit Plus on non-consecutive days. During each session participants underwent a five-minute warm-up (running in place as part of the Basic Run game), played two separate Wii Fit Plus games (Yoga, Strength Training, Aerobics or Balance Training) for fifteen minutes each and then completed a five-minute cool down (identical to the warm up). Borg RPE and heart rate were assessed during the final 30 seconds of the warm up and cool down, as well as the final 30 seconds of minutes 15 and 30 of Wii Fit Plus play.

**RESULTS:** Correlation analysis combining data from both exercise sessions indicated a moderate positive relationship between heart rate and RPE (r = 0.32). Mixed-effects model regression analyses demonstrated that RPE scores were significantly associated with heart rate (p < 0.001). The average percentage of age-predicted heart rate maximum achieved (58 ± 6%) was significantly greater (p = 0.001) than the percentage of maximum RPE indicated (43 ± 11%)

**CONCLUSIONS:** Borg RPE scores were found to be positively associated with heart rate in adults during exercise sessions using the Wii Fit Plus. However, this relationship was lower than observed in past research that assessed RPE validity during different modes of exercise (e.g. walking, running and cycling) without distracters.

**D-28 Free Communication/Poster - Physical Activity Assessment**

MAY 31, 2012 1:00 PM - 6:00 PM  
ROOM: Exhibit Hall

**2508 Board #183 MAY 31 3:30 PM - 5:00 PM**

**Accuracy of Self-Reported Height and Weight among Basic Combat Trainees**

Ryan Steelman<sup>1</sup>, Joseph J. Knapik, FACSM<sup>1</sup>, Marilyn Sharp<sup>2</sup>, Nathan Hendrickson<sup>2</sup>, Jan Redmond<sup>2</sup>, Bruce Cohen<sup>2</sup>, Bruce H. Jones, FACSM<sup>1</sup>. <sup>1</sup>Army Institute of Public Health, Aberdeen Proving Ground, MD. <sup>2</sup>US Army Research Institute of Environmental Medicine, Natick, MA.

(No relationships reported)

Height (H) and weight (W) measurements are used to calculate body mass index (BMI) to indicate overweight and obese status. Studies looking at the relationship between self-reported and measured H and W have been mostly conducted using middle-aged men and women (Niedhammer, Int J Obesity, 2000;24:1111-18.; Spencer, Public Health Nutr, 2002;5:561-65). Few studies have specifically looked at the relationship of these measures in younger adults, the age group of basic combat trainees. If self-reported H and W are similar to measured values then self-reports may be adequate for epidemiological uses.

**PURPOSE:** To compare the accuracy of self-reported height, weight and resulting BMI among recruits entering Basic Combat Training (BCT).

**METHODS:** Participants were 539 recruits entering BCT at Fort Jackson, South Carolina. They completed a questionnaire asking them to report their H and W. Immediately afterwards, H and W was measured with a stadiometer and digital scale, respectively. Age was calculated from the day of questionnaire administration to their date of birth obtained from the Defense Medical Surveillance System. BMI was calculated as  $W/H^2$ . Pearson correlations examined the relationship between self-reports and measured H, W, and BMI; t-tests examined the differences between the two values. Mean  $\pm$  standard deviation (SD) differences were calculated by subtracting each recruit's measured H, W, and BMI from their respective self-reported H, W, and BMI.

**RESULTS:** Participants were  $20.7 \pm 3.8$  years old. Average  $\pm$  SD measured and self reported H, W, and BMI were, respectively,  $172.5 \pm 9.4$  and  $173.7 \pm 10.0$  cm ( $p < 0.01$ ),  $73.9 \pm 13.8$  and  $72.8 \pm 13.9$  kg ( $p < 0.01$ ) and  $24.73 \pm 3.51$  and  $24.00 \pm 3.39$  kg/m<sup>2</sup> ( $p < 0.01$ ). Correlations between self-reported and measured H, W, and BMI were 0.97, 0.99, and 0.97, respectively. Trainees over-reported their height by an average of  $1.2 \pm 2.5$  cm and under-reported their weight by an average of  $1.2 \pm 2.0$  kg. The calculated BMI was under-reported by  $0.72 \pm 0.92$  kg/m<sup>2</sup>.

**CONCLUSIONS:** Among BCT recruits, there was a close relationship between self-reported and measured H, W, and BMI. Self-reported H and W appears adequately valid for use in epidemiological studies involving large numbers of basic trainees, although the direction of the biases should be considered in drawing conclusions from self-reports.

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**2509** Board #184 MAY 31 3:30 PM - 5:00 PM

**Validation of a Previous Day Recall Measuring Time Spent in Physically Active and Sedentary Behaviors**

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(No relationships reported)

Previous-day recalls (PDR) can collect detailed information about time spent in specific active and sedentary behaviors, as well as contextual information often missing from other measures.

**PURPOSE:** Test the validity of a PDR administered by phone against a valid reference measure.

**METHODS:** Adolescents ( $n=91$ ; 12-17 yrs; 53% female) and adults ( $n=88$ ; 18-71 yrs; 55% female) wore an activPAL (aPAL) for 7 days to measure sedentary (sit/lie) and active time (standing/stepping) and completed up to three PDRs. Interviewers conducted PDRs eliciting open-ended reports of time spent sleeping and in specific active and sedentary behaviors at home, work/school and in the community. Bland-Altman methods and measurement error models evaluated PDR validity versus aPAL on days matched by date and observation time.

**RESULTS:** Adolescents and adults reported 10.0 (SD=2.2) and 9.9 (SD=2.8) hr/d of sedentary time, and 4.2 (SD=1.8) and 5.2 (SD=2.6) hr/d of active time, respectively. Total PDR active and sedentary time was greater than aPAL wear time (difference=0.58 hr/d,  $p < 0.01$ ). Bland-Altman analysis of differences between measures (bias=PDR-aPAL) revealed a non-significant ( $p > 0.05$ ) negative bias for active time in adolescents (bias=-0.27 (SD=1.37) hr/d) and adults (bias=-0.13 (SD=1.44) hr/d). In contrast, a significant positive bias in PDR sedentary time was evident ( $p < 0.01$ ) in adolescents (bias=0.81 (SD=1.52) hr/d) and adults (bias=0.74 (SD=1.59) hr/d), in part due to greater PDR observation time. Measurement error models indicated: (1) only modest systematic error over the range of sedentary ( $B_{QI}=0.90$  to 1.00) and active time ( $B_{QI}=0.70$  to 0.95); (2) random reporting error was greater than systematic reporting error; and (3) correlations between measures were relatively high (Active:  $r_{QI}=0.54$  to 0.73; Sedentary:  $r_{QI}=0.62$  to 0.80). Reporting error was higher for adolescent females, but similar for adolescent males and all adults.

**CONCLUSION:** PDRs measuring active and sedentary behaviors can provide useful estimates of population means, can rank-order individuals on the day observed, and systematic reporting errors were low. PDRs may have value in future epidemiological research, particularly for studies testing hypotheses about specific behaviors and the context within which behavior occurs.

**Support:** R01NR011477

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**2510** Board #185 MAY 31 3:30 PM - 5:00 PM

**Moderate Intensity Cutpoints for Vertical Axis and Triaxial Vector Magnitude in Simulated Lifestyle Physical Activities**

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(No relationships reported)

Men and women engage in 30 and 23 minutes, respectively, of daily moderate intensity physical activity, but in just one minute of vigorous intensity physical activity (Health Survey for England, 2008). Therefore, the point differentiating light from moderate intensity is most relevant from a public health perspective.

**PURPOSE:** To derive cutpoints for the vertical axis and triaxial vector magnitude for demarcating the light and moderate physical activity intensity domains (3 standard metabolic equivalents; METs).

**METHODS:** Forty-nine participants (21 male) volunteered to participate. Guided by the Compendium of Physical Activities, we selected 5 'lifestyle' activities intended to hover around the 3 METs threshold. These activities comprised one 'lawn and garden' (Code 08135, 2.0 METs), three 'home activities' (05090, 2.0 METs; 05148, 2.5 METs; 05140, 4.0 METs), and one 'walking' activity (17190, 3.5 METs). Simultaneously, participants wore a portable indirect calorimeter and a triaxial accelerometer (Actigraph GT3X) while performing each activity for a period of 5 minutes with 5 minutes rest between each bout. We excluded the first 2 minutes and the last 15 s of each bout and derived mean counts per 10 s epoch for both the vertical axis and vector magnitude. Classification as either 'light' or 'moderate' was in agreement with the Compendium for all activities bar one ('home activities' code 05090; measured mean energy expenditure of 3.1 METs). We used Receiver Operating Characteristic curve analysis to derive optimum cutpoints for vertical and vector magnitude counts (sensitivity and specificity weighted equally).

**RESULTS:** For vector magnitude, the area under the curve (AUC) was 0.914 (90% confidence interval, 0.885 to 0.943). The optimum cutpoint was  $>275$  counts/10 s (Sensitivity: 74.6% [67.9 to 80.6%]; Specificity: 94.8% [89.5 to 97.9%]). For the vertical axis, the AUC was 0.757 (0.118 to 0.196). The optimum cutpoint was  $>98$  counts/10 s (Sensitivity: 57.0% [49.8 to 64.1%]; Specificity: 91.8% [85.6 to 95.8%]). There was a substantial difference for the AUC between the vector magnitude versus vertical axis markers of 0.157 (0.118 to 0.196).

**CONCLUSION:** The vector magnitude is clearly superior to the vertical axis marker in discriminating between light and moderate intensity lifestyle physical activities.

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**2511** Board #186 MAY 31 3:30 PM - 5:00 PM

**Validity of the Global Physical Activity Questionnaire (GPAQ) for Measuring Physical Activity**

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(No relationships reported)

**PURPOSE:** To evaluate the convergent validity of the Spanish and English versions of the GPAQ for estimating time spent in moderate to vigorous physical activity (MVPA).

**METHODS:** A community sample of 88 participants (mean age = 41y, SD = 9y; mean BMI = 30, SD = 5) completed an English ( $n = 64$ , 73%) or Spanish ( $n = 24$ , 27%) language GPAQ and wore an ActiGraph GT3X accelerometer for 7 days. The majority of participants were women (90%), self-identified as Latino (83%), born in Mexico (52%), married (64%), and employed at least part time (76%). Outcome variables from the GPAQ were computed as Weekly Minutes of MVPA (WM-MVPA) during work, transportation, leisure, and total (work + transportation + leisure). Participants who did not wear the accelerometer for  $>600$  min per day for 5 days, or  $\geq 3,000$  min in 5 days or less were asked to re-wear the device. Data were scored using a 60s epoch with Freedson cut points being used to classify intensity levels. Outcome variables from the accelerometer were minutes spent in sedentary, light, moderate, and vigorous PA. For both measures, participants with  $\geq 150$  WM-MVPA were identified as meeting national PA guidelines.

**RESULTS:** 100% of participants who completed the Spanish language GPAQ reported meeting PA guidelines; however, only 77% met guidelines when objective data were used. 79% of participants who completed the English-language GPAQ reported meeting PA guidelines, but only 68% met guidelines based on accelerometer data. Levels of MVPA varied substantially between the two measures for both languages (878 vs 227 median WM-MVPA for the Spanish GPAQ and ActiGraph, respectively; 300 vs 176 median WM-MVPA, for the English GPAQ and ActiGraph, respectively). Correlations between the individual indicators from GPAQ (weekly minutes of moderate and vigorous work-, leisure-, and travel-related PA) and accelerometer (moderate and vigorous WM-PA) ranged from 0.02 to 0.32.

**CONCLUSIONS:** Compared to ActiGraph data, the GPAQ leads to greater reporting of time spent in MVPA, especially in the Spanish-language version. Comparison of the levels of MVPA estimated by the two measures suggests that the English language version but not the Spanish-language version appears to be a valid measure of PA in this sample.

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2512 Board #187 MAY 31 3:30 PM - 5:00 PM

**Reliability And Validity Of Two Physical Activity Surveys In Spanish-Speaking Mexican Americans**

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(No relationships reported)

The accurate assessment of physical activity (PA) is important to understand the relationship that exists between PA and chronic disease. There is a need for reliable and valid measures of PA in the Spanish-speaking population.

**PURPOSE:** The purpose of this study was to assess the test-retest reliability and criterion validity of the Spanish translation of two physical activity surveys, the Stanford Brief Activity Survey (SBAS), and Rapid Assessment of Physical Activity (RAPA), in a Spanish-speaking, Mexican-American population.

**METHODS:** A total of 31 participants (male=12, female=19, age=37.5±9.8y) completed all or part of the study. The responses to the SBAS were placed into three categories (score 1=Inactive, 2=Light/Moderate, and 3=Hard/Very Hard) and the RAPA scores were placed into four categories (1=Sedentary, 2=Underactive/Underactive regular/light, 3=Underactive regular, and 4=Active). Chi-squared correlations were performed to determine one week, test-retest reliability for each survey. Criterion validity was assessed by having the participants wear an Actigraph GT1M accelerometer for one week to objectively measure activity levels. The minutes of moderate- and vigorous-intensity physical activity were determined using Freedson cut-points. A Spearman rank order correlation was performed to determine the association between objectively measured PA and responses on the two surveys.

**RESULTS:** Test-retest reliability for the SBAS and RAPA were .62 ( $p < 0.01$ ) and .40 ( $p < 0.01$ ), respectively. The SBAS and RAPA both demonstrated criterion validity ( $r = .45$ ,  $p < 0.05$  for both) with minutes of moderate- and vigorous-intensity physical activity.

**CONCLUSION:** In this sample, the SBAS was a more reliable measure of physical activity than the RAPA. Both surveys are sufficiently valid against accelerometry. The SBAS shows acceptable validity and reliability for use in the Spanish-speaking, Mexican-American population.

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2513 Board #188 MAY 31 3:30 PM - 5:00 PM

**Validity And Accuracy Of Physical Activity Monitors For Estimating Energy Expenditure During Wheelchair Locomotion**

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(No relationships reported)

**PURPOSE:** To compare energy expenditure (EE) estimates of two physical activity monitors with measured EE during wheelchair locomotion.

**METHODS:** Participants were fourteen individuals who used manual wheelchairs. Each participant performed five different locomotion activities in a manual wheelchair. These activities included wheeling on a level surface that elicited a low rolling resistance at three different speeds (4.5, 5.5, and 6.5 km·hr<sup>-1</sup>), wheeling on a rubberized 400m track that elicited a higher rolling resistance at one speed (5.5 km·hr<sup>-1</sup>), and wheeling on sidewalk course that included uphill and downhill segments at the participants self-selected speed. EE was measured using a portable indirect calorimetry system (Oxycon Mobile, Viasys Healthcare). Each subject wore an Actical (AC) and a SenseWear (SW) activity monitor on the right wrist and upper arm, respectively. A repeated measures ANOVA was used to compare measured EE to the estimates from the AC and the SW. Additionally, EE estimates from a wheelchair specific prediction equation using the SW data (Hiremath and Ding, 2011) was also compared. Bland-Altman plots were used to assess the agreement between the criterion values and the predicted values.

**RESULTS:** A repeated measures ANOVA demonstrated a significant main effect between measured EE and estimated EE ( $p < 0.01$ ). There were no significant differences between the criterion method and the AC ( $\pm 9$  to 25%,  $p > 0.05$ ). The SW significantly overestimated EE when wheeling at 4.5 km·hr<sup>-1</sup>, 5.5 km·hr<sup>-1</sup>, 6.5 km·hr<sup>-1</sup>, and during self-paced sidewalk wheeling (+30 to 80%,  $p < 0.05$ ). The Hiremath and Ding SW equation on average improved in the EE prediction during low intensity activities, but error progressively increased during higher intensity activities (+27 to 43%).

**CONCLUSION:** Overall, the wrist-mounted AC can accurately estimate EE ( $\pm 9$  to 25%) whereas the SW tends to overestimate EE during wheelchair locomotion. The wrist-mounted accelerometer is a viable option for physical activity assessment during wheelchair propulsion.

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2514 Board #189 MAY 31 3:30 PM - 5:00 PM

**Comparison of New Wristband Type Activity Monitor and Accelerometer**

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(No relationships reported)

To simplify the objective assessment of physical activity during daily activity, many accelerometers have been used. The accelerometers generally underestimate the physical activity energy expenditure during vertical work, arm activity, and carrying a baggage. The ViM sports memory wristband (ViM), using a uniaxial accelerometer and a gyro-sensor, was designed to classify activity patterns and estimate energy expenditure in daily activity.

**PURPOSE:** To assess the accuracy of the ViM during various activities compared with an indirect calorimeter (IC) and an accelerometer (Kenz Lifecorder EX: KL).

**METHODS:** Eight men (20.8 ± 0.4 yrs) and Seven women (20.6 ± 0.6 yrs) performed each 10 min of 15 type activities (Kendama, active video games [Wii Sports tennis, baseball, boxing], static and dynamic stretch, jump-rope, step exercise, table tennis, darts, ball juggling, balance ball, golf putting, walking, and dumbbell exercise). The ViM was placed on non-dominant wrist position. The KL was placed on waist. During all activities, the IC (MetaMax-3B) measured energy expenditure (MET). The ViM and the KL recorded body motion, we then calculated MET by using outputs of both the ViM and the KL. Estimated MET by the KL and the ViM and the IC measured MET were analyzed with two-way ANOVA model in mixed models. We also calculated correlation coefficients of the KL and the ViM to the IC measurements.

**RESULTS:** Two-way ANOVA model results showed significant interaction ( $F(14, 492.5) = 12.4$ ,  $p < 0.05$ ). The KL estimates significantly underestimated (-62 to -9%) measured MET during all 15 activities. The ViM estimates significantly underestimated (-56 to -24%) measured MET during Kendama, active video games (tennis and boxing), static stretch, jump-rope, step exercise, table tennis, ball juggling, balance ball, golf putting, and dumbbell exercise. No significant differences were found between the IC and the ViM of MET during dynamic stretch, darts, active video game (boxing), and walking (-11 to 7%). Correlation coefficient of the KL to the IC ( $r = 0.80$ ,  $p < 0.05$ ) was higher than it of the ViM ( $r = 0.63$ ,  $p < 0.05$ ).

**CONCLUSIONS:** The ViM can provide more accurate estimates of MET than the KL during non-regulated activities; however, large errors are found in the ViM estimates. The validity of the ViM is lower than the KL's validity.

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2515 Board #190 MAY 31 3:30 PM - 5:00 PM

**Comparison of the New and Old Compendium of Physical Activities to Predict Energy Expenditure in Pregnant Women.**

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(No relationships reported)

The Compendium of Physical Activities (CPA) provides the energy expenditure (EE) for hundreds of daily activities reported in metabolic equivalents (MET). An updated version of the CPA was published in June 2011. The CPA has been used to quantify the EE of activities in pregnant women although metabolic changes associated with pregnancy may render the CPA values invalid.

**PURPOSE:** This study compares the METs measured via indirect calorimetry (IC) in pregnant women to the METs published in the 2011 (CPA<sub>new</sub>) and the 2000 (CPA<sub>old</sub>) CPA.

**METHODS:** EE was measured in 23 pregnant women during their 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> trimester. Each woman completed a series of activities consisting of typing, folding laundry while standing, sweeping (household activities), and treadmill walking at speeds of 2.0, 2.5, 3.0 mph, 0% incline and 3.0 mph, 3% incline. METs were defined two ways: absolute method (1 MET = 3.5 mL O<sub>2</sub>/kg/min or 1 kcal/kg/h) and ratio method (EE<sub>activity</sub>/EE<sub>rest</sub>). Data were compared across pregnancy using repeated measures ANOVA. Observed METs were compared the CPA<sub>new</sub> and CPA<sub>old</sub> with t-tests. A Bonferroni-corrected P-value was used to test significance.

**RESULTS:** Data across all trimesters were not significantly different, thus 2<sup>nd</sup> trimester data is presented. CPA<sub>old</sub> vs. observed METs: For the absolute definition, all activities were

significantly different ( $P < 0.005$ ) except for level walking at 2.0 and 2.5 mph; household activities were overestimated by CPA<sub>old</sub> ( $P < 0.001$ ). With the ratio definition, all activities were significantly different than observed METs ( $P < 0.005$ ); household activities were overestimated whereas all walking was underestimated by the CPA<sub>old</sub>. CPA<sub>new</sub> vs. observed METs: Using the absolute definition, all activities except level walking at 2.5 and 3.0 mph were significantly overestimated ( $P < 0.0001$ ). Using the ratio definition, only folding and sweeping were significantly different ( $P < 0.005$ ) however walking at a level grade was significantly underestimated ( $P < 0.001$ ).

**CONCLUSION:** Using either version of the CPA, the ratio definition significantly overestimates household activities and underestimates walking. The 2011 CPA minimizes the error associated with assessing energy expenditure; the CPA METs still provide a significantly different MET than what is measured in pregnant women.

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**2516** Board #191 MAY 31 3:30 PM - 5:00 PM

**Agreement of Hip and Ankle Worn Activity Monitors for Measurement of Physical Activity**

Matthew T. Mahar, FACSM, Mallory Peavler, Grace Anne Edwards, Nicholas A. Boerio, Lucas J. Carr. *East Carolina University, Greenville, NC.*

(No relationships reported)

**PURPOSE:** To examine agreement among three activity monitors for assessment of moderate and vigorous physical activity.

**METHODS:** Participants ( $N = 39$ ) wore three activity monitors for 48 hours. The monitors included the ActiGraph GT1M accelerometer, the three-dimensional GT3X+ accelerometer, both worn at the hip, and the ankle-worn StepWatch activity monitor. Moderate-to-vigorous physical activity (MVPA) was calculated for the ActiGraph monitors using previously published cut points. MVPA was calculated from the StepWatch steps per minute output based upon previously published moderate intensity cut points relative to height. Average minutes of MVPA were compared with repeated measures ANOVA. Effect sizes ( $ES$ ) were estimated with Cohen's delta and Pearson correlations were calculated. Participants were then categorized as either meeting or not meeting the recommendation for 30 min of MVPA per day. Criterion-referenced agreement between different monitors was examined with proportion of agreement ( $Pa$ ) and modified kappa ( $kq$ ).

**RESULTS:** The GT3X+ produced significantly ( $p < .05$ ) more daily minutes of MVPA ( $69.5 \pm 42.9$  min) than the GT1M ( $47.8 \pm 35.8$  min;  $ES = 0.55$ ;  $r = .70$ ) and StepWatch ( $48.4 \pm 32.6$  min;  $ES = 0.56$ ;  $r = .75$ ). The difference in mean daily minutes of MVPA between the GT1M and StepWatch was not significant ( $p = .89$ ;  $ES = 0.02$ ;  $r = .58$ ). Criterion-referenced agreement was high between the GT1M and StepWatch on day 1 ( $Pa = .90$ ,  $kq = .79$ ), but lower on day 2 ( $Pa = .74$ ,  $kq = .49$ ). Agreement between the GT3X+ and GT1M was moderate ( $Pa = .77$ ,  $kq = .54$  [day 1],  $Pa = .79$ ,  $kq = .59$  [day 2]). Similar moderate levels of agreement were found between the GT3X+ and StepWatch ( $Pa = .77$ ,  $kq = .54$  [day 1],  $Pa = .74$ ,  $kq = .49$  [day 2]).

**CONCLUSIONS:** The three-dimensional accelerometer (GT3X+) produced approximately 20 more minutes of MVPA per day than the GT1M or StepWatch. Although average number of daily minutes of MVPA was similar for the GT1M and StepWatch, agreement between these monitors for categorizing participants as meeting or not meeting physical activity recommendations was only of moderate accuracy on day 2. The cut points used in this study for the GT3X+ monitor do not provide high levels of agreement with the other monitors studied for daily minutes of MVPA or for categorization for meeting or not meeting physical activity recommendations.

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**2517** Board #192 MAY 31 3:30 PM - 5:00 PM

**Perceptions of Objective and Self-Report Methods for Monitoring Sedentary and Physical Activity Behaviors**

Lucas J. Carr, Mallory Peavler, Grace Anne Edwards, Nicholas Boerio, Matthew T. Mahar, FACSM. *East Carolina University, Greenville, NC.*

(No relationships reported)

While many studies have examined the accuracy, validity, and reliability of physical activity measures, little is known about individual perceptions of the monitoring process. Such information could provide researchers insight to assist in reducing non-compliance when assessing physical activity.

**PURPOSE:** To identify participant perceptions of two objective (hip-worn ActiGraph accelerometer, ankle-worn StepWatch monitor) and two self-report methods (online 48 hour recall questionnaire, 48 hour activity log) of measuring sedentary and physical activity behaviors.

**METHODS:** A convenience sample of 53 college-aged students wore two objective monitors for 48 hours during all non-bathing hours including sleep time. Participants documented their sedentary/active time in 15 minute blocks using a 48 hour behavioral log. Participants completed a four-item, online 48 hour sedentary/activity recall survey. Participants rated the objective monitors (e.g., comfort during day, comfort while sleeping, ease of wear during exercise, awareness of monitor, intrusiveness, responsiveness to device for engaging in physical activity) and self-report surveys (e.g., difficulty to complete, perceived accuracy) using a five-point Likert Scale (strongly disagree=1; disagree=2; neutral=3; agree=4; strongly agree=5).

**RESULTS:** Participants rated the ankle-worn StepWatch significantly more comfortable to wear during the day ( $3.6 \pm 1.0$  vs.  $2.8 \pm 1.1$ ;  $P < 0.001$ ), more comfortable while sleeping ( $3.1 \pm 1.3$  vs.  $1.9 \pm 1.0$ ;  $P < 0.001$ ), easier to wear during exercise ( $3.6 \pm 1.1$  vs.  $2.8 \pm 1.1$ ;  $P < 0.001$ ) and less intrusive/interfering ( $2.2 \pm 0.8$  vs.  $2.8 \pm 1.0$ ;  $P < 0.001$ ) than the ActiGraph accelerometer. Participants also reported being more aware of the hip-worn ActiGraph than the StepWatch ( $3.1 \pm 1.0$  vs.  $2.9 \pm 1.1$ ;  $P = 0.008$ ). No differences were observed between the self-report assessment tools.

**CONCLUSIONS:** Participants found the ankle-worn StepWatch to be more agreeable to wear during the assessment process than the hip worn ActiGraph monitor. These findings support future studies that explore individual perceptions of assessment tools to ensure maximum compliance.

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**2518** Board #193 MAY 31 3:30 PM - 5:00 PM

**The Utility of a Simple Physical Activity Screener to Differentiate Cardiometabolic Risk in Latino Youth**

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(No relationships reported)

**PURPOSE:** Latino youth are disproportionately impacted by obesity and type 2 diabetes, therefore early identification of high-risk youth is an essential step for closing the obesity-related health disparity gap. As researchers develop and implement sophisticated approaches to objectively quantify physical activity (PA), clinicians struggle to translate these approaches into real-world settings. Therefore, the purpose of this study was to examine the utility of a simple PA screener for differentiating cardiometabolic disease risk in Latino youth.

**METHODS:** 151 non-diabetic Latino adolescents (age  $16.6 \pm 2.7$  yrs, 70 male /81 female) were assessed for fasting: Triglycerides (TG), HDL-cholesterol (HDL), LDL-cholesterol (LDL), VLDL-cholesterol (VLDL), and plasma glucose and insulin. In addition, participants underwent a 2-hour Oral Glucose Tolerance Test to assess insulin sensitivity (Matsuda index) and glucose tolerance. Prior to testing, participants completed a questionnaire which asked whether or not they engage in regular PA (yes or no).

**RESULTS:** 100 youth answered "yes" and 51 answered "no" to the single-question PA screener with a significantly greater proportion of males answering yes than females (84.3% vs. 50.6%,  $p < 0.0001$ ). After adjusting for age and gender, those responding "yes" had significantly lower TG ( $92.3 \pm 47.1$  vs.  $113.5 \pm 59.6$  mg/dl), VLDL ( $15.5 \pm 7.9$  vs.  $19.0 \pm 9.9$  mg/dl), fasting and 2-hour glucose ( $90.7 \pm 6.3$  vs.  $91.4 \pm 7.0$  mg/dl,  $112.4 \pm 24.3$  vs.  $122.5 \pm 21.8$  mg/dl), 2-hour insulin ( $69.7 \pm 66.2$  vs.  $108.1 \pm 78.2$   $\mu$ U/ml), and total glucose AUC ( $15123.0 \pm 2465.2$  vs.  $16386.2 \pm 2685.4$   $\text{mg} \cdot \text{dl}^{-1} \cdot \text{h}^{-1}$ ), all  $p < 0.05$ . Participants responding yes also had significantly higher HDL ( $44.5 \pm 8.2$  vs.  $41.9 \pm 11.6$  mg/dl) and insulin sensitivity ( $5.2 \pm 3.4$  vs.  $4.5 \pm 3.6$ ) (both  $p < 0.05$ ). In multiple regression analysis controlling for age, gender, and BMI, a yes response was a significant and independent predictor of higher insulin sensitivity ( $\beta = 0.112$ ,  $p < 0.05$ ) and lower 2-hour glucose levels ( $\beta = -0.038$ ,  $p < 0.05$ ).

**CONCLUSIONS:** These data suggest that a simple PA screener may differentiate risk for cardiometabolic disease in Latino youth. Given that obesity and type 2 diabetes disproportionately impact Latino youth, simple PA screeners may provide clinicians with a useful tool when caring for this vulnerable population.

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**2519** Board #194 MAY 31 3:30 PM - 5:00 PM

**Validity Of A Direct Observation Measure To Evaluate Group Exercise Classes**

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(No relationships reported)

Group exercise classes are a common physical activity modality but there is currently no validated objective measure to assess class content, instructor quality, or participant activity levels.

**PURPOSE:** To adapt and validate the System for Observing Fitness Instruction Time (SOFIT) for use in adult group exercise classes (SOFIT-X).

**METHODS.** Three sequential studies were used to adapt and validate a new direct observation measure. Study 1 used a nominal group technique with subject-matter experts to modify and content-validate the target behaviors of the SOFIT-X. Study 2 used behavioral assessment experts to establish criterion codes across seven types of group-exercise classes through iterative cycles of pilot testing and measure revision. Study 3 assessed ecological validity and inter-rater reliability via data collected by trained observers on 36 live group exercise classes.

**RESULTS.** Seven subject-matter experts developed four coding categories (posture, intensity, class context, and instructor behavior), 22 sub codes (observable behaviors within each coding category) with definitions, and 23 instructor behavior criteria to yield a face- and content-valid version of the new measure. Three trained observers then established criterion codes for 140 minutes of video-taped group exercise classes which were used subsequently for observer training. Interobserver agreement (IOA) among any two of three observers was 97%, 100%, 99%, and 100% on posture, intensity, class context, and instructor behavior. Agreement for all three observers ranged from 76% (intensity) to 87% (posture). Data collected on 36 live classes using SOFIT-X revealed that participants were predominantly ambulatory (49.4%) at light intensity (43.1%), designed to promote cardiovascular fitness (39.2%). Instructors mainly 'promoted and demonstrated' fitness (59.7%). IOA during live observation was 91%, 76%, 92%, and 86% for posture, intensity, class context, and instructor behavior, respectively.

**CONCLUSIONS.** SOFIT-X is a content- and criterion-valid measure that can be used to evaluate the quality of adult group exercise classes. Further research should attempt to improve the validity of coding exercise intensity. Funded by a research grant (1R18DP0021380-01) from the Centers for Disease Control and Prevention.

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**2520** Board #195 MAY 31 3:30 PM - 5:00 PM  
**Validation Of New Sensewear Mini Armband Algorithms (version 5.2) In Children**

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(No relationships reported)

The SenseWear Mini Armband (SWM) has been shown to provide valid estimates of energy expenditure (EE) in adults and children. A new set of pattern recognition algorithms version (v) 5.2 has recently been developed to further improve precision for assessing free-living activities, particularly for non-locomotor activities.

**PURPOSE:** The purpose of the study was to evaluate the new v8.0 software (algorithm v5.2) compared to the previous v7.0 software (algorithm v2.2) in a sample of children performing a range of lifestyle activities ranging from sedentary to vigorous.

**METHODS:** Forty five boys (n=34) and girls (11) ages 7 to 13 years performed 12 randomly assigned activities (out of a set of 24) while wearing a SWM with simultaneous indirect calorimetry monitoring using a portable metabolic analyzer (Oxycon Mobile, OM). Each activity lasted 5 minutes with a 1 minute break in between. Data from minute 3 and minute 4 were utilized to obtain steady-state EE values from both OM and SWM. The SWM data were processed with both the v2.2 and v5.2 (pre-release version) algorithms.

**RESULTS:** Pearson product-moment correlations (r) with OM were similar for both algorithms (v5.2: r = 0.91; v2.2: r = 0.90). However, the absolute error rates (computed as average absolute value of the individual errors) were considerably lower for the new v5.2 algorithm (6.7%) compared with the v2.2 algorithm (30.1%). The v5.2 algorithms yielded non-significant (p>.05) differences in EE estimates for most of the walking related activities as well as for stationary cycling at moderate intensity (absolute error = 3.13%). Significant differences were found for vigorous cycling (absolute error = 20.46%).

**CONCLUSIONS:** The newly developed SenseWear v5.2 (pre-release) algorithms yielded more accurate estimates of EE than the v2.2 algorithms for monitoring lifestyle activities in children. The result for moderate intensity cycling is particularly noteworthy since this activity has proven difficult to assess with traditional accelerometry-based monitors.

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**2521** Board #196 MAY 31 3:30 PM - 5:00 PM  
**Does Changing Firmware Affect Actigraph Gt1m And Gt3x Monitor Output?**

Jeffer E. Sasaki, Dinesh John, Amanda Libertine, Marianna Mavilia, Patty Freedson, FACSM. *University of Massachusetts, Amherst, MA.*  
(No relationships reported)

The flash-memory within ActiGraph GT1M and GT3X monitors contains software code (firmware) that performs various functions including signal filtering. ActiGraph frequently update firmware for these monitors. A recent study attributed significant differences between GT1M and GT3X activity counts to firmware differences.

**PURPOSE:** To compare vector magnitude (VM) activity counts from GT1M and GT3X monitors programmed with different firmware versions.

**METHODS:** Five GT3X and 7 GT1M firmware versions were selected for comparison. Each activity monitors was programmed with one of the 12 firmware versions. These GT1M and GT3X monitors were worn at the hip by 10 participants (age=25.5 ± 5.0, BMI= 23.3 ± 2.2 kg m<sup>-2</sup>) who performed treadmill (walking at 1.5, 3 and 4.5 mph and running at 6 mph) and simulated free-living (sitting, self-paced walking, filing papers, dusting, vacuuming, and cleaning the room) activities during two lab visits. Two-way ANOVAs (p<0.05) were used to compare VM activity counts from monitors with different firmware versions.

**RESULTS:** There were no significant differences in VM activity counts from monitors with different firmware versions during all activities. For treadmill activities, the smallest inter-firmware percent difference in activity counts was less than 1% between the GT3X with firmware 2.1.0 and the GT1M with firmware 5.1.0 during running at 6 mph. The largest difference was 19% between the GT3X with firmware 1.0.0 and the GT1M with firmware 4.3.0 during walking at 1.5 mph. For simulated free-living activities, the smallest inter-firmware percent difference in activity counts was less than 1% between the GT3X with 2.1.0 and the GT3X with 4.1.0 during self-paced walking. The largest difference was 41% between the GT3X with firmware 2.1.0 and the GT1M updated with firmware 4.1.0 during filing papers.

**CONCLUSION:** All firmware versions used in this study produced consistent results and seemed free of errors. Previously reported inconsistencies in firmware version 4.1.0 for the GT1M have been corrected. It is recommended that prior to a firmware release, the manufacturer should verify consistency in output with previous firmware releases by conducting both mechanical and human testing and provide these results to the end-user.

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**2522** Board #197 MAY 31 3:30 PM - 5:00 PM  
**Calibration Method for Accelerometer-Based Physical Activity Monitors**

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(No relationships reported)

Accelerometer-based physical activity monitors (PAMs) have recently been used to estimate ground reaction forces (GRFs) during gait. However, to estimate GRFs, the accelerometer must be properly calibrated and its amplitude range must match the site where the PAM will be worn (e.g. the hip). Currently, no standard PAM calibration methods exist.

**PURPOSE:** Develop and test a standardized PAM accelerometer calibration method.

**METHODS:** A PAM calibration system was developed and its utility demonstrated by calibrating a hip-PAM. Hip accelerations during gait can reach 6 g; therefore, the calibration system must provide accelerations over a range of at least 0 to 6 g. A calibration system capable of producing this acceleration range was constructed using a 122 cm long aluminum frame with its center mounted to the shaft of a variable speed motor (0-110 rpm). Custom fixtures were built to mount a PAM in 3 orthogonal orientations anywhere along the length of the frame (r). During a constant angular velocity ( $\omega$ ), the PAM axis aligned with the radial axis of the frame experiences a constant radial acceleration ( $a_r = \omega^2 r$ ). For the system characteristics defined,  $a_r$  can be varied between 0.3 and 8g. To illustrate the utility of this calibration system, 30 custom PAMS (±8g amplitude range) were calibrated. Each sensitive axis (±X, ±Y, and ±Z) was tested at 3  $a_r$  settings (18 total trials). A least squares solution was used to find accelerometer calibration factors from theoretical and raw acceleration values. To test the validity of the calibration, 2 intermediate  $a_r$  settings were tested. Applied and calibrated  $a_r$  values were compared. Percent error (normalized to amplitude) and Pearson correlations were calculated and results for the 30 PAMs were averaged.

**RESULTS:** PAMs were accelerated up to 7g without saturation indicating sufficient range for hip mounted applications. Normalized % error (mean ± standard deviation) averaged for the  $a_r$  validation settings were 2.6 ± 0.5, 2.2 ± 0.7 and 1.1 ± 0.2 for the X, Y, and Z axes respectively. Pearson correlations were excellent for 12 validation conditions (r = 1.0, p < 0.001).

**CONCLUSIONS:** A simple, inexpensive PAM calibration method was developed and shown to accurately find calibration factors for custom PAMs. Calibrated accelerations had less than 3% normalized error and did not saturate.

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2523 Board #198 MAY 31 3:30 PM - 5:00 PM

**Validity Of The PAtacker Device For Observational Quantification Of Physical Activity**

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<sup>1</sup>USARIEM, Natick, MA. <sup>2</sup>L-3 Communications, San Diego, CA. (Sponsor: Dr Edward Zambraski, FACSM)  
(No relationships reported)

Most pedometer or accelerometer-based methods for tracking physical activity (PA) cannot assess body posture, external loads carried, activity intensity and type. Direct observation, by trained observers (OBS), can be used to capture this information. Custom software (PAtacker) has been developed for use on an Android smart phone to observe PA.

**PURPOSE:** To determine the validity of a direct observational method using the PAtacker software that quantifies (in seconds) and characterizes PA over extended periods of time.

**METHODS:** PA was classified into body positions, activity types, intensities and external loads carried. To establish a criterion score (CRIT), expert observers agreed on the scoring of a 30-min video. To determine validity, 6 trained observers (OBS), who were actively using the device, watched and scored this video immediately following training and again after 5 and 9 weeks. Agreement between OBS and the CRIT were analyzed. Mean % of the CRIT = OBS score - CRIT/CRIT x 100.

**RESULTS:** Agreement between OBS and CRIT, as measured by mean percent (SD) of the CRIT, is displayed in Table 1.

**CONCLUSIONS:** The PAtacker provides a valid method by which to classify body positions and activity types. While the load and intensity categories do not appear to be valid measures, they may be improved upon with additional training or redefining the operational definitions.

Table 1. Mean Percent Agreement (MPA) between OBS and CRIT (SD).

| Body Position | MPA       | PA Type      | MPA      | PA Type    | MPA       | Load (lbs) | MPA      | PA Intensity | MPA      |
|---------------|-----------|--------------|----------|------------|-----------|------------|----------|--------------|----------|
| Kneeling      | 101 (14)* | Calisthenics | 55 (10)  | Climbing   | 40 (51)   | 0-10       | 130 (45) | Rest         | 159 (32) |
| Lying         | 116 (17)* | Combatives   | 98 (16)* | Running    | 78 (39)   | 11-25      | 16 (90)  | Light        | 36 (50)  |
| Sitting       | 49 (29)   | Crawling     | 90 (14)* | Stationary | 118 (27)* | 51-75      | 171 (34) | Mod          | 58 (55)  |
| Standing      | 91 (10)*  | Lift/Carry   | 91 (13)* | Walking    | 107 (29)* |            |          | High         | 147 (56) |

\*Indicates 80-120% acceptable level of agreement. If MPA = 100 then CRIT values = Observed Values. If MPA < 100 then Observed values underestimated CRIT values. If MPA > 100 then Observed values overestimated CRIT values.

2524 Board #199 MAY 31 3:30 PM - 5:00 PM

**Evaluation Of The ActiGraph's 'low Frequency Extension' - A Pilot Study**

Yuri Feito, Heather Garner. Barry University, Miami Shores, FL  
(No relationships reported)

The accuracy of the ActiGraph accelerometer has been widely established. However, the effect of its 'low-frequency extension' (LFE) during treadmill walking and the free-living environment has not been studied.

**PURPOSE:** To determine the accuracy of the ActiGraph's LFE during treadmill walking and the free-living environment.

**METHODS:** Participants wore the StepWatch (SW) and the ActiGraph with and without the LFE activated (GT3X-LFE and GT3X-N). They walked on a treadmill at five different speeds (1.5, 2.0, 2.5, 3.0, and 3.5 mph) and wore the devices in the free-living environment for an entire day. The hand-tally counter and the SW served as the criterion method for the treadmill and free-living condition, respectively.

**RESULTS:** Repeated measures ANOVA showed the GT3X-N significantly underestimating step counts at speeds less than 2.5 mph. During the free-living condition, significant differences ( $P < 0.001$ ) were observed between the GT3X-LFE (overestimated), GT3X-N (underestimated) and the criterion method.

**CONCLUSIONS:** Repeated measures ANOVA showed the GT3X-N significantly underestimating step counts at speeds less than 2.5 mph. During the free-living condition, significant differences ( $P < 0.001$ ) were observed between the GT3X-LFE (overestimated), GT3X-N (underestimated) and the criterion method.

2525 Board #200 MAY 31 3:30 PM - 5:00 PM

**Validation of the Actical Step Count Function in Older Adults**

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(No relationships reported)

**PURPOSE:** To assess the validity of the Actical accelerometer step count function in older adults.

**METHODS:** Twenty-nine participants aged  $67.70 \pm 6.07$  participated in the study. Actical step counts were compared to actual steps taken and those recorded by three pedometers (Yamax, Omron, & Walk4Life). Participants walked around a 200-m indoor track at a self-selected pace and performed treadmill walking at different speeds (40.2 m/min, 53.64 m/min, and 67.2 m/min) for 5 minutes at each speed. Two trained observers counted steps using hand tally counters for all walking activities. Paired t-tests were used to assess significant differences between actual steps taken and step counts registered by the activity monitors for all walking activities. Mean absolute percent error (MAPE) was also determined for all walking activities.

**RESULTS:** There was no statistical difference between Actical step counts and actual steps taken during self-paced walking ( $p = .50$ ; MAPE = .44%). During treadmill walking at 40.2 m/min speed, the Actical step counts were significantly different from actual steps taken ( $p < .01$ ; MAPE = 57%). During treadmill walking at 53.64 m/min, the Actical step counts were significantly different from actual steps taken ( $p < .01$ ; MAPE = 17%). During treadmill walking at 67.2 m/min, the Actical step counts were significantly different from actual steps taken ( $p < .05$ ) but had an acceptable MAPE value (1.51%). Overall, MAPE values were acceptable for all activity monitors during self-paced walking (< 3%). MAPE values were acceptable for the Omron and Walk4Life pedometers during treadmill walking at 67.2 m/min speeds (< 3%).

**CONCLUSIONS:** The Actical step count function provides valid estimates of step counts during self-paced walking and walking at constant speeds of  $\geq 67.2$  m/min in older adults.

2526 Board #201 MAY 31 3:30 PM - 5:00 PM

**Accuracy Of Sensewear® Pro Armband In Estimating Energy Expenditure During Steady-state And Non-steady-state Physical Activity**

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(No relationships reported)

The SenseWear® Pro Armband (SWA) estimates energy expenditure (EE) for facilitation of physical activity and weight goals.

**PURPOSE:** We compared EE estimates from the SWA to indirect calorimetry-derived EE during physical activity.

**METHODS:** 17 men ages  $61 \pm 16$  years (BMI:  $29.1 \pm 4.6$  kg/m<sup>2</sup>) and 28 women ages  $48 \pm 20$  years (BMI:  $26.5 \pm 6.1$  kg/m<sup>2</sup>) performed 90-min and 65-min physical activity routines on separate days. The 90-min routine (steady-state: SS) routine consisted of 8-min bouts of 8 different activities including rest, walking, cycling, arm cranking, and simulated activities of daily living (ADL), performed in a random order, with a 4-min rest period between each activity (only steady-state data during min 4-7 were analyzed). The 65-min routine (non-steady-state: Non-SS) consisted of 5-min bouts of 12 different randomly assigned activities performed in one continuous routine, after an initial 5-min rest period, and included walking, jogging, cycling, rowing,

simulated sports, and ADL (all 65 min were analyzed). EE was measured by indirect calorimetry using the Oxycon™ Mobile (OM) and predicted using the SWA (Version 7.0). Pearson correlations, paired t-tests, intraclass correlation coefficients (ICC) and Bland-Altman plots were used for the analysis.

**RESULTS:** EE from SWA and OM were moderately correlated for both SS and Non-SS routines ( $r = 0.75$  and  $0.63$  respectively,  $p < 0.01$ ). SWA overestimated total EE (TEE) compared to OM for SS ( $337 \pm 80$  kcal vs  $252 \pm 59$  kcal,  $p < 0.01$ ) and Non-SS ( $293 \pm 80$  kcal vs  $212 \pm 62$  kcal,  $p < 0.01$ ) routines. For TEE, Bland-Altman analysis showed wide limits of agreement for SS (85 kcal, 95% CI: -14 to 181 kcal) and Non-SS (86 kcal, 95% CI: -3 to 175 kcal) routines. In the SS routine, strong ICC values were observed for walking at 4 mph (0.95) and jogging at 5 mph (0.95), and moderate ICCs were observed for rest and walking at 2.0 and 2.5 mph (0.75 to 0.77). Lower ICCs were obtained for the remaining activities, ranging from 0.35 (cycling) to 0.58 (walking at 3 mph). ICCs for each activity in the Non-SS routine ranged from 0.21 (arm cranking) to 0.85 (jogging at 5.5 mph).

**CONCLUSIONS:** Our results indicate that the SWA overestimates EE across a variety of low- and moderate-intensity activities, but produces better estimates of EE during high-intensity activities.

Supported by NIH grant R01 HL091006

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2527 Board #202 MAY 31 3:30 PM - 5:00 PM

**Physical Activity Scale for Elderly (PASE): A Cross-validation study for Chinese Older Adults**

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(No relationships reported)

**PURPOSE:** To cross-validate PASE, a valid and reliable physical activity (PA) recall questionnaire, for the Chinese older adults.

**METHODS:** 66 (41 males & 25 females; aged  $70.0 \pm 7.1$ , Height =  $165.6 \pm 9.4$  cm, Weight =  $65.1 \pm 16.0$  kg, BMI =  $23.5 \pm 4.22$ ) Chinese older adults' 7-day energy expenditures (EE) were collected using Armband Pro 3. They were then asked to recall their PA using PASE before and after the Armband data collection. Total EE, average METs, steps, Measured EE, Measured Active EE by Armband Pro 3 were computed and compared with EE derived from PASE and test-retest reliability was computed also for PASE.

**RESULTS:** 77% of the subjects wore the armband for 24 hr. a day. The correlation between the Armband Measured Active EE and that reported by PASE is 0.58, which moderately supported the validity of PASE when applying it to the Chinese sample. The test-retest reliability coefficient of PASE is 0.87. In average, the Chinese older adults' daily PA are: Total EE =  $2088.92 \pm 539.86$  (METs), Average METs =  $1.62 \pm 0.35$ , Measured EE =  $1751.58 \pm 507.21$  METs, Measured Active EE  $502.52 \pm 288.26$  METs, according to the Armband.

**CONCLUSIONS:** PASE's validity and reliability was confirmed for the Chinese older adult sample and the Chinese older adults spent most of their time at low and light PA.

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2528 Board #203 MAY 31 3:30 PM - 5:00 PM

**Validation Of The Mywellness Key In Walking And Running Speed**

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(No relationships reported)

**PURPOSE:** This study was performed to assess the validity of the MyWellness Key (MWK) accelerometer during a treadmill-based protocol. The identification of different exercise intensities is imperative to objectively measure time spent at a specified exercise intensity.

**METHODS:** Thirty subjects (age =  $24.5 \pm 2.6$  years; body mass index =  $22.5 \pm 2.5$  kg·m<sup>-2</sup>) participated in a treadmill protocol using three different walking velocities (3, 4.5, and 6 km·h<sup>-1</sup>) and run (8 km·h<sup>-1</sup>) while outfitted with a MWK. Exercise intensity was measured by indirect calorimetry (ICVO2).

**RESULTS:** The relationship between exercise intensity predicted from MWK (MWKVO2) and oxygen consumption (VO2), yielded a high and significant correlation ( $r = 0.944$ ;  $P < .001$ ) with standard error of estimate =  $2.42$  ml·kg<sup>-1</sup>·min<sup>-1</sup>. The average differences between the two methods (MWKVO2-ICVO2) were  $-0.79$  (-8.0%),  $-0.02$  (-0.02%),  $0.51$  (3.26%) and  $-0.74$  (-2.7%) ml·kg<sup>-1</sup>·min<sup>-1</sup> at 3, 4.5, 6, and 8 km·h<sup>-1</sup> respectively. Only the 3 km·h<sup>-1</sup> speed showed a difference when compared to the criterion measure ( $p < .001$ ). Bland and Altman analysis revealed less than a 1 MET difference in the mean at each point estimate and relatively tight distribution with the standard errors, especially with the 2 moderate walking speeds.

**CONCLUSIONS:** We found a high correlation between oxygen utilization and the MWK with low standard errors estimates. This indicates that this accelerometer can be used to accurately identify exercise intensities that are related to walking and running.

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2529 Board #204 MAY 31 3:30 PM - 5:00 PM

**Validating GPS Data With The PALMS System To Detect Different Active Transportation Modes**

Jacqueline Kerr, Gregory Norman, Suneeta Godbole, Frederick Raab, Barry Demchak, Kevin Patrick. UCSD, San Diego, CA.

(No relationships reported)

Active transportation e.g. walking and cycling can contribute to overall physical activity levels. Travel diaries are often used to measure active transportation but are prone to self-report bias and individuals often round travel times to the nearest 5 minutes causing error. Hip worn accelerometers do not provide information on travel mode and do not detect cycling behavior. GPS devices that record speed of travel may improve assessment of active transportation. While GPS devices have become cheaper, smaller and more accurate, methods to process the data are not widely available.

**PURPOSE:** To test the validity of web-based GPS processing software to detect transportation mode.

**METHODS:** A total of 714 protocolized travel trips were made by trained researchers. They carried 2 GPS models set to collect data every 30 seconds. Trips across four transportation modes (bus, car, walk, cycle) were made in open space locations or downtown corridors (with more signal interference from buildings) with either continuous transitions across modes or with planned pauses. Start and end times of the journeys were noted to provide an annotated "truth" file to match to the processed GPS data. The GPS data were processed in the Personal Activity Location Measurement Software (PALMS). Sensitivity and specificity were tested and algorithm classification was considered correct if transportation mode was correct for 85% of the trip.

**RESULTS:** There were no significant differences by device model. Across conditions sensitivity ranged from .38-.64 and specificity ranged from .44-.59. Under the best conditions (i.e., pause between trips, open space location) sensitivity ranged from .73-1.0 and specificity ranged from .12-.25 for both device models.

**CONCLUSIONS:** Validation studies using field based trials of naturally occurring travel modes have not been reported before. Validation studies to date have not tested different conditions for algorithm specificity and sensitivity. Under optimal conditions the algorithm demonstrated good sensitivity but poor specificity, suggesting that further algorithm refinement is needed to improve accuracy of transportation classification. Our validation and processing protocols are available for researchers to use to test the conditions under which GPS may function best in their region.

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2530 Board #205 MAY 31 3:30 PM - 5:00 PM

**Validity of the Bouchard Activity Record in Free-Living Older Adults**

Nora E. Miller<sup>1</sup>, Ann M. Swartz<sup>1</sup>, Teresa L. Hart<sup>2</sup>, John M. Hawkins, Jr.<sup>1</sup>, Scott J. Strath<sup>1</sup>. <sup>1</sup>University of Wisconsin - Milwaukee, Milwaukee, WI. <sup>2</sup>Arizona State University, Phoenix, AZ.

(No relationships reported)

Current literature supports a growing interest in identifying accurate and feasible assessment tools of sedentary and physical activity (PA) behaviors in older adults. The Bouchard Activity Record (BAR) represents a self-report PA assessment tool that could practically and feasibly be employed in field-based studies. To date, limited evidence exists on the validity of the BAR within older adults.

**PURPOSE:** To assess the validity of the BAR against accelerometry in an older adult population in a free-living environment.

**METHODS:** Forty-nine healthy participants (33 females,  $65.6 \pm 7.8$  yrs,  $25.6 \pm 4.3$  kg/m<sup>2</sup>; 16 males,  $68.6 \pm 8.1$  yrs,  $26.7 \pm 3.0$  kg/m<sup>2</sup>) completed a 1-day BAR while wearing the

activPAL™ (Glasgow, Scotland, UK) affixed to the right anterior thigh. For comparison purposes, the nine PA intensity categories from BAR were collapsed into three sedentary/activity categories (categories one & two=sedentary time; three=standing time; four-nine=walking time), and total time (hrs) spent in each category was calculated. Spearman's rho correlation coefficients and Wilcoxon signed rank tests were conducted to compare total sedentary, standing, and walking time between BAR and activPAL™.

**RESULTS:** Data from this study show that older adults self-reported 17.53 hours sedentary, 3.18 hours standing, and 3.27 hours walking on the BAR, compared with 17.28 hours, 3.94 hours, and 2.70 hours, recorded via activPAL™, for sedentary, standing, and walking respectively. Significant and moderately strong correlations were found between BAR and activPAL™ for time spent in sedentary ( $r=0.44$ ,  $p=0.002$ ) and walking ( $r=0.50$ ,  $p<0.001$ ) behavior. There were no significant mean differences reported between BAR and activPAL™ for time spent in sedentary, standing, or walking behaviors.

**CONCLUSION:** The BAR and activPAL™ provide similar results for sedentary behavior and PA time in this older adult sample with reported sedentary, standing, and walking time differing from objective measurement by 1%, 19%, and 21%, respectively over a 24-hour period of time. The BAR, therefore, represents a viable pen-and-paper option for those interested in assessing sedentary behavior and PA profiles in an older adult free-living population.

This work was supported by funding sources K01-AG025962 and UWM Research Growth Initiative.

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**2531 Board #206 MAY 31 3:30 PM - 5:00 PM**  
**Accuracy Of The Fitbit Pedometer For Self-paced And Prescribed Physical Activity**

Ernesto R. Ramirez, Carlyn Peterson, Wanmin Wu, Gregory J. Norman. *University Of California, San Diego, La Jolla, CA.* (Sponsor: Jeanne Nichols, FACSM)  
(No relationships reported)

**PURPOSE:** The purpose of this study was to examine the validity of the FitBit pedometer (FB; FitBit Inc.) for measuring steps taken during self-paced and prescribed physical activity.

**METHODS:** A total of 17 adults (8 males, 9 females; age = 41.19, BMI = 28.82 kg/m<sup>2</sup>) participated in this study. Participants completed four to eight bouts of physical activities in a laboratory condition and in a simulated free-living condition. During the laboratory (treadmill) condition participants completed walking bouts at a slow pace (1.5 mph), a normal pace (3.0 mph), a brisk pace (4.0 mph) and one jogging bout (5.5 mph). Each bout lasted three minutes. Participants then completed 400m self-paced walking bouts at slow, normal, and brisk paces as well as one 400m jog on an outdoor track. Male participants wore one FB and one Omron HJ-720IT (OM) on the right hip attached to an elastic belt and one FB in the right front pocket. Female participants wore the devices in the same configuration but also wore an additional FB attached to the front/center of the sports bra. Absolute and percent differences were calculated for FB vs. directly observed (DO) steps. Linear mixed models were determined effects of body location, speed, condition (laboratory vs. free-living) on FB accuracy.

**RESULTS:** The magnitude of the difference between DO and the FB devices (M(SD); range) across all activities was small for both the FB-waist (2.0%(4.7%); -6 - 23%) and FB-br (0.8%(4.3%); -11 - 15%) and moderate for the FB-pocket (8.8%(16.8%); 4 - 74%). Model parameter estimates from the full factorial mixed-model indicated the FB under estimated by 24 (SE = 2.83) steps across all conditions compared to direct observation. Significant parameter estimates for body location, speed and the body location x speed interaction (all  $p < .001$ ) indicated that the FB in the pocket underestimated steps more than on the waist, both devices underestimated steps more as speed increased, and the magnitude of the underestimation increased more for the pocket compared to the waist as speed increased.

**CONCLUSIONS:** The FB appears to be a valid device for assessing step counts in adults when worn on the waist. Caution should be taken when assessing activities at higher ambulatory speeds. Further research is needed to better understand the validity of the FB in free-living conditions.

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**2532 Board #207 MAY 31 3:30 PM - 5:00 PM**  
**Determinants of Variance in Habitual Total and Moderate-to-Vigorous Physical Activity in Overweight Adults**

David Paul<sup>1</sup>, Matthew Kramer<sup>2</sup>, William Rumpel<sup>2</sup>, Kim Stote<sup>2</sup>, Beverly Clevidence<sup>2</sup>, G. Keith Harris<sup>2</sup>, David Baer<sup>2</sup>. <sup>1</sup>University of Idaho, Moscow, ID. <sup>2</sup>US Department of Agriculture, Beltsville, MD. (Sponsor: Justin Moore, FACSM)  
(No relationships reported)

**PURPOSE:** To determine the number of days of data and number of subjects necessary to accurately represent habitual total physical activity (TPA) and moderate-to-vigorous physical activity (MVPA).

**METHODS:** Seventy-one women and men wore accelerometers for seven day intervals, one week-on and one-week off, for 6 consecutive months. Daily counts were log transformed before analysis in a mixed model.

**RESULTS:** TPA was 195.2±63.1 counts/min/day, while subjects averaged 27.1±16.4 minutes of MVPA per day. Day of week effects were present (Sundays lower than the other days), but no monthly effects were found. Percent body fat was inversely related to log counts for both TPA and MVPA; women had significantly higher log counts for TPA, but not MVPA; and age was not a significant factor. The principle source of subject related variation (after accounting for fixed effects) in TPA was within-subject (day-to-day) (57.2%); the other two components were between-subject (33.3%) and week-to-week (9.4%). Based on within-subject variances, only 5 days of data are required to represent habitual TPA, with coefficients of variation (CV) of 5%. Similar percentages were obtained for MVPA: 57.0%, 35.0%, and 7.9%. Estimates of habitual

MVPA were twice as variable (based on CVs): therefore 8 and 30 days of data are necessary to represent habitual MVPA, with resulting CVs of 10 and 5%, respectively. Based on between-subject variances, to detect a 10% difference between two groups at a power of 85% requires approximately 125 and 450 subjects per group for TPA and MVPA, respectively.

**CONCLUSIONS:** TPA and MVPA counts are influenced by factors

such as day of the week, body composition, and gender. Estimates of MVPA are more variable than TPA in free-living adults, therefore more days of data are required to estimate habitual physical activity. The large variances translate into requiring large sample sizes to detect treatment differences, as measured by TPA and MVPA counts.

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**2533 Board #208 MAY 31 3:30 PM - 5:00 PM**  
**Mass Media Campaigns: Outcomes Vary by Degree to Which Self-Reported Measures Assess Weekly Physical Activity**

David R. Brown, FACSM, Jesus Soares, Jacqueline Epping, Tina Lankford. *Centers for Disease Control and Prevention, Atlanta, GA.*  
(No relationships reported)

The Task Force on Community Preventive Services concluded that there is insufficient evidence to determine the effectiveness of stand alone mass media campaigns to increase physical activity (PA) at the population level. Findings were based on self-reported PA and varied in consistency and magnitude.

**PURPOSE:** Determine if self-report measures of PA used in stand alone mass media studies that provide an estimate of the weekly volume of physical activity (wVPA), i.e., frequency [F], intensity [I], and duration [D], lead to greater magnitude of PA behavior change compared to measures that do not provide indepth estimates of the wVPA.

**METHODS:** Relying on a qualitative assessment of self-report measures in 13 mass media studies, 2 authors independently ranked the measures high, medium, or low based on each measures ability to estimate wVPA. Measures asking respondents to report their F, I, and D of weekly activity were ranked high. Measures that obtained information on 2 of the 3 indicators of wVPA were rated medium. Measures based on a single item (more active? yes or no) or on 1 indicator were ranked low. Differences between rankings of the 2 raters were discussed until agreement was obtained. A Kappa coefficient was calculated to determine interrater agreement of the raters' initial assessments. The median relative % change in PA outcomes by rankings of the measures were calculated.

**RESULTS:** The Kappa coefficient among the 2 raters was 0.77 (adequate agreement). Studies (n=5) possessing high potential to provide information about wVPA resulted in a median relative increase in PA of 3.1% (interquartile range = -31.2%, 56.5%), studies (n=2) having medium potential to yield information about respondents' wVPA lead to a median relative increase in PA of 1.4% (interquartile range = -1.6%, 4.4%), and studies (n=6) having low potential to yield information about respondents' wVPA resulted in a median relative increase in PA of 12.2% (interquartile range = 5.4%, 18.2%).

**CONCLUSION:** Numerous factors may have influenced outcomes in the stand alone mass media studies reviewed. Our findings highlight just one of these factors and reinforces the need to consider PA measurement in the evaluation of community- or population- based interventions.

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2534 Board #209 MAY 31 3:30 PM - 5:00 PM

**Agreement of a Repeated Primary Care Physical Activity Measure with Accelerometry**

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(No relationships reported)

Repeatability has not been estimated simultaneously with agreement in self-report physical activity (PA) methods comparison studies.

**PURPOSE:** To apply the Bland-Altman limits of agreement method (LoA) to repeated measures (RM) of a self-report PA measure designed for primary care.

**METHODS:** 45 clinic staff wore an accelerometer (accel) for 7 days and then self-reported days they acquired  $\geq 30$  bout-mins of moderate to vigorous PA (MVPA). 11 of these 45 staff repeated this procedure 18 months later. Both accel-PA and self-report PA were recorded as number of days with  $\geq 30$  mins MVPA. The LoA method was applied by estimating the mean difference of days with  $\geq 30$  mins MVPA between measures, and the standard deviation (SD) of differences about the mean, i.e. 95% LoA. 95% LoA were estimated by within and between-subject variances from ANOVA, with the subject as the factor. A 95% repeatability coefficient for each method was estimated by  $1.96\sqrt{2}$  within-subject SD between RM.

**RESULTS:** Staff ( $38.3 \pm 9.6$  yr) were mostly female (91%) and Caucasian. The self-report PA measure overestimated days  $\geq 30$  mins MVPA by a mean of 1.86 days. 95% of the differences in days  $\geq 30$  mins MVPA between RM of accel-PA and self-report PA were between -1.22 and 4.95 days (see Figure). The repeatability coefficient of the self-report PA was 71% greater than the coefficient of accel-PA.

**CONCLUSIONS:** Agreement of self-report PA with a criterion PA measure is most useful when self-report PA also agrees with itself - that is, it's repeatable. This small sample had poor agreement with one repeated measure of self-report PA, with 95% LoA between -1.22 and 4.95 days.

Funded in part by DHHS Office on Women's Health (ASTWH070006-01-00); University of Utah Department of Family and Preventive Medicine.

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2535 Board #210 MAY 31 3:30 PM - 5:00 PM

**The Influence of Body Mass Index on Physical Activity Level and Recall Accuracy**

Katrina D. DuBose, FACSM, Brooke Graves, Thomas D. Raedeke, Lucas Carr, Lesley Lutes. East Carolina University, Greenville, NC.  
(No relationships reported)

**PURPOSE:** To evaluate whether normal weight and overweight/obese college students differ on physical activity level and self-reported physical activity recall accuracy.

**METHODS:** On day one, 52 college students ( $18.7 \pm 0.85$  years) had height and weight measured and received an ActiGraph GT1M accelerometer to wear for 7 consecutive days. After wearing the GT1M, participants completed self-report physical activity questions on the Behavior Risk Factor Surveillance Survey (BRFSS) and the International Physical Activity Questionnaire (IPAQ). Body mass index (BMI) was classified as either normal weight  $<25.0$  kg/m<sup>2</sup> ( $n=30$ ;  $21.08 \pm 2.01$  kg/m<sup>2</sup>) or overweight/obese:  $\geq 25.0$  kg/m<sup>2</sup> ( $n=22$ ;  $29.57 \pm 4.76$  kg/m<sup>2</sup>). Recall accuracy was calculated by self-reported minutes in moderate and vigorous physical activity minus minutes in moderate and vigorous physical activity measured by the GT1M. Independent *t*-tests compared the time spent in moderate and vigorous physical activity on the BRFSS, IPAQ, and GT1M by BMI group. The independent *t*-tests compared differences between the BMI groups and the level of recall accuracy on the BRFSS and IPAQ questionnaires for moderate and vigorous physical activity.

**RESULTS:** No significant differences were found between normal and overweight/obese participants on the average minutes per day spent in moderate and vigorous physical activity based on the BRFSS, IPAQ, and ActiGraph GT1M ( $p>.05$ ). Recall accuracy was similar between the normal weight and overweight/obese groups on the BRFSS (Moderate: normal= $104.29 \pm 116.9$  min/d, overweight/obese= $88.56 \pm 106.96$  min/d; Vigorous: normal= $24.43 \pm 25.28$  min/d, overweight/obese= $44.28 \pm 47.33$  min/d) and IPAQ questionnaires (Moderate: normal= $108.14 \pm 139.26$  min/d, overweight/obese= $89.42 \pm 116.81$  min/d; Vigorous: normal= $34.15 \pm 40.08$  min/d, overweight/obese= $38.09 \pm 46.03$  min/d).

**CONCLUSIONS:** These results suggest that in college students physical activity levels and recall accuracy are similar regardless of BMI.

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2536 Board #211 MAY 31 3:30 PM - 5:00 PM

**Validity Of Actigraphs Uniaxial And Triaxial Accelerometers For Assessment Of Physical Activity In Adults**

Duncan GE McMillan, Alexandra Alexandra, Morgan Fippinger, Gunnar Fillerup, Louise A. Kelly. California Lutheran University, Thousand Oaks, CA.  
(No relationships reported)

**PURPOSE:** To assess the validity of the uniaxial GT1M and the triaxial GT3X Actigraph accelerometers against oxygen consumption

**METHODS:** Thirty-four participants aged 18 to 30 years performed three 6-minute bouts of exercise on a treadmill at 4.8, 6.4, and 9.7 km.h-1. Oxygen consumption was measured minute-by-minute using a metabolic system.

**RESULTS:** The GT3X had significant higher counts at all speeds as compared with the GT1M accelerometer ( $p<0.001$ ). Mean error for the GT1M at 4.8 km.h-1 was +2862 cpm (limits of agreement +1897 to +3828), at 6.4 km.h-1 was +4852 cpm (limits of agreement +3616 to +6088), and at 9.7 km.h-1 was +9369 cpm (limits of agreement +6589 to +12148). Whereas, mean error for the GT3X at 4.8 km.h-1 was +5716 cpm (limits of agreement +3589 to +7843), at 6.4 km.h-1 was +13142 cpm (limits of agreement +8329 to +17954), and at 9.7 km.h-1 was +8580 cpm (limits of agreement +5846 to +11314).

**CONCLUSIONS:** These data suggest that the uniaxial GT1M and the triaxial GT3X Actigraph accelerometers are valid tools for measuring treadmill walking and jogging.

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2537 Board #212 MAY 31 3:30 PM - 5:00 PM

**Distributional Characteristics of Athletic Performance**

Andrew C. Cornett<sup>1</sup>, Joel M. Stager<sup>2</sup>, Karen Kafadar<sup>2</sup>. <sup>1</sup>Eastern Michigan University, Ypsilanti, MI. <sup>2</sup>Indiana University, Bloomington, IN.  
(No relationships reported)

**INTRODUCTION:** It is difficult to characterize the distribution shape for an athletic performance variable, due largely to unavailable data. On the rare occasions when an adequate data set is available, discussion typically focuses on measures of location and dispersion and ignores skewness of the data and elongation (or heaviness) of the tails.

**PURPOSE:** This study characterizes the skewness and elongation parameters for an athletic performance variable (swim times) and assesses the effects of age and sex on these distribution parameters.

**METHODS:** Data for this project was provided by USA Swimming (USAS) and consisted of the best 50-yard Freestyle performance for all USAS registered male and female swimmers from 6-19 years of age that competed in the event from 2005-2010 ( $N = 1,193,362$ ). First, the distribution skewness and elongation parameters were assessed using methods previously described (Hoaglin, 2006). Then, MANOVA was conducted to test for differences in the parameters for age, sex, and competition year.

**RESULTS:** MANOVA revealed a highly significant effect of age on both the skewness and elongation parameters ( $V = 1.59$ ,  $F(26, 130) = 19.27$ ,  $p < .001$ ), a result that was confirmed by separate univariate ANOVAs. There was significantly greater positive skew (0.44-0.49) for the middle ages (9-15 years) as compared to the skewness (0.37-0.42) for the youngest and oldest ages (6-7 and 16-18 years). The elongation parameter was positively correlated with age with the smallest value (-0.02) occurring for 6 year old swimmers and the greatest values (0.10-0.11) occurring for the oldest swimmers (17-19 years).

**CONCLUSIONS:** Positive skewness was confirmed for all combinations of age, sex, and competition year. The degree of skewness appears to be influenced by the number of swimmers of a given age. The positive correlation between age and elongation is a novel finding. Whether or not a similar relationship exists for variables such as height and muscle mass is unclear and could aid in a better understanding of the elongation parameter for this particular athletic performance variable.

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2538 Board #213 MAY 31 3:30 PM - 5:00 PM

**Estimation Of Energy Expenditure Using Heart Rate And Triaxial Accelerometry In Overweight And Obese Adults**

Christopher C. Howe, Chris Easton. *Kingston University, Kingston upon Thames, United Kingdom.* (Sponsor: Dr Yannis Pitsiladis, FACSM)  
(No relationships reported)

To date, no study has examined the validity of the Actitrainer tri-axial accelerometer (AT) (Actigraph, Florida, USA) in combination with heart rate (HR) for prediction of energy expenditure (EE) during walking in overweight and obese adults.

**PURPOSE:** To examine the validity of existing regression equations (Freedson and vector magnitude equations (VM)) based on accelerometer counts (AC) from the AT for predicting EE in overweight and obese adults during treadmill and outdoor walking. Further, to examine whether novel gender-specific equations combining AC, HR and body mass (BM) can enhance the accuracy of the EE prediction.

**METHODS:** Twenty overweight or obese adults (eight males and twelve females, age  $43 \pm 11$  years, BMI  $30.5 \pm 4.9$  kg/m<sup>2</sup>) completed a 30 min incremental walking protocol on a treadmill in a laboratory setting (4-6.5 km·h<sup>-1</sup>). VO<sub>2</sub> and VCO<sub>2</sub> were measured throughout via breath-by-breath indirect calorimetry (IC) and EE for each stage was calculated using the Weir equation. AC and HR were continuously measured using the AT and Polar HR monitor. Novel gender-specific EE prediction equations were generated by multiple linear regression using AC, HR and BM. In a separate study, ten overweight and obese adults (five males and five females, age  $44 \pm 13$  years, BMI  $30.4 \pm 4.0$  kg/m<sup>2</sup>) conducted a self-paced three kilometre external walk during which EE, AC and HR were measured as before. EE was estimated using existing and novel prediction equations for both treadmill and external walks and compared to IC.

**RESULTS:** The Freedson equation overestimated EE ( $7.9 \pm 1.3$  kcal·min<sup>-1</sup> vs. IC:  $5.5 \pm 1.1$  kcal·min<sup>-1</sup>,  $P < 0.01$ ) during treadmill walking as did the VM equation ( $7.1 \pm 1.1$  kcal·min<sup>-1</sup>,  $P < 0.01$ ). There was no difference between EE estimated using the novel gender specific prediction equations and EE measured by IC during either treadmill ( $P = 0.993$ , standard error of estimate (SEE)  $0.17$  kcal·min<sup>-1</sup>) or outdoor walking ( $P = 0.114$ , SEE  $0.77$  kcal·min<sup>-1</sup>).

**CONCLUSIONS:** The Freedson and VM equation significantly overestimated EE in overweight and obese adults during walking exercise. However, novel gender specific prediction equations based on VM, HR and BM appear to provide valid estimations of EE in this population during both treadmill and self-paced external walking.

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2539 Board #214 MAY 31 3:30 PM - 5:00 PM

**Physical Activity Pattern Complexity Reveals Associations between Pattern, Health and Socio-Demographic Determinants**

Oleksii Mandrychenko, Malcolm Howard Granat, Sebastien François Martin Chastin. *Glasgow Caledonian University, Glasgow, United Kingdom.*

(O. Mandrychenko: Salary; PhD research scholarship provided by the Glasgow Research Partnership in Engineering, Scottish Overseas Research Student Award Scheme.)

**PURPOSE:** Free-living physical activity is comprised of complex patterns of activity periods and sedentary behaviour. Recent studies have suggested that these patterns have an impact on health. Currently, there is no methodology available that can robustly quantify the patterns of physical activity. However, complexity theory provides an analytical framework to develop such a measure. The aim of this study was to investigate the relationship between the complexity of patterns of physical activity, health and socio-demographics (such as complexity of patterns and BMI, age, gender, socioeconomic deprivation, and occupation).

**METHODS:** Data was obtained from 120 adults who wore a physical activity monitor for 5 to 7 continuous days. The complexity of patterns of physical activity was quantified using a robust method based on GZIP compression. Regression models were developed to investigate the relationship between common physical activity determinants and the complexity of the patterns.

**RESULTS:** The regression model for the complexity of patterns of physical activity adjusted for the volume of physical activity was significant ( $p < .001$ ). The model explained 52% of the variance in the dataset. All regression coefficients were significant: BMI ( $p < .001$ ), age ( $p = .004$ ), socioeconomic deprivation ( $p = .043$ ), occupation ( $p = .002$ ), interaction of socioeconomic deprivation and occupation ( $p = .002$ ), interaction of gender and occupation ( $p = .017$ ).

**CONCLUSIONS:** Complexity of patterns of physical activity reveals that only 50% of the variance in physical activity can be explained. The complexity has a clear association with the determinants of physical activity independently of the amount of physical activity. Quantifying complexity of the pattern provides important added information to inform the design, and monitor the impact of interventions.

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**D-29 Free Communication/Poster - Physical Activity in Youth**

MAY 31, 2012 1:00 PM - 6:00 PM

ROOM: Exhibit Hall

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2540 Board #215 MAY 31 3:30 PM - 5:00 PM

**Role Of The Playground Environment On Levels Of Physical Activity In Elementary School Children**

Heidi J. Nace<sup>1</sup>, Christine A. Schaefer<sup>1</sup>, Eve M. Kutchman<sup>2</sup>, Claudio R. Nigg<sup>3</sup>, Lois A. Brink<sup>2</sup>, James O. Hill<sup>2</sup>, Raymond C. Browning, FACSM<sup>1</sup>. <sup>1</sup>Colorado State University, Fort Collins, CO. <sup>2</sup>University of Colorado Denver, Denver, CO. <sup>3</sup>University of Hawaii at Manoa, Honolulu, HI.

(No relationships reported)

The school environment offers opportunities for children to be active, particularly during recess. Yet the influence of the playground on levels of daily physical activity (PA) has not been well described.

**PURPOSE:** To determine the role of renovated (Learning Landscapes, LL) vs. non-renovated playgrounds on levels of recess, school day and after school PA in elementary school children. Data collected serve as baseline for the Intervention of Physical Activity in Youth (IPLAY) Study.

**METHODS:** We measured 5-6 days of free-living PA via wrist-mounted Actical accelerometers in 277 low socioeconomic status elementary school children in metropolitan Denver, CO. We applied age specific cutpoints to the data to determine minutes and percent time spent in moderate-vigorous PA (MVPA). Univariate ANOVA was conducted to determine between-subject effects of weight status, presence of LL and sex on recess, school day, after school (end of school day-5PM) PA, and likelihood of meeting the PA guideline.

**RESULTS:** During recess (see figure) and the school day, but not after school, children in LL accumulated more PA than their non-LL counterparts (school day mins MVPA: 35.7 (LL) vs. 25.5 (non-LL)). Boys were significantly more active than girls at all time points. Normal weight children were more active than overweight children over the course of the school day. Children in LL were no more likely than their non-LL counterparts to meet the guideline for daily MVPA.

**CONCLUSIONS:** In LL schools, normal weight girls and all boys participate in greater levels of recess PA compared to non-LL. However, overweight girls' levels of PA are not different between playground conditions, signifying the need for additional approaches to encourage them to be more active.

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2541 Board #216 MAY 31 3:30 PM - 5:00 PM

**Objectively Measured Physical Activity, Sedentary Behavior and Academic Performance in Finnish School-Aged Children**

Heidi Syväoja<sup>1</sup>, Marko Kantomaa<sup>2</sup>, Timo Ahonen<sup>3</sup>, Tuija Tammelin<sup>1</sup>. <sup>1</sup>LJKES- Research Center for Sport and Health Sciences, Jyväskylä, Finland. <sup>2</sup>Imperial College London, London, United Kingdom. <sup>3</sup>University of Jyväskylä, Jyväskylä, Finland.

(No relationships reported)

**PURPOSE:** To provide basic data of objectively measured physical activity and sedentary behavior of Finnish school-aged children, and determine the relationships between objectively and subjectively measured physical activity and sedentary behavior and academic performance.

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**METHODS:** 278 children from five schools in the Jyväskylä school district in Finland (59% of the 475 eligible students; their mean age was 12.2 years; 55% were girls) participated in the study in the spring of 2011. Self-reported physical activity and screen time were evaluated by questions used in the WHO Health Behavior in School-aged Children (HBSC) study. Children's physical activity and sedentary time were measured objectively by using an ActiGraph GT1M/ GT3X accelerometer for seven consecutive days. A cut-off value of 2,000 counts per minute was used for moderate to vigorous physical activity (MVPA) and 100 counts per minute for sedentary time. Schools' grade averages were provided by the education services of the city of Jyväskylä. Cross-tabling and the analysis of variance were used to analyze the relationships between physical activity, sedentary behavior and academic performance.

**RESULTS:** Based on objective measurements, 59% of the children met the recommended level of 60 minutes of MVPA per day. Children were sedentary 59% of their waking hours. Children's self-reported screen time was 3.6 hours per day on average. Objectively measured physical activity ( $p=0.595$ ) and sedentary time ( $p=0.551$ ) were not associated with the schools' grade average. However, high levels of self-reported physical activity ( $p=0.001$ ) and low levels of self-reported screen time ( $p<0.001$ ) were associated with the high average of school grades.

**CONCLUSIONS:** The level of physical activity and sedentary behavior of Finnish school-aged children is comparable with that reported in international results. In this study, self-reported physical activity was directly, and screen time inversely, associated with academic performance. Objectively measured physical activity and sedentary time were not associated with academic performance. Objective and subjective measures may reflect different constructs and contexts of physical activity and sedentary behavior in association with academic outcomes.

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**2542** Board #217 MAY 31 3:30 PM - 5:00 PM

**Factors Associated With Children's Walking Or Biking To School**

Robin DeWeese, Punam Ohri-Vachaspati. *Arizona State University, Phoenix, AZ.*

*(No relationships reported)*

The percentage of trips youth made to and/or from school every day using active transport (e.g., walking or biking) declined from almost 50% of all trips in 1969, to approximately 13% of trips in 2009. The daily commute to and from school accounts for 22% of both total trips and time spent traveling by 5-18 year-olds. These facts, coupled with the nation's childhood obesity epidemic, led the 2010 White House Task Force on Childhood Obesity to recommend a goal of increasing by 50% active transport to school among 5-18 year-old youth.

**PURPOSE:** To determine the prevalence of and factors associated with walking or biking to school in four low-income urban communities with large Hispanic and black populations.

**METHODS:** A random digit-dial survey of 1400 households was conducted in 2009-10. Survey questions included information about active transport to school for one randomly selected child in the household, parental perceptions of the neighborhood physical environment, and household demographic characteristics. Objective data on neighborhood physical activity facilities was collected as well. Geographic location of households and physical activity facilities were geocoded to calculate proximity measures. Descriptive statistics and bivariate relationships were investigated using SPSS.

**RESULTS:** 39% percent of all children walked to school on a regular basis. Factors associated with walking to school included income level (45% of students  $\leq 200\%$  of poverty walked to school vs 32% of those at  $>200\%$  of poverty), presence of sidewalks (43% of children living in communities with sidewalks walked to school vs 18% living in communities with no sidewalks), and perceived neighborhood pleasantness (44% of children living in neighborhoods perceived as pleasant walked to school vs 33% living in unpleasant neighborhoods).

**CONCLUSION:** Physical environment plays a critical role in whether children use active transport such as walking or biking to get to school.

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**2543** Board #218 MAY 31 3:30 PM - 5:00 PM

**Correlates of Physical Fitness in Children. A Multilevel Analysis**

Thayse Natacha Q F Gomes<sup>1</sup>, Fernanda K. Santos<sup>2</sup>, Raquel N. Chaves<sup>2</sup>, Michele C. Souza<sup>2</sup>, Daniel Santos<sup>1</sup>, Rojapon Buranarugsa<sup>1</sup>, André Seabra<sup>1</sup>, Rui Garganta<sup>1</sup>, José A R Maia<sup>1</sup>. <sup>1</sup>CIF12D, Faculty of Sport, University of Porto, Porto, Portugal. <sup>2</sup>CAPEs Foundation, Ministry of Education of Brazil, Brasília – DF, Brazil and CIF12D, Faculty of Sport, University of Porto, Porto, Portugal.

*(No relationships reported)*

In the last decade, children physical fitness (PF) levels have declined. School conditions and/or environmental characteristics may be of great help in promoting increases in PF among children.

**PURPOSE:** To identify student- and school-level correlates responsible for inter-individual variability in PF levels of Portuguese children.

**METHODS:** PF levels and school characteristics were collected in 2801 children (aged 6 to 10 years) of both gender (1342 girls and 1460 boys) in 75 primary schools from North of Portugal. PF was assessed with Fitnessgram test battery, and physical activity with the Godin & Shephard questionnaire; body mass index (BMI) was also computed. School characteristic included socio-geographical localization (rural, urban and suburban area), frequency of physical education (PE) classes, professional qualification of PE teachers, and student participation in swimming classes. Results from each PF test were transformed in a z-score and then summed, creating an overall PF-score. Multilevel modeling was used to examine individual and school characteristics related to the overall PF-score. HLM 6.0 software was used in all analysis.

**RESULTS:** School-effects explain only 14% of the total variance of PF in children. Fitter children are more physically active ( $\beta=0.017$ ,  $p<0.05$ ) and older ( $\beta=0.708$ ,  $p<0.05$ ); and boys showed higher PF levels than girls ( $\beta=0.530$ ,  $p<0.05$ ); on the other hand, heavier children had a lower PF-score ( $\beta=-0.193$ ,  $p<0.05$ ). At the school-level, only school setting was related to children's PF-score, where rural children ( $\beta=0.626$ ,  $p<0.05$ ) were fitter than urban or suburban.

**CONCLUSIONS:** At the individual level, age, gender, physical activity, and BMI are relevant correlates of PF; at the school level the socio-geographical school localization was a significant predictor of PF levels among Portuguese children.

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**2544** Board #219 MAY 31 3:30 PM - 5:00 PM

**Assessing Physical Activity in Children - a Comparison: Parental Questionnaire versus Objective Measurement with Accelerometry**

Susanne Kobel, Sarah K. Kettner, Benjamin Koch, Jens Dreyhaupt, Nanette Fischbach, Rainer Mueche, Juergen M. Steinacker, FACSM. *Ulm University, Ulm, Germany.*

*(No relationships reported)*

Assessing physical activity (PA), especially in young children has become to play an important role but can be challenging. According to recent studies (e.g. Andersen et al, 2011), only a minority of children reach the current recommendations on health-enhancing PA. Many of these results are based on self-report questionnaires and parental accounts.

**PURPOSE:** This study therefore aims to compare an objective assessment method with a subjective one in order to gain a better understanding whether parental report data can be used to determine daily PA in children.

**METHODS:** PA was measured in 374 children (7.1 $\pm$ 0.7yrs; 50% male, 16.1 $\pm$ 2.4 BMI) over four consecutive days using accelerometry combined with heart rate (Actiheart; CamNtech, UK). Parents were asked to estimate the number of days a week their child is moderately to vigorously active (MVPA); so they would start sweating or breathing heavily and therefore equating to current guidelines) for a minimum of 60 minutes. Measured daily MVPA was defined as activity with a heart rate above 140bpm and compared with parental responses. Kendall's correlation coefficients are reported, based on the total measured and reported PA.

**RESULTS:** Over a period of four consecutive days, the children spent an average of 55 min ( $\pm 27.2$ ) at MVPA and 36.7% managed to achieve a mean of 60 min/day. 69.1% of parents reported 60 min/day of MVPA of their child on 0-3 days/week, 24.4% on 4-5 days/week and 6.5% on 6-7 days/week. No correlation was found between parental responses to the question if their child is physically active for at least 60 minutes daily and PA objectively measured by Actiheart. This non-existing correlation also applies for those children who reached the 60 minutes MVPA per day as well as for those whose parents categorise their children as active. No gender difference was found.

**CONCLUSION:** This study shows that in order to obtain reliable information about children's daily PA, parental estimation of PA in a structured questionnaire is not sufficient. Therefore, objective measurements such as accelerometry and heart rate are needed. However, it might be discussed whether more or more specific questions about PA would overcome this problem.

2545 Board #220 MAY 31 3:30 PM - 5:00 PM

**Impact of Physical Activity Breaks on Healthy Activity Children Policy (HSP-S-000) Adherence in Middle Schools**

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In North Carolina, a statewide policy mandates that schools provide at least 30 minutes of daily PA for children in grades K-8, over and above PE requirements (HSP-S-000). To assist middle schools with policy adherence we provided 16 middle schools in suburban NC with Instant Recess® (IR), which provides 10-minute classroom-based PA breaks, available on CD or DVD.

**PURPOSE:** This study evaluated the impact of IR in 16 middle schools in Winston-Salem Forsyth County Schools (WS/FCS).

**METHODS:** The WS/FCS Superintendent implemented a requirement for middle school students to engage in at least one IR break daily. Study staff trained middle school staff on IR use. School staff determined when IR would be implemented. IR videos were loaded on a central server that could be accessed through a networked computer in each classroom. Schools implemented IR for 8 weeks in Spring 2011. Students completed a pre-post online survey to assess health-related behaviors and attitudes toward IR. Teachers maintained a daily log of IR use. After 4 weeks, trained volunteers and study staff conducted direct classroom observations of IR, on/off task behavior of students, and teacher engagement. Teachers and students also provided qualitative feedback about IR.

**RESULTS:** Pre-post online surveys were completed by 1,553 middle school students (26.3% 6<sup>th</sup> graders, 37.4% 7<sup>th</sup> graders, and 35.4% 8<sup>th</sup> graders; 43% white, 25% black, and 32% other). Seventy-seven percent of students reported participating in an IR at any time during the evaluation period and 56% of students reported doing IR daily. Most students (73%) reported that they did IR first thing in the morning. Students participated in 8.0±3.4 IR minutes per classroom (n=75 classrooms), of which 3.9±3.0 minutes were spent in moderate to vigorous-intensity PA (MVPA). There was a significant association between teacher engagement ( $p = 0.03$ ), teacher activity level ( $p < 0.0001$ ), and student IR MVPA minutes. Students indicated that they would prefer alternative types of activities and to have activity breaks at different times during the school day.

**CONCLUSION:** Policies for daily activity breaks can facilitate increased school day PA. Student and staff input is critical when developing and implementing policies and programs to increase school day PA. Further research is needed to confirm these findings.

2546 Board #221 MAY 31 3:30 PM - 5:00 PM

**Back Tracking Of Growth, Motor Coordination And Physical Fitness Of Primary School Children**

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Gross motor coordination (GMC) and physical fitness (PF) are related, in part, to growth status during childhood. GMC and PF influence physical activity (PA) and can also be influenced by PA.

**PURPOSE:** to describe antecedents of growth, GMC, PA and health- and performance-related PF of children at 6 years of age relative to level of PA at 10 years of age.

**METHODS:** 285 primary school children (142 girls, 143 boys) from the Azores islands, Portugal, were measured annually (in the Fall) from 6 to 10 years. PA was assessed with personal interview using the Godin and Shephard questionnaire. Tertiles for PA (sedentary, moderate, very active) at 10 years of age were calculated. Then, growth status, health and performance-related PF (Fitnessgram and AAHPERD) and GMC of the children in each tertile at 10 years were tracked back to 6 years of age. ANOVA models were computed with SPSS 18.

**RESULTS:** Sedentary and high active girls at 10 years of age differed in GMC ( $F=4.23$ ,  $p=0.016$ ) and had poorer performances in the curl-up ( $F=3.57$ ,  $p=0.028$ ), push-up ( $F=1.14$ ,  $p<0.001$ ) and 50 yard dash ( $F=9.40$ ,  $p<0.001$ ) at 6 years; sedentary girls had poorer scores on all variables. Sedentary and moderately active girls at 10 years differed only in 50 yard dash test ( $F=9.40$ ,  $p=0.003$ ) at 6 years, while moderately and very active girls at 10 years differed only in push up test ( $F=1.14$ ,  $p<0.001$ ) at 6 years. Sedentary boys at 10 years of age had a higher fatness ( $F=3.28$ ,  $p=0.038$ ) and lower GMC ( $F=3.35$ ,  $p=0.035$ ) and did not perform as well in push-ups ( $F=3.44$ ,  $p<0.001$ ) compared to high active boys at 6 years. Sedentary and moderately active boys, and moderately and very active boys at 10 years differed only in push-ups ( $F=3.44$ ,  $p<0.001$  and  $F=3.44$ ,  $p<0.001$ , respectively) at 6 years.

**CONCLUSIONS:** Children with high level of PA at 10 years tended to have a better profile of GMC and health and performance-related PF at 6 years of age compared to those with low PA. The findings highlight a need to incorporate GMC into PA intervention programs.

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2547 Board #222 MAY 31 3:30 PM - 5:00 PM

**Physical Activity And Clustered Metabolic Risk Score In Young Children: A Cross-sectional Study (the Idefics Study)**

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The relevance of physical activity (PA) as the main therapeutic tool for combating cardiovascular risk and metabolic syndrome in children has been highlighted.

**PURPOSE:** To study the association between objectively measured PA intensities and clustered metabolic risk score (MRS) in a large sample of European children aged 2<10 years.

**METHODS:** We conducted a cross sectional study (the IDEFICS) which comprised 5548 children (2863 boys; 2<10 years) from eight European countries with complete measurements. Triglycerides, total cholesterol (TC), high-density lipoprotein cholesterol (HDL-c), glucose, insulin, systolic blood pressure, sum of two skinfold thickness and cardiorespiratory fitness were measured. The ratio TC/HDL-c and the homeostasis model assessment were calculated. Z-scores were calculated for each risk factor variable by age group and sex, and then all individual Z-scores were summed to create a continuous score clustering metabolic risk factors. Since cardiorespiratory fitness was only available in children older than 6 years old, a second clustered metabolic risk score was obtained only for older children. Physical activity (PA) was assessed by accelerometry and minutes spent at the follow intensities were calculated; low PA, moderate PA, vigorous PA and average physical PA.

**RESULTS:** In pre-school boys (2<6 yrs), the odds ratio for having high MRS in the least active quintile compared with the most active quintile of average PA was 2.79 (1.23 - 6.32). Odds ratios, in pre-school girls, compared with the most active quintile were raised in the second and least active quintiles for vigorous PA (4.55 and 5.34, respectively) and in the second quintile for moderate PA (2.87). The logistic regression analysis were repeated for the MRS including cardiorespiratory fitness only available for older children (6 < 10 yrs), and the results show that the strongest associations were found with moderate PA, where the least active quintiles had an odds ratios of MRS around 5 compared with the most active quintile in both sexes.

**CONCLUSIONS:** Our results suggest that those children who are less active have a higher risk score compared to those who are in the highest quintile of PA in both sexes aged from 2 to 10 years. Special focus on moderate and vigorous PA and to start at earlier age (2 yrs) should be provided.

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2548 Board #223 MAY 31 3:30 PM - 5:00 PM

**Factors Associated with Physical Activity in Children Attending Family Child Care Homes**

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(No relationships reported)

Family Child Care Homes (FCCHs) are among the largest providers of non-relative care for young children in the U.S. However, little is known about physical activity (PA) levels of children attending FCCHs. The available, limited evidence suggests these children spend most of their time engaging in sedentary behavior, and the factors which influence children's PA in this setting are unknown.

**PURPOSE:** To determine the relationship between FCCH characteristics and practices and objectively measured PA in 2- to 5-year old children attending FCCHs.

**METHODS:** FCCH practices and characteristics were assessed in 45 FCCHs using the Nutrition and Physical Activity Self-Assessment for Child Care Instrument (NAP SACC-SA). Within the 45 FCCHs, 136 children (ages 2 to 5 yrs) wore an accelerometer during childcare attendance over one-week. Time spent in light, moderate, and vigorous PA per hour was calculated using intensity-related cut-points. For each NAPSACC-SA item, FCCHs were divided into two groups: Promoting PA (PPA) or not promoting PA (Non-PPA). Mixed model analysis of variance was used to evaluate differences in total activity between groups. Models included FCCH as a random effect to control for the clustering of children within FCCHs. Age, sex, and BMI z-score were included as child-level covariates.

**RESULTS:** FCCH characteristics and practices associated with higher levels of PA (min/hr;  $p < 0.05$ ) included provision of sufficient outdoor active play ( $32.2 \pm 1.0$  vs.  $28.6 \pm 1.3$ ), active play using portable play equipment ( $31.7 \pm 1.0$  vs.  $29.3 \pm 1.4$ ), the presence of a variety of fixed play equipment ( $32.2 \pm 1.0$  vs.  $28.9 \pm 1.3$ ), suitable indoor play space ( $32.2 \pm 1.0$  vs.  $28.6 \pm 1.3$ ), engaging in active play with children ( $32.1 \pm 1.1$  vs.  $29.6 \pm 1.2$ ), and receiving activity-related training ( $33.1 \pm 1.2$  vs.  $30.3 \pm 1.1$ ). Children were most active in FCCHs with  $\geq 4$  significant PPA characteristics/practices compared to children in FCCHs with  $< 4$  significant PPA characteristics/practices.

**CONCLUSIONS:** This is the first study to identify specific practices and characteristics of FCCHs that influence children's PA. These data should be considered when developing programs and policies to promote PA in FCCHs.

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**Biological and Behavioral Predictors of Cardiometabolic Risk in 6th Graders: The Cardiovascular Health Intervention Program.**

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(No relationships reported)

**PURPOSE:** The prevalence of obesity has increased significantly among adolescents, and is now considered to be the primary cause of various cardiometabolic comorbid conditions. The purpose of this study was to determine the biological and behavioral variables associated with cardiometabolic disease risk among adolescents, and to assess the pattern of risk component clustering.

**METHODS:** A large cohort ( $n=2886$ ) of 6<sup>th</sup> grade students was assessed for cardiometabolic profiles. Risk components included waist circumference, fasting glucose, blood pressure, plasma triglycerides levels and HDL-cholesterol. Principal components analysis was used to determine the pattern of risk clustering and to derive a continuous aggregate score (MetScore). Individual risk components and MetScore were analyzed for association with age, adiposity (BMI), cardiorespiratory fitness (CRF), physical activity (PA), and parental factors (i.e. age, adiposity, family history of CVD, etc.).

**RESULTS:** BMI was associated with multiple risk factors, and overall MetScore among boys and girls. CRF was a strong negative predictor, such that greater CRF conferred less risk. Maternal smoking was associated with multiple risk factors in girls and boys, even after controlling for children's BMI. Paternal family history of early CVD and parental age were associated with increased blood pressure and MetScore for girls. Children's PA levels, maternal history of early CVD, and paternal BMI were also indicative for various risk components, but not MetScore in girls or boys.

**CONCLUSIONS:** Several biological and behavioral factors are independently associated with children's cardiometabolic disease risk. These findings serve to bolster the value of fitness, PA, and family-oriented healthy lifestyles for improving children's cardiometabolic health.

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2550 Board #225 MAY 31 3:30 PM - 5:00 PM

**Objectively Measured Sedentary Time Among Finnish Students Aged 7 To 15 Years**

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(No relationships reported)

**PURPOSE:** Accumulating evidence suggests that, independent of physical activity levels, sedentary behaviours are associated with increased health risk. The purpose of this study was to evaluate the differences in sedentary time among Finnish school-aged children of different ages and to compare the results with recently published international data.

**METHODS:** The study population consisted of 218 boys and girls from grades 1 to 9 (ages 7 to 15), from 6 schools who were involved in the baseline measurements of the "Finnish Schools on the Move" program in 2010-2011. Sedentary time and physical activity were measured objectively by an ActiGraph accelerometer for 7 consecutive days. A cut-off value of 100 counts per minute for sedentary time and 2000 counts per minute for moderate to vigorous physical activity (MVPA) was used. Analysis of variance was used for group comparisons.

**RESULTS:** Total sedentary time was 4.4, 5.6, and 8.0 h/day for students in grades 1-3, 4-6 and 7-9, respectively ( $p < 0.001$  for group differences). Mean sedentary time was 35.7, 38.5, and 46.0 min/h during the school day, and 33.2, 37.7, and 42.8 min/h outside school hours for students in grades 1-3, 4-6, and 7-9, respectively ( $p < 0.001$ ). Mean MVPA time was 69, 61, and 45 min/day for these age groups, respectively ( $p < 0.001$ ); and boys had on average 13 min/day more MVPA than girls ( $p < 0.001$ ). No gender difference was observed in total sedentary time among younger students, but girls in grades 7-9 had 0.9 h/day more sedentary time than boys ( $p < 0.001$ ).

**CONCLUSION:** Total sedentary time, as well as sedentary time during and outside the school-day, was directly associated with increasing age. Gender difference in sedentary time was observed in grades 7-9, where girls had more sedentary time than boys. Among Finnish students, total sedentary time was 1.3 h/day lower in grade 1-6 students and 0.6 h/day higher in grade 7-9 students than recently published data for children of the same ages from USA and Europe (Pate et al., 2011). Results raise concern about extensive sedentary time among young people, especially among older students in grades 7 to 9.

REFERENCE: Pate et al. Sedentary behavior in youth. *Br J Sports Med* 2011 45: 906-913.

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2551 Board #226 MAY 31 3:30 PM - 5:00 PM

**Reducing Obesity Trends in Secondary Public School Physical Education Classrooms through Innovative Technology**

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(No relationships reported)

Currently 1 in 3 Americans are classified as being overweight or obese and the obesity rate continues to rise. The impact of physical activity on obesity and overall physical fitness has been widely accepted. Dramatic declines in physical activity have been observed across a person's life with a dramatic decline occurring as they enter high school.

**PURPOSE:** To assess the difference in physical activity levels in students enrolled in secondary physical education classes and other programs that are "approved" by the state of Texas to substitute for physical education classes.



**METHODS:** High school students enrolled in drill team (n=33), band (n=33) (both are approved substitutes for physical education credits), and physical education (n=36) were recruited for participation in this study. Participants completed a brief survey, physical measurements, and wore an ActiTrainer Accelerometer, which is a valid and objective method of continuously recording physical activity, for a seven-day period. The groups were compared in two areas: 1) total time spent in moderate to vigorous physical activity (MVPA) and 2) time spent in MVPA during class (in minutes).

**RESULTS:** The drill team group (180.64 ± 87.77) participated in a significantly (P<0.01) greater amount of MVPA during class than both the band (95.30 ± 56.41) and PE groups (71.28 ± 39.06) which were not significantly different from each other. The overall weekly MVPA for the band group (743.64 ± 304.25) was significantly greater than the PE group (533.67 ± 242.00) while neither were significantly different from the drill team group (677.39 ± 265.99).

**CONCLUSION:** These findings suggest that a significantly greater amount of moderate to vigorous physical activity occurs in the drill team classes compared to the physical education and band classes that were examined in this study. The findings of this study suggest that approved substitutes for physical education that result in increases in physical activity should be encouraged as options for students to enroll in as a means of combating the prevalence of sedentary behavior in high school students. Further research is needed to examine other extracurricular activities' impact on physical activity in students.

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2552 Board #227 MAY 31 3:30 PM - 5:00 PM

**Evaluation of an After School Physical Activity Program for Disadvantaged Youth**

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(No relationships reported)

**PURPOSE:** To evaluate the effectiveness of "Keep It Moving" (KIM), an afterschool physical activity program in Colorado Springs, CO designed to encourage healthy movement outside of the formal school setting.

**METHODS:** Children at four disadvantaged elementary schools (87-93% free and reduced lunches) were assessed using an accelerometer along with the SOFIT observation method at two different time points during spring 2011. Standard data reduction processes for accelerometer and SOFIT data were used to determine time spent participating in physical activity. KIM facilitators were also observed using SOFIT to evaluate their interaction with participants during the program.

**RESULTS:** Among the entire sample (N=119) an average of 20.8 ± 9.5 minutes of moderate physical activity and 2.9 ± 3.9 minutes of vigorous physical activity was accumulated during the 45 minute KIM sessions, resulting in a combined 23.7 ± 11.3 minutes of moderate to vigorous physical activity (MVPA). Data from the SOFIT observation demonstrated that participants in the KIM program spent 12.3% of the session being "very active." (i.e. MVPA), with the majority of time spent "standing" (40.3%) and "walking" (36.0%). Only a small portion of the KIM sessions were devoted to sitting (10.5%) or lying down (0.8%). SOFIT data for facilitators indicated the majority of time was spent "managing" (40.6%), "observing" (33.3%), "promoting fitness" (10.1%) and in "general instruction" (9.2%), while lesser time was spent "demonstrating fitness" (2.6%) and on non-codifiable tasks (4.3%).

**CONCLUSIONS:** The KIM afterschool program succeeded at engaging participants in approximately 24 minutes of MVPA per session. The SOFIT observation results also suggest that participants spent a large portion of each KIM session being physically active. In addition to other activity accumulated throughout the day, the program could potentially assist children in reaching the recommended levels of PA, thus aiding them in achieving the benefits of a healthy lifestyle.

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2553 Board #228 MAY 31 3:30 PM - 5:00 PM

**Is Maintained Pattern of Physical Activity from Adolescence to Adulthood Associated with Reduced CVD-risk? HUNT-Study, Norway**

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(No relationships reported)

Little is known about the effect of adolescent physical activity on later health status, and few studies have examined physical activity patterns from adolescence to young adulthood as predictors of subsequent risk of cardiovascular disease (CVD).

**PURPOSE:** In a prospective longitudinal design we examined how different physical activity patterns from adolescence to young adulthood associated with CVD risk factors in young adulthood.

**METHODS:** Data were from the Nord-Trøndelag Health Study (HUNT2, 1995-97 and HUNT3, 2006-08), Norway. In the present 10-year longitudinal study we included 1869 individuals (males n=838) who participated in both the youth part of HUNT2, aged 13-19 years old (baseline) and the follow-up HUNT3, aged 23-31. Measurements included self-reported physical activity, body mass index (BMI), waist circumference (WC), total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C), glucose, triglycerides, resting heart rate (HR), and blood pressure. We used separate linear regressions models to investigate associations between physical activity patterns and each CVD risk factor. Physical active maintainers (physical active defined as ≥2-3 days/wk) were compared to inactive maintainers (IM). Adopters (those who were inactive (<2 days/wk) as adolescents (baseline) and physical active as young adults, follow-up) were compared to IMs and to those who discontinued activity (relapsers).

**RESULTS:** AMs had significantly lower HR, compared to all other PA patterns. Men who were AMs had significantly lower WC than relapsers and IMs. In unadjusted analyses, AMs had significantly lower WC, BMI, HR, diastolic blood pressure, TC, triglycerides and higher HDL-C compared to IMs. When adjusted for age and gender, WC BMI, HR, diastolic blood pressure and HDL-C remained significant. When comparing IMs against adopters, only HR was significant lower. In gender specific analysis, male adopters had no different CVD risk compared to inactive maintainers. Among females, adopting was associated with lower HR and TC compared to IMs.

**CONCLUSIONS:** Active maintainers had the best profile, with significantly lower CVD risks compared to inactive maintainers. Adopting physical activity between adolescence and young adulthood may not confer a lowered CVD risk, compared to inactive maintainers.

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2554 Board #229 MAY 31 3:30 PM - 5:00 PM

**Physical Activity And Its Association With Academic Performance In Korean Adolescents**

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(No relationships reported)

**PURPOSE:** The purpose of this study was to investigate the association between PA and AP, as well as between media time (MT) and AP.

**METHODS:** This study used cross-sectional data included 75,066 (39,612 male students, 35,454 female students) middle and high school students from Korea Youth Risk Behavior Web-based Survey (KYRBWS, 2009). Logistic regression performed to analyze the association between PA, MT, and AP.

**RESULTS:** From an analysis of Odds Ratio (OR), male students who achieved lower AP showed a significant decline in PA participatory rate compared to those who reported higher AP. For the high AP groups' PA participatory rate, the reference value was 1. The middle AP group showed an OR value of 0.92(95% CI 0.87-0.96), and the low group showed an OR value of 0.86(95% CI 0.82-0.90). In the case of female students, OR values were 0.92(95% CI 0.87-0.98), 0.99(95% CI 0.93-1.04), respectively. Male students who achieved lower AP showed a significant decline in MT guideline practical rate compared to those who reported higher AP. For the high AP groups' MT guideline practical rate, the reference value was 1. The middle AP group showed an OR value of 0.78(95% CI 0.73-0.83), and the low group showed an OR value of 0.49(95% CI 0.46-0.51). In the case of female students, OR values were 0.83(95% CI 0.77-0.88), 0.53(95% CI 0.50-0.56), respectively.

**CONCLUSIONS:** Our results show a correlation between practical rate of PA and MT guideline with AP. Therefore, to improve AP of Korean youth, there is a need for encouraging a regular PA participation and MT guideline practice.

**2555** Board #230 **MAY 31 3:30 PM - 5:00 PM**  
**Examining Girls' Physical Activity Levels in Organized Sports**

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(Sponsor: Karen Croteau, FACSM)  
(No relationships reported)

Many children do not meet recommended levels of physical activity (PA). This is particularly evident for girls in adolescence, when PA declines sharply. Organized sports (OS) may have potential to increase girls' likelihood of meeting PA recommendations, but little research has focused on girls' PA within OS.

**PURPOSE:** The purpose of this study was to describe the amount of PA that girls accumulate during games and practices within three OS, and to compare the levels between games and practices.

**METHODS:** A cross-sectional design was used. Participants were 94 girls, aged 10 to 17 yr, mean ( $\pm$ SD) = 13.4  $\pm$  2.2 yr, recruited from 10 teams in three OS (netball, basketball, soccer) in Sydney's Western Suburbs. Each participant wore one ActiGraph GT3X monitor, placed on the right hip via elastic belt, for the duration of one practice and one game. Accelerometers were initialized to record counts and steps, using 5 s epochs. Freedson's cut-points were used to determine PA intensity.

**RESULTS:** Across OS, the mean ( $\pm$ SD) for percent time in moderate-to-vigorous PA (MVPA) during games (30.1  $\pm$  10.2%) was significantly lower ( $r = -5.27$ ,  $P < 0.001$ ) than during practices (36.4  $\pm$  8.3%). In games (mean duration = 90.8  $\pm$  13.7 min), OS featured similar proportions of MVPA (netball = 30.9  $\pm$  9.1%; basketball = 29.9  $\pm$  8.5%; soccer = 29.1  $\pm$  8.5%). In OS practices (mean duration = 82.6  $\pm$  22.6 min), MVPA was more heterogeneous (netball = 39.4  $\pm$  4.7%; basketball = 35.5  $\pm$  8.1%; soccer = 32.6  $\pm$  11.2%). Overall, steps/h for games (OS = 2,702  $\pm$  960; netball = 2,543  $\pm$  699; basketball = 2,349  $\pm$  660; soccer = 3,340  $\pm$  1267) was significantly lower ( $r = -5.05$ ,  $P < 0.001$ ) than during practices (OS = 3,234  $\pm$  743; netball = 3,430  $\pm$  432; basketball = 2,753  $\pm$  767; soccer = 3,602  $\pm$  916).

**CONCLUSION:** Our observations of the three sports showed that participants achieved significantly higher levels of MVPA and steps during OS practices, compared to OS games. Girls spent 21.8 min/h in MVPA during practices and 18.1 min/h in MVPA during games. For this population, OS appears to make a substantial contribution to the PA of participating girls. OS alone, however, does not provide amounts of PA sufficient to meet daily recommendations for adolescent girls. This information on OS can be used as a platform from which to inform policies, and to develop strategies to increase adolescent girls' PA levels through sport.

**2556** Board #231 **MAY 31 3:30 PM - 5:00 PM**  
**Physical Activity Tracking in Iowa Bone Development Study Youth: Alignment by Biological versus Chronological Age**

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(No relationships reported)

**PURPOSE:** To compare the tracking of childhood and adolescent objectively-measured physical activity (PA) using peak height velocity (PHV) as a predicted measure of biological age (BA) versus chronological age (CA, yr). To investigate whether known gender differences in PA trajectories were altered after aligning by BA instead of CA.

**METHODS:** The Iowa Bone Development Study has collected longitudinal ActiGraph data at ages 5, 9, 11, 13, and 15 yr. To be included in this analysis, participants had to have worn an accelerometer at least two measurement periods (N = 112 girls; N = 96 boys). Spearman correlation coefficients were used to determine two-year intervals of tracking of moderate to vigorous PA (MVPA) before and after maturity (PHV). Gender-specific MVPA trajectories were compared using mixed models with autoregressive residual covariance.

**RESULTS:** Moderate two-year tracking associations were present, except the -1 yr PHV to +1 yr PHV in boys. The mixed models indicate MVPA was highest at age 5 and then declined in girls. Boys' MVPA increased until 9 yr and then decreased at a faster rate than girls. A significant interaction between age and gender confirmed the different trajectories. By 2.5 to 3 yr post PHV girls and boys had similar levels of MVPA.

**CONCLUSIONS:** Exploring opportunity, availability, and support of MVPA in boys and girls may help explain why levels are decreasing with age. Further research into the immediate time period surrounding PHV appears warranted in boys.

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**2557** Board #232 **MAY 31 3:30 PM - 5:00 PM**  
**Comparison Of Adolescents Risk Factors Prevalence To Chronic Disease Development In Urban Regions In Brazil**

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(No relationships reported)

**PURPOSE:** This paper compared both sex adolescents' risk factors to chronic diseases development living at four distinct areas in developing country. Sample: We evaluated 1.442 adolescents [710 (49.2%) girls and 732 (50.8%) boys] from 14 to 19 years of age living in São Paulo State-Brazil. We selected three regions in countryside and one in central area. The sample distribution was at countryside regions: North (n=355) and East (n=366) side in Sao Paulo State. Both cities presented as main activity the rural profile (rural-non-urban cities) while in the West area (n=42), the city presented urban profile (rural-urban city). The city at Central (n=379) area presented urban profile (central-urban city).

**METHODS:** All adolescents were surveyed by cross sectional evaluation answering the Youth Behavior Risk Questionnaire and the International Physical Activity Questionnaire (IPAQ-short version). Four behavioral risks were assessed: 1) physical inactivity (PI): adolescents that reported less than 300 minutes/week of moderate-vigorous physical activity in the previous evaluation week; 2) alcohol intake (AI): drink at least one dose of any kind of alcohol beverage in the previous evaluation week; 3) cigarette smoking (CS): smoke at least once in the previous evaluation week; 4) overweight indicator (OW): present at least 21.66 (Kg/m<sup>2</sup>) body mass index value. Data Analysis: Qui-Square test (p<.05 as significance level).

**RESULTS:** Data analysis evidenced significant differences in risk factors prevalence by gender. Boys presented higher behavior risk for AI as well CS than girls. On the other hand, female group presented higher prevalence value for PI and OW. IN general, more than 2 risks factors were higher in girls than boys. The analysis by regions, showd different physical inactivity prevalence. Rural non-urban cities (Norths = 56.7% and East = 64.6%) presented more active adolescents than rural-urban city ( West = 39.2%) and central-urban city (Central = 35.4%). Similar trend was found for AI, CS and OW by region.

**CONCLUSION:** This paper allow us to conclude that: 1- distint regional development may influence the amount behavior risk prevalence in adolescents; 2- prevalence of risk factors were different in boys and girls; 3- the comparison among the four studied risk factors, PI presented the highest prevalence,

**2558** Board #233 **MAY 31 3:30 PM - 5:00 PM**  
**Metabolic Syndrome and Lifestyle Behaviors in Adolescents**

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University of Madeira, Funchal, Portugal.  
(No relationships reported)

Research about metabolic syndrome and the relationship with lifestyle behaviors in youth is crucial in the design of intervention strategies.

**PURPOSE:** The objective of this study was to examine the differences between adolescents with Metabolic Syndrome (MetS) and without MetS (w/MetS) in physical activity (PA) levels, sedentary behaviors and consumption of processed foods and sugary drinks.

**METHODS:** A total of 468 adolescents (247 boys and 215 girls), between 10 and 15 years of age, participated this study. Participants were measured for height, weight, waist circumference, triceps and calf skinfolds, and blood pressure. Measures of triglycerides, glucose and C-HDL were taken by blood draw, and MetS diagnosis was done according to the IDF et al. (2008) criteria. Percent body fat (%BF) was estimated according to Slaughter et al. (1988), and participants classified according to Lohman's (1987) categories. Abdominal obesity (AOB) classification was defined according to Katzmarzyk et al. (2004), and the prevalence of the MetS was determined with the IDF (2008) criteria. PA and sport participation were assessed by the

PAQ-C questionnaire and PA general scores (PAgS) estimated according to Crocker et al. (1997). Sedentary behavior, consumption of processed foods and sugary drinks (Wilson et al., 2008) were assessed by self-report.

**RESULTS:** The prevalence of MetS was 3.5%. Significant differences were found between participants w/MetS and with MetS in PAgS ( $2.56 \pm 0.71$  vs  $2.1 \pm 0.67$ , respectively), and participants with MetS had a significantly lower mean score ( $p=0.012$ ). Regarding the risk factors for MetS (HDL, LDL, WACL, blood pressure and triglycerides), significant differences were found between subjects with AOb and without AOb (w/AOb) ( $2.43 \pm 0.64$  vs  $2.66 \pm 0.70$ , respectively). Those with AOb also had lower scores in PAgS ( $p<0.001$ ). There were no differences between subjects with MetS and wMetS for sedentary behaviors ( $1.77 \pm 1.69$  vs  $1.79 \pm 2.30$  hrs/wk, respectively), and scores of processed foods and sugary drinks consumption ( $5.56 \pm 3.78$  vs  $5.73 \pm 5.23$ ).

**CONCLUSION:** A physically active lifestyle may prevent the diagnosis of metabolic syndrome in adolescents.

Sponsored by the Research Center of Sport, Health and Human Development (CIDESD) and the Department of Education in Madeira Autonomous Region

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**2559** Board #234 MAY 31 3:30 PM - 5:00 PM  
**Physical Activity Levels of Elementary School Students during Physical Education and Recess.**

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(No relationships reported)

Physical education class (PE) and recess are the two main opportunities that children have to be physically active during the school day. However, no study has directly observed the exact time spent, by children, in these settings, while using accelerometry for the purpose of quantifying physical activity in these settings.

**PURPOSE:** The purpose of this study was to precisely document time spent in PE and recess and to describe the physical activity levels of elementary school children in those settings.

**METHODS:** One-hundred and forty-one 1st and 5th graders, attending 10 elementary schools, participated in the study. Participants wore Actigraph accelerometers for one-week, and during that period the precise times spent in PE and recess each day were documented for each participant. Accelerometer counts per 30-seconds were categorized as sedentary, light, moderate-to-vigorous (MVPA) and vigorous physical activity (VPA). Minutes spent in these categories were calculated for PE and recess periods for each day and across the week.

**RESULTS:** Participants attended PE once per week for an average of 48 minutes. Percent of time spent in MVPA during PE was approximately 30%, except for 5th grade girls, who spent 23% of PE class in MVPA. First graders spent significantly more time in recess compared to 5th graders (24 minutes per day vs. 17 minutes per day), and more of that time was spent in MVPA (65% vs. 48%).

**CONCLUSION:** The results suggest lower than recommended levels of MVPA during PE for both grades. Proportion of time spent in MVPA during recess was higher than PE. Physical activity during PE and recess, as determined by close observation of times spent in these settings, was variable based on grade and gender. PE, as an active opportunity for children, warrants continued examination. While activity levels were higher in recess, modifications of active opportunities may be necessary especially for older girls.

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**2560** Board #235 MAY 31 3:30 PM - 5:00 PM  
**Breaks in Sedentary Time during Childhood and Adolescence: Iowa Bone Development Study**

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(No relationships reported)

**PURPOSE:** The frequency of interruptions in sedentary time (sedentary

breaks) is an aspect of sedentary behaviors which may be associated with metabolic health outcomes. The aim of this study was to describe the change in the frequency of sedentary breaks over a 10-year period from ages 5 to 15 yr.

**METHODS:** The longitudinal Iowa Bone Development Study has collected accelerometry data at approximately 5, 8, 11, 13, and 15 years of age. Data from participants who wore an accelerometer at least 10 hours per day and three days per data collection episode were used (423 children at age 5, 550 at age 8, 520 at age 11, 454 at age 13, and 344 at age 15). The frequency of sedentary breaks was determined based on accelerometry data and compared by weekday/weekend, time period during the day, gender, and data collection episode.

**RESULTS:** The frequency of sedentary breaks decreased by > 200 times/day over a 10-year period from ages 5 to 15. Linear regression models estimated a 1.8 times/hour decrease per year for boys and a 2.0 times/hour decrease per year for girls ( $P_s < 0.0001$ ). Both boys and girls showed significantly fewer breaks on weekdays from morning to 3:00 PM than on weekends from morning to 3:00 PM ( $P_s < 0.0001$ ). The frequency of sedentary breaks was slightly higher among boys than girls (gender difference  $\leq 2$  times/hour;  $P_s < 0.01$  at ages 11, 13, and 15).

**CONCLUSIONS:** Breaks in sedentary time notably decrease during childhood and adolescence. During school hours, boys and girls have fewer breaks in sedentary time than during any other time period of weekday or weekend day. If health effects of sedentary breaks are proven, schools may be a potential intervention setting for increasing the frequency of sedentary breaks. School policy interventions such as increasing recess time and activity breaks during class time may have an impact on students' sedentary break behaviors.

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**2561** Board #236 MAY 31 3:30 PM - 5:00 PM  
**Is Physical Activity Set in Stone? Tracking of Accelerometer-measured Activity in Early Childhood**

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(No relationships reported)

**PURPOSE:** To determine whether relative physical activity (PA) levels at age 3 years are sustained in subsequent years during early childhood.

**METHODS:** This study enrolled 372 children. Objective measures of PA (RT3, triaxial accelerometer) were collected for 3 days every 4 mo from age 3 to age 7 y. Non-wear time was defined as 60 min with consecutive zero vector magnitudes per min (vpm) allowing up to 3 min with vector magnitudes  $\leq 100$ . Valid days were defined as 8 to 18 h wear time. PA for each year of age (e.g. 3.0-3.99 y) was calculated as mean daily vpm averaged across valid days ( $\geq 1$ ). Spearman rank correlation coefficients between PA at age 3 y and ages 4 through 7 y were calculated. Participants were categorized into gender-specific tertiles of PA at each age. Differences in PA throughout the study between sexes and between the High PA tertile and Middle/Low PA tertile at age 3 y were tested using t-tests.

**RESULTS:** At age 3, PA was  $613 \pm 201$  vpm (mean  $\pm$  SD) in boys and  $564 \pm 199$  vpm in girls; boys' PA remained higher at each age ( $P < 0.01$ ). PA at age 3 y was significantly correlated with PA levels at ages 4 through 7 y ( $P < 0.015$ ; Table). Participants in the highest tertile of PA at age 3 y were approximately twice as likely to remain in the highest tertile in subsequent years compared with those not in the highest tertile at age 3 (50% vs. 26%;  $P < 0.001$ ).

**CONCLUSIONS:** Boys are more active than girls at ages 3 through 7 y. Children who are relatively more physically active at age 3 y have a significantly greater likelihood of maintaining higher PA levels from age 4 to 7 y than their peers. These findings highlight the importance of establishing healthy PA levels early in life.

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Physical activity at ages 3 through 7 years.

|  | Age 3<br>(N=342) | Age 4<br>(N=339) | Age 5<br>(N=329) | Age 6<br>(N=311) | Age 7<br>(N=260) |
|--|------------------|------------------|------------------|------------------|------------------|
| PA, mean vpm (SD)                                      | 589<br>(201)     | 604<br>(219)     | 601<br>(214)     | 581<br>(205)     | 555<br>(206)     |
| Correlation with PA at age 3*                          | 1.00             | 0.37             | 0.35             | 0.24             | 0.16             |
|  |                  |                  |                  |                  |                  |
| Proportion in High PA tertile during subsequent years: |                  |                  |                  |                  |                  |
| High PA tertile at age 3                               | 100%             | 52%              | 53%              | 49%              | 39%              |
| Middle/Low PA tertile at age 3                         | 0%               | 23%              | 27%              | 27%              | 29%              |
|  |                  |                  |                  |                  |                  |
| *P < 0.015 for all correlations.                       |                  |                  |                  |                  |                  |

**2562 Board #237 MAY 31 3:30 PM - 5:00 PM**  
**Correlates Of Physical Fitness Among Secondary School Students**

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 (No relationships reported)

Physical fitness is an important health correlate. In Portugal the FitnessGram tests have been distributed to schools and physical education teachers are asked to apply it in order to assess the physical fitness levels of students.

**PURPOSE:** This cross-sectional study examined the patterns and factors related to adolescents' physical fitness in Portuguese high school students.

**METHODS:** A total of 387 healthy students (150 boys, 237 girls) age 14 to 18 years (16±1.2 years) participated in the study. In the total sample, leisure time physical activity was assessed using a questionnaire and physical fitness were measured utilizing the FitnessGram tests. Students' aerobic capacity, muscular strength, muscular endurance, flexibility, and body composition were assessed. Scores from these assessments were compared to Healthy Fitness Zone standards and students were labeled as not fit or fit according to the Pacer test results. The correlates of physical fitness were assessed using log-binominal regression analysis separately for boys and girls.

**RESULTS:** Overall, 51% (66% of boys and 41% of girls) were considered fit, according to Pacer test adjusted to the age of the students. Those who reported participation in organized youth sport on a regular basis (boys: OR=1.86, 95% CI: 1.31-2.64, p=0.001; girls: OR=1.66, 95% CI: 1.20-2.29, p=0.002) were more likely to have a better performance on Pacer test in both genders. On the other hand, body mass index for boys (OR=0.728, 95% IC: 0.62-0.86, p<0.001), and age for girls (OR=0.60, 95% CI: 0.46-0.78, p<0.001) were negatively associated with being considered physically fit. The total amount of physical activity practice and the practice of non-organize physical activity during the week were not significant correlates of physical fitness.

**CONCLUSION:** The figures of physically fit students are low, and a cause of concern, especially among girls, because physical fitness is a health correlate. It was concluded that adolescents' regular participation in formal sport activities is an important factor in increasing the likelihood of being physically fit.

**2563 Board #238 MAY 31 3:30 PM - 5:00 PM**  
**Pedometer Determined Physical Activity of Azores Youth and Psychosocial Correlates.**

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 (No relationships reported)

Pedometers have the potential to become effective youth physical activity surveillance tools because they are inexpensive, easy to use and provide objective measures of PA (physical activity). Psychosocial correlates such as enjoyment and self-efficacy have been reported as factors influencing the amount of PA among youth.

**PURPOSE:** To determine the PA amount of Azores adolescents using pedometers and assess the impact of individual and psychosocial correlates.

**METHODS:** A cross-sectional school-based study - The Azorean Physical Activity and Health Study II, of 799 adolescents (446 girls) aged 15-18y from Azorean Islands was conducted. PA was assessed by pedometer for 7 consecutive days. Psychosocial correlates, enjoyment and self-efficacy, were determined by established questionnaires. The impact of the different variables on the amount of PA (steps/day) was assessed by regression analysis (p<.05).

**RESULTS:** Steps per day were significantly (p<.001) higher in males than females, 8776.59 ± 3430.28 vs 7895.63 ± 2900.64, respectively. Males also had higher values in self-efficacy index 2.51 ± .32 vs 2.43 ± .38 (p<.001), and enjoyment index 4.54 ± .69 vs 4.39 ± .74 (p<.004). There was no significant effect for age and BMI on steps/day. The final model included the effect in steps/day of gender β= 810.45 (p<.001), self-efficacy β= 731.38 (p<.035) and enjoyment β= 355.57 (p<.036).

**CONCLUSION:** Results are consistent with other objective assessments of youth PA indicating that males are typically more active than females. Psychosocial correlates, such as self-efficacy and enjoyment are significant factors in adolescents PA.

**KEYWORDS:** Adolescents, Pedometers, Psychosocial correlates

Pedro Silva is supported by FCT SFRH/BPD/71332/2010

**2564 Board #239 MAY 31 3:30 PM - 5:00 PM**  
**Cross-cultural Differences In Physical Activity, Sedentary Behaviour And Obesity Of British And Saudi Youth**

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 (No relationships reported)

While there is a general decline in levels of physical activity (PA) and prevalence of sedentary activities across various populations due to mechanisation and modernisation, obesity seems to rise concurrently in almost all parts of the world coupled with changes in the global food system, which is characterized by caloric dense, more processed, affordable and effectively marketed foods. Although the rise of the global obesity epidemic during the past few decades is substantial, there are wide variations in obesity prevalence across countries and populations due to socioeconomic, cultural and transport differences in national and local environments.

**PURPOSE:** 1) to explore the lifestyle of youth from culturally and environmentally diverse cities, two in Central England (Birmingham & Coventry) and one in the Eastern Province of Saudi Arabia (Al-Ahsa); 2) to examine differences due to gender, age and geographical location.

**METHODS:** 2290 volunteered youth (15-17 years) from the three cities completed a self-report questionnaire that contained 47 items relating to patterns of physical activity, sedentary behaviours and eating habits. The questionnaire allows the calculation of total energy expenditure in METs-min per week based on reported metabolic equivalent values.

**RESULTS:** The univariate ANOVA revealed highly significant differences in levels of PA of youth across the three cities ( $p < .001$ ). Youth from Al-Ahsa were less active than youth in Birmingham and Coventry (1495, 3627 & 3949 METs-min/wk respectively). Using Chi-square analysis, frequency data revealed a significant difference in PA levels between youth in Birmingham, Coventry and Al-Ahsa ( $\chi^2 = 653.85, p < 0.001$ ), with 72.3%, 77.2% and 26% of youth being 'active' respectively. Also, ANOVA revealed highly significant differences ( $p < .001$ ) in the proportions of overweight/obese participants based on IOTF BMI classification, with males and females from Al-Ahsa exhibiting a higher prevalence of overweight/obesity (36.4% and 36.6%, respectively).

**CONCLUSIONS:** Youth from Birmingham and Coventry are more physically active than their counterparts living in Al-Ahsa. Males are generally more physically active than females. Additionally, youth with higher BMI reported lower levels of physical activity and higher amounts of sedentary time.

**2565 Board #240 MAY 31 3:30 PM - 5:00 PM**

**Longitudinal Investigation Of Daily And Yearly Physical Activity In Australian Children**

Rohan M. Telford<sup>1</sup>, Richard D. Telford, FACSM<sup>2</sup>, Ross B. Cunningham<sup>3</sup>, Rachel C. Davey<sup>1</sup>, Gordon Waddington<sup>1</sup>, Thomas Cochrane<sup>1</sup>. <sup>1</sup>Canberra University, Canberra, Australia. <sup>2</sup>Canberra Hospital, Canberra, Australia. <sup>3</sup>Australian National University, Canberra, Australia.  
(No relationships reported)

Longitudinal studies of the daily and yearly physical activity (PA) patterns in young children may provide valuable information for intervention strategies aiming to promote and increase PA in youth.

**PURPOSE:** To contribute to our understanding of the patterns of PA which may exist on a yearly and daily basis within a cohort of boys and girls as they progress through elementary school.

**METHODS:** Participants were initially 775 children (394 boys and 381 girls, mean age 8.0 ± 0.3) recruited from 29 elementary schools in suburbs where the household income was similar to the Australian average. Pedometers were worn annually for a 7 day period over five consecutive years and step counts were converted to a physical activity index (PAI, approximately the square root of steps) to satisfy requirements for statistical analysis. In the final two years accelerometers were worn to assess PA intensity.

**RESULTS:** Overall, the PAI of boys was higher than girls, the respective means and standard errors being 102.5, 0.76 v 93.5, 0.77 ( $p < 0.001$ ). Boys spent more time per day (values expressed as the means of the sqrt of minutes and standard errors) in moderate (5.71, 0.10 v 4.7, 0.11,  $p < 0.001$ ) and vigorous (2.8, 0.09 v 2.4, 0.09,  $p < 0.001$ ) intensity activity, while girls spent more time in sedentary classified activities (20.4, 0.12 v 19.9, 0.12  $p < 0.01$ ). There were changes in the average daily step count from year to year ( $p < 0.001$ ), but these changes fluctuated, providing little evidence of any systematic changes in total PA between the ages of 8 and 12 years. On the other hand, a systematic pattern of step counts did emerge according to day of the week ( $p < 0.001$ ). This was characterized by a gradual build up of daily steps from Monday to Friday followed by a decline over the weekend, with Sunday being the least active day. This pattern persisted from year to year in both genders and a corresponding pattern was found for time spent in moderate, vigorous and light intensity activity.

**CONCLUSION:** Whilst there was little evidence of any systematic changes in step-counts within this cohort over the final four years of elementary school, there were systematic day by day changes during the week which persisted from year to year. These data suggest that strategies to increase PA in elementary school children might benefit from targeting specific days of the week.

**2566 Board #241 MAY 31 3:30 PM - 5:00 PM**

**Physical Activity and Motor Skill Development in Young Children**

Jennifer I. Flynn, Dawn P. Coe, Jeffrey T. Fairbrother, R. Sean Durham. *The University of Tennessee, Knoxville, TN.* (Sponsor: Dixie Lee Thompson, FACSM)  
(No relationships reported)

Young children should accumulate at least 60 minutes of moderate-to-vigorous physical activity (MVPA) daily. Physical activity (PA) contributes to motor skill development, particularly for tasks requiring complex movement patterns thought to underlie skill-related activity and PA later in life (e.g., sport and dance).

**PURPOSE:** To assess the association between MVPA and motor skill development in young children.

**METHODS:** Participants were 40 children (4.8 ± 0.8 years) enrolled in a university research laboratory school. MVPA was assessed using an accelerometer (Actigraph GT3X) set to collect data at 15 s epochs. These data were used to calculate average daily time (min) spent in MVPA for one week (Pate et al., 2006). The Tests of Gross Motor Development-2 (TGMD2) was used to assess 8 gross motor skills that were considered to represent complex skills (CS). CS tests were TGMD2 subtests that show the lowest percentage of mastery for 3-5 year old children. The CS tests were 4 locomotor (galloping, unipedal hopping, leaping, and horizontal jumping) and 4 object control (stationary basketball dribble, catching, kicking, and underhand rolling) skills. Relationships between MVPA and CS scores were examined using Pearson correlations.

**RESULTS:** There were significant correlations between MVPA and galloping ( $r = 0.372$ ;  $P = 0.028$ ), hopping ( $r = 0.471$ ;  $P = 0.004$ ), dribbling ( $r = 0.393$ ;  $P = 0.020$ ), and catching ( $r = 0.337$ ;  $P = 0.048$ ).

**CONCLUSIONS:** These correlations indicate that further research is warranted to determine a causal link between MVPA and CS competency. It is important to determine if PA drives CS competency or if CS competency supports PA efforts. This relationship is important given the recognition that motor skill development and CS competency are critical to success in lifetime PA. This study was funded by a grant from the University of Tennessee Korn Learning, Assessment, and Social Skills (KLASS) Center.

**2567 Board #242 MAY 31 3:30 PM - 5:00 PM**

**Types of Physical Activities Among High School Students - United States, 2010**

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(No relationships reported)

There are no recent nationally-representative studies on participation in types of physical activity among U.S. high school students.

**PURPOSE:** Describe the most frequently reported types of leisure-time physical activities among U.S. high school students overall, and by sex and body mass index (BMI).

**METHODS:** We analyzed data from the 2010 National Youth Physical Activity and Nutrition Survey among 8,895 U.S. high school students in grades 9-12 who completed a self-administered questionnaire. A total of 35 different physical activities were listed in the questionnaire. Students were classified as participating in a specified activity if they reported that activity ≥ 1 days/week. Weighted prevalence estimates and 95% confidence interval (CI)s were compared by sex and BMI (normal, overweight, obese).

**RESULTS:** Overall, walking was the most frequently reported physical activity among U.S. high school students (80.4%, 95% CI [79.1, 81.6]) followed by running/jogging (70.0%, [68.0, 71.9]), weight-lifting (44.1%, [41.8, 46.5]), basketball (43.5%, [41.5, 45.6]), and active video-games (39.8%, [37.7, 42.0]). Four of the top five reported activities were the same between boys and girls (Table). Stratified by sex and BMI, four of the top five activities in each sex group were also reported the top five in all BMI categories for that sex.

**CONCLUSIONS:** Walking and running/jogging were the most frequently reported activities among U.S. high school students for all sex and BMI groups. Knowledge of the types of activities in which youth engage may inform public health professionals to develop targeted strategies to improve participation in physical activities among U.S. youth.

| Male               |      |            | Female             |      |            |
|--------------------|------|------------|--------------------|------|------------|
| Activity           | %    | 95% CI     | Activity           | %    | 95% CI     |
| Walking            | 77.3 | 75.4, 79.1 | Walking            | 83.6 | 81.8, 85.3 |
| Running/Jogging    | 72.0 | 69.5, 74.4 | Running/Jogging    | 68.0 | 65.3, 70.5 |
| Weight-lifting     | 61.1 | 58.6, 63.5 | Dance              | 50.8 | 47.8, 53.7 |
| Basketball         | 56.7 | 53.8, 59.5 | Active video-games | 39.3 | 36.9, 41.8 |
| Active video-games | 40.3 | 37.5, 43.2 | Basketball         | 30.2 | 27.7, 32.7 |

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2568 Board #243 MAY 31 3:30 PM - 5:00 PM

**Outside of School Physical Activity Participation in Children and Adolescents from the Urban Core**

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Although 60 minutes of physical activity (PA) per day are recommended for children and adolescents, many schools have physical education (PE) class 1 to 2 times per week for 30 minutes to 1 hour per class. It is unknown whether, despite the lack of opportunity for PA in PE, students from a multi-ethnic, low income, urban setting meet the recommendations for PA through participation in outside of school activities, and in what types of PA students most often engage.

**PURPOSE:** To determine the number and types of PA children and adolescents from an urban core area participate in outside of school.

**METHODS:** The Physical Activity Checklist Interview (PACI) was administered to students (n= 1332; age 9-15 years; grades 4-8) in the school setting. Students were asked to circle activities in which they had participated before or after school on the previous day. Students were instructed to include only activities in which they had participated for at least 15 minutes. Students could indicate as many activities as appropriate and report additional activities that were not included on the form (PA and sedentary activities (SA)).

**RESULTS:** Ninety-two percent of students reported participating in  $\geq 1$  PA with an overall average of 2.8 activities before or after school. The most common out of school activities reported were walking (55% of students), running/jogging (30%), dance (29%), basketball (26%), and football (23%). However, 55% of students also reported participating in  $\geq 1$  SA. The majority of SA (46% of students) reported were technology based (screen time) such as TV, non-active video games, and computer use. Twenty-two percent of students also reported participating in other SA which included activities such as reading, doing homework, and talking on the phone.

**CONCLUSION:** Although they indicated a range of PA types, the majority of students were not participating in the recommended amount of PA. Because PA has a beneficial effect on physical and mental health, and patterns of health-related behaviors are often established in childhood, strategies to increase PA outside of school are needed. Additionally, because PA levels begin to decline during adolescence, health care providers, school personnel, community leaders and families should work to develop PA programs appropriate to students' interests.

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2569 Board #244 MAY 31 3:30 PM - 5:00 PM

**Screen-based Entertainment Time And Physical Fitness In School-aged Children And Youth**

Leandro F6mias Machado de Rezende, Gerson Ferrari, Sandra Mahecha Matsudo, Victor Keihan Matsudo. *Celafiscs, S6o Caetano do Sul, Brazil.* (No relationships reported)

**INTRODUCTION:** Accumulated evidences suggest that, independent of physical activity level, sedentary behaviors are associated to high body composition in youth.

**PURPOSE:** to associate the computer time with physical fitness variables in children and youth from a low socioeconomic region.

**METHODS:** cross-sectional study from the "Longitudinal Project of Growth, Development and Physical Fitness in Children from Ilhabela", Brazil. The sample consisted of 191 youth aged 10-15 years-old, male (n=99) and female (n=92), living in a low socioeconomic status island in Brazil. The sedentary time was measured by interviewed-administered proxy-reported about screen time of: a- computer (1.34 $\pm$ 0.96 hours/day); b- videogame (1.01 $\pm$ 1.96 hours/day); c- TV (3.06 $\pm$ 2.39 hours/day); d- total-time (amount of computer, videogame and TV time) (5.09 $\pm$ 3.97 hours/day). Exposure was dichotomized as more than 2 hours and less than two hours. The physical fitness variables measured were: body weight, body height, adiposity (mean of 7 skinfolds) and waist circumference. The neuromotor variables included flexibility (sit and reach test), agility (shuttle run test), lower and upper-limb muscle strength (vertical jump test and handgrip, respectively), speed (50 meters dash test). All results from physical fitness variables were divided in tertile. The Logistic Regression was performed by unadjusted and adjusted (sex and gender) with confidence intervals of 95%.

**RESULTS:** The analysis showed that computer time was associated, in an adjusted odds ratios in the third tertile for vertical jump 4.22 (CI 95% 1.55-1.52) and agility 0.35 (CI 95% 0.12-1.02). Videogame time was associated with the third tertile of waist circumference 0.29 (CI 95% 0.09-0.97), adiposity 3.68 (CI 95% 1.17-11.58) vertical jump test 3.16 (CI 95% 1.19-8.38). Television viewing time was associated with vertical jump 3.86 (CI 95% 1.29-11.55) and agility 0.19 (CI 95% 0.68-0.54).

**CONCLUSION:** Screen based entertainment time was associated with low-performance in neuromotor variables as agility and lower-limb muscle strength as well with high adiposity in school-aged children from a low socioeconomic level living in an island in Brazil.

#supported by FAPESP process number 2010/20749-8

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2570 Board #245 MAY 31 3:30 PM - 5:00 PM

**Is Active Transport to/from School Important to Improve Metabolic Health in Adolescents?**

Andreia N. Pizarro, Clarice Martins, Joana Teixeira, Jos6 Ribeiro, Jorge Mota, Maria Paula Santos. *Porto University - Sports faculty, Porto, Portugal.* (No relationships reported)

Active transport (AT) should be consider a major key factor to reduce important negative health outcomes as it has been identified as an important source of physical activity (PA) for young people. However, it is still unclear whether this type of PA has enough potential to reduce the metabolic risk factors by improving lipid profile, glucose and blood pressure, reducing obesity or help achieving physical activity recommendations.

**PURPOSE:** to determine associations between active transport and metabolic risk factors.

**METHODS:** Participants were 230 adolescents (122 girls) with mean age of 11.7 ( $\pm$ 0.8) years old from Porto, Portugal. AT was accessed by questionnaire. Physical activity was obtained with Actigraph accelerometer Model GT1. Lipid profile measurements were conducted with Cholestech LDX<sup>®</sup> analyser. Waist circumference (WC) was measured midway between the lower rib margin and the iliac crest at the end of normal expiration. Blood pressure was obtained with Dinamap model BP 8800 according to standard procedures. Metabolic risk factors included HDL-C <40 mg/dL, triglycerides (TG)  $\geq$ 150 mg/dL, Glucose (GLU)  $\geq$ 100mg/dL, systolic/diastolic blood pressure  $\geq$ 130/85 mm hg, WC  $\geq$ 90th percentile.

**RESULTS:** Binary logistics regression showed that adolescents who reported active transport to/from school had a significantly higher likelihood of having a better HDL-C levels (OR=2.64, 1.27 to 5.48, p<.01) and achieving PA recommendations (OR=3.82, 1.09 to 13.33, p<.05) compared to those who reported passive transport. No significant associations were observed for TG, GLU, BP and WC.

**CONCLUSION:** Active transport to/from school appears to improve HDL-C; however more interventions and longitudinal studies are needed to investigate the nature of this relationship.

Supported by FCT grant: PTDC/DES/099018/2008, FCT/FCOMP-01-0124-FEDER-009573 and SFRH/BD/70513/2010

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2571 Board #246 MAY 31 3:30 PM - 5:00 PM

**Syndrome Metabolic Risk, Physical Activity And Overweight In Children Of Rural Communities.**

Jose G. Montano Corona<sup>1</sup>, Ma. Teresa Melchor-Moreno<sup>1</sup>, Fernando Cervantes<sup>1</sup>, Roberto Caffo<sup>2</sup>. <sup>1</sup>Universidad de Guanajuato, Leon, Guanajuato, Mexico. <sup>2</sup>Universidad Nacional de Trujillo, Trujillo, Peru. (Sponsor: Universidad de Guanajuato, FACSM) (No relationships reported)

**PURPOSE:** Identify the level of physical activity, dietary habits and metabolic syndrome in rural children.

**METHODS:** 5 boys and 9 girls 10 years of age. They were measured, weight, height and calculated the body mass index (BMI), waist circumference and blood pressure. In addition, we applied the lifestyle survey, Survey Food and blood sample to determine fasting conditions, glucose, HDL, triglycerides. Was implemented with a physical activity monitor and energy expenditure.

**RESULTS:** In men and women body weight was found in 33.0 and 34.0 $\pm$ 4 $\pm$ 2 kg, height 134 $\pm$ 4 and 135 $\pm$ 2 cm and BMI 17.5 $\pm$ 0.4 and 18.6 $\pm$ 0.3 respectively. In addition, physical activity in men and women registered was 45 and 60% (light), 40 and 30% (moderate) and 15 and 5% (intense), respectively. The results in blood was observed that significant differences existed between gender p<0.05=0.0014 and only triglycerides showed values [Unsupported Character - &#8203;] [Unsupported Character - &#8203;] for SM in children.

**CONCLUSIONS:** 100% of the children do daily physical activity, foods high in energy content will increase. There are significant differences in SM variables except abdominal circumference and triglycerides in children only qualified for metabolic syndrome.

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**2572** Board #247 **MAY 31 3:30 PM - 5:00 PM**  
**Eating Behaviors And Fitness Scores Differ By Socio-economic Status In Elementary School Students**  
Mariane M. Fahlman, FACS<sup>1</sup>, Heather L. Hall<sup>2</sup>. <sup>1</sup>Wayne State University, Detroit, MI. <sup>2</sup>Elmhurst College, Detroit, MI.  
(No relationships reported)

There is a clear disparity in health in the United States such that groups of lower socioeconomic status (SES) (L) are more likely to suffer from morbidity and mortality related to chronic disease than those of higher SES (H). While chronic disease does not manifest itself until late in life, the health behaviors that contribute to it begin in childhood and have a cumulative effect. Thus, direct intervention strategies aimed at high risk populations are appropriate.

**PURPOSE:** To determine if fitness levels and eating behaviors differ by SES as early as elementary school.

**METHODS:** The study population consisted of 1064 elementary school students from urban and suburban schools in the Midwest. Students completed the Fitnessgram® fitness test which measured aerobic fitness, abdominal and upper body muscular endurance, back and hamstring flexibility, and body mass index (BMI); and the Eating Behavior Survey which measured intake of fruits, vegetables, meats, grains and non-nutritious foods. Comparisons between SES were conducted using analysis of variance with a Tukey post hoc.

**RESULTS:** Significant differences between H SES and L SES students were found on the following dependent variables in both males and females. ( $p < 0.05$ ). Sample data for females: BMI (L = 20.1 + 1.2; H = 18.5 + 0.5); mile run in seconds (L = 834 + 30.7; H = 626 + 18.5); curl-ups (L = 20.8 + 3.3; H = 35.0 + 2.7); and push-ups (L = 8.7 + 1.3; H = 15.1 + 0.7). Eating behaviors showed similar trends. Fruits (L = 0.8 + 0.3; H = 3.0 + 0.7); vegetables (L = 0.9 + 1.0; H = 2.9 + 1.5); grains (L = 4.8 + 2.3; H = 6.3 + 3.7); and non-nutritious foods (L = 9.2 + 7.3; H = 4.5 + 2.5).

**CONCLUSIONS:** L SES students have lower fitness scores and poorer eating behaviors than H SES students. Recent research indicates that improvements in fitness reduce the risk of becoming overweight across puberty. Targeting these students for interventions at an early age may decrease their risk of obesity related disorders in adulthood.

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**2573** Board #248 **MAY 31 3:30 PM - 5:00 PM**  
**Change in School Choice Policy and Active Commuting to Elementary School**  
John R. Sirard<sup>1</sup>, J. Michael Oakes<sup>2</sup>, Kelsey McDonald<sup>2</sup>. <sup>1</sup>University of Virginia, Charlottesville, VA. <sup>2</sup>University of Minnesota, Minneapolis, MN.  
(No relationships reported)

The strongest and most consistent correlate of whether a child will walk to school is the commute distance. In existing urban areas, restricting school choice, which forces more children to attend their neighborhood school, may reduce this distance barrier to actively commuting to school.

**PURPOSE:** The purposes of this study were to assess the effect of a new, more restrictive school choice policy, which separated the city into three geographical transportation zones, on changes in 1) travel distance to school for students in Minneapolis K-5 and K-8 schools and 2) prevalence of active commuting to Minneapolis K-5 and K-8 schools. We hypothesized that travel distance to school would decrease and the proportion of students actively commuting would increase.

**METHODS:** Baseline data were collected in spring 2010 and follow-up data in fall 2010 after the policy went into effect. School district transportation data were used to determine distance to school for the approximately 20,500 enrolled students across 39 schools. Direct observations of student travel modes (i.e., walking, bicycling, auto) during morning and afternoon commute times were used to assess changes in active and automobile commuting for school. Each school was observed by trained research staff on 2 morning and 2 afternoon commutes at each time point. A transportation survey was completed by the transportation coordinator at each school to control for any new active commuting programs or infrastructure projects.

**RESULTS:** Across all schools, distance to school significantly decreased from spring to fall 2010 (1.83+0.48 miles vs. 1.74+0.46 miles;  $p=0.002$ ). From spring to fall, there was a statistically significant 1% increase in the proportion of students actively commuting (about 205 students;  $p=0.024$ ) that was seen for the morning ( $p=0.033$ ) and afternoon commuting times ( $p=0.018$ ).

**CONCLUSIONS:** We observed a significant increase in active commuting to and from school after implementation of a restricted school choice policy, which was similar across the transportation zones. These findings indicate that reducing school choice options may decrease travel distance and increase active commuting to school.

Supported by a grant from Active Living Research #67295.

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**2574** Board #249 **MAY 31 3:30 PM - 5:00 PM**  
**A Survey of Sports Health and Nutrition in Urban High School Athletes**  
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(No relationships reported)

**PURPOSE:** To survey the baseline knowledge of sports health and nutrition in urban high school athletes and identify areas that can be targeted for education.

**METHODS:** Student-athletes enrolled in grades 9-12 at an urban, Title I-funded, public high school were asked to submit self-reported age, height, and weight, and complete a 23-item multiple-choice questionnaire covering various topics in sports nutrition and health. CDC criteria were used to determine BMI %ile, underweight, overweight, and obesity. Comparisons of means and proportions were made using two-tailed t-tests and confidence intervals, respectively.

**RESULTS:** 424 students (304 M, 120 F) completed the survey. Mean age was 16 y (M 15.8 y, F 15.9 y;  $p = 0.76$ ). Mean BMI %ile was 68.9, (M 69.9, F 66.1;  $p = 0.15$ ). 32% were overweight (M 34%, F 24%; CI 0.003-0.2) and 15% were obese (M 19%, F 4%; CI 0.09-0.21). 1 boy and 1 girl were underweight. Overall, 44% were happy with their bodies (M 47%, F 38%; CI -0.02-0.19). Girls more frequently reported a desire to lose weight (M 37%, F 67%; CI 0.2-0.4) and endorsed planning to lose weight (M 14%, F 25%; CI 0.02-0.19). Boys were more likely to desire gaining weight (M 32%, F 7%; CI 0.18-0.32). 9% of athletes reported current dieting to lose weight (M 9%, F 11%; CI -0.09-0.04) and 15% admitted to dieting to lose weight in the past (M 14%, F 18%; CI -0.12-0.04) with no significant differences between sexes. 76% identified carbohydrates (CHO) as an important source of fuel during exercise, but only 48% and 58% correctly identified cereals and fruit, respectively, as good sources of CHO. Girls were more likely to consider nuts a good source of CHO (M 55%, F 69%; CI 0.05-0.25), whereas boys were more likely to consider steak a good source of CHO (M 36%, F 26%; CI 0.01-0.2). 59% of athletes considered a high protein diet the ideal diet for teenage athletes and 56% considered protein an important source of fuel during exercise. 60% believed that all athletes should be taking a daily multivitamin. Boys were more likely to agree with the statement that B vitamins improve exercise performance (M 14.5%, F 5.8%; CI 0.14-0.03). 57% of girls were able to identify the female athlete triad.

**CONCLUSIONS:** High school athletes display deficits in several areas of knowledge related to sports health and nutrition, and may benefit from targeted education addressing these topics.

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**2575** Board #250 **MAY 31 3:30 PM - 5:00 PM**  
**The Relationship Between Active Travel to School, Sports Participation and Obesity in Young People**  
M. Joao C A Almeida, Marlene M. Rodrigues, Ana J A Rodrigues, Mario A. Botelho, Diogo J. Neves, Fatima J. Goncalves, Marco Fernandes. *University of Madeira, Funchal, Portugal.*  
(No relationships reported)

Informal physical activity (PA) such as active travel to school (ATS) is an important source of physical activity for children and adolescents. However, more research is needed for better understanding the relationship between ATS and parameters of health-related fitness.

**PURPOSE:** The purpose of this study is to investigate the relationship between ATS and, % body fat (%BF) and estimates of  $VO_2$ max.

**METHODS:** Participants in this study were 1329 adolescents (630 boys and 699 girls), between 10 and 17 years of age ( $x=11.7\pm 1.6$  yrs), from 4 schools in Madeira Island, Portugal. Participants completed the PAQ-C questionnaire (Crocker et al., 1997), and answered questions about transport to and from school as well as sport participation. Measures for height, weight, waist circumference, triceps and calf skinfolds were taken, % BF was estimated according to Slaughter et al. (1988), and participants classified in health risk categories (Lohman, 1987).

**RESULTS:** Of all participants, only 10% walked daily to and from school, with a duration of at least 20 minutes. About 53.1% of participants did not participate in any organized activities

apart from PE classes, and 41% had a high or very high %BF. Results showed significant differences between boys and girls ( $p < 0.05$ ), with boys reporting higher mean levels in the PA score ( $2.73 \pm 0.71$  vs.  $2.23 \pm 0.51$  for boys and girls, respectively), with a significant decrease in the PA scores, as age increased. Students who went to school by car or bus (non-ATS) had a significantly higher %BF ( $p < 0.05$ ), compared to those who use ATS (26.7% vs. 22.2%, respectively). Three predictors for high or very high % BF were identified: being younger (OR=1.136; 95%IC: 1.036-1.246), using non-ATS (OR=1.002; 95%IC: 1.000-1.005), and not participating in organized sports and activities (OR = 1.212; 95%IC: 1.034-1.421).

**CONCLUSION:** Strategies to promote PA in youth should target active travel to school, younger ages and opportunities for participating in organized physical activities.

Sponsored by the Research Center of Sport, Health and Human Development (CIDESD) and the Department of Education in Madeira Autonomous Region

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2576 Board #251 MAY 31 3:30 PM - 5:00 PM

**Screening for Risk of the Female Athlete Triad Among High School Athletes**

Katie N. Brown<sup>1</sup>, Heidi J. Wengreen<sup>1</sup>, Katherine A. Beals, FACSM<sup>2</sup>. <sup>1</sup>Utah State University, Logan, UT. <sup>2</sup>University of Utah, Salt Lake City, UT.

(No relationships reported)

Screening to identify high school athletes at risk for the Female Athlete Triad (Triad) would allow for intervention to prevent deleterious effects of the Triad. Currently there are no screening tools that are brief and easy to administer to large numbers of athletes in a high school setting.

**PURPOSE:** To develop and explore the use of a brief survey to assess knowledge and prevalence of Triad risk factors among female high school athletes so as to guide the development of future screening and intervention programs.

**METHODS:** Female high school athletes (n=163) representing a variety of sports completed a brief questionnaire that assessed knowledge of the components of the Triad as well as Triad risk factors including eating behaviors, body weight beliefs, menstrual history and history of stress fracture. Triad knowledge questions were piloted among 52 athletes, and formally assessed in the remaining 91. Descriptive statistics were calculated and differences between athlete groups were examined using analysis of variance and chi squared distributions.

**RESULTS:** None of the athletes had heard of the Triad and few answered the Triad knowledge questions correctly. Only 31% knew that skipping a period during training was not normal; 30% knew that not eating enough could influence menstrual dysfunction; 13% knew that stress fractures occurred more frequently in girls who skip their period; and 23% knew that skipping periods could cause their bones to become weak. Cheerleaders had more correct answers (53%) than the other athlete groups ( $p = .006$ ). Nineteen percent of athletes reported having suffered a stress fracture, although this was more common among drill team members (59%,  $p < .0001$ ). A history of amenorrhea was reported by 24% of athletes. Seventeen percent of the athletes had a BMI  $< 18.5$  kg/m<sup>2</sup>, 79% had a BMI between 18.5 kg/m<sup>2</sup> and 25 kg/m<sup>2</sup>, and 4% had a BMI greater than 25 kg/m<sup>2</sup>. The average desired weight change was -4.0 lbs. Of the 46 athletes (28%) who reported wanting to lose more than 10 lbs, 92% had a BMI less than 25 kg/m<sup>2</sup>. Fifty-nine percent of the athletes reported feeling pressure to be a certain weight; for most (80%) the pressure was self-imposed.

**CONCLUSIONS:** Knowledge of the Triad among this group of female high school athletes was poor and many were demonstrating behaviors and attitudes that placed them at risk for the Triad.

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2577 Board #252 MAY 31 3:30 PM - 5:00 PM

**Physical Activity In Adolescents In An Olympic Borough Prior To The London 2012 Olympic Games**

Zoe Hudson, Stephanie JC Taylor, Eoin McNamara. *Barts and The London School of Medicine and Dentistry, Queen Mary University of London, London, United Kingdom.*

(No relationships reported)

Overweight and obesity continues to escalate in children. Tower Hamlets (TH) is multi ethnic, socio-economically deprived and one of the five Olympic boroughs for the Olympic Games in London 2012.

**PURPOSE:** To evaluate current pedometer determined physical activity and body composition in 11-12 yr olds in TH.

**METHODS:** All secondary schools were invited to participate. A sealed pedometer was worn for 7 days. Internationally recognised mean daily step count cut-offs (boys = 15000, girls = 12000) were used to define activity level. BMI, BIA-determined % body fat (BF) and waist circumference (WC) were all measured. Children were classified as normal weight, overweight or obese according to international cut-off points. A questionnaire was also administered to establish socioeconomic status and ethnicity.

**RESULTS:** 452 boys and 229 girls took part, 69 and 62% were South Asian, respectively. Boys were more active than girls (mean daily steps  $11,580 \pm 3560$  vs  $10,062 \pm 3239$ ) ( $p < 0.001$ ). Activity was greater during the week compared to the weekend (mean step counts of 11,297 and 10,080, respectively). There was no significant difference by ethnicity or socioeconomic status. Overweight/obesity ranged from 33.5%, 53.2% and 61.5% for BMI, % BF and WC, respectively (Table 1). BMI cut-offs may under-estimate overweight/obesity in a South Asian population.

Table 1 Percentage body composition according to 3 different measures

|            | BMI  | WC   | % BF |
|------------|------|------|------|
| Normal     | 66.0 | 46.8 | 38.5 |
| Overweight | 20.5 | 23.8 | 16.5 |
| Obese      | 13.5 | 29.4 | 45.0 |

There was no significant interaction between activity and body composition in this cohort.

**CONCLUSION:** Over 50% were overweight or obese according to % BF and WC. Only 16.6 % of boys and 27.9 % of girls achieved the minimum recommended daily step counts. Intervention strategies are required.

Supported by an Icebreaker grant

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2578 Board #253 MAY 31 3:30 PM - 5:00 PM

**Physical Activity, Bmi Percentile, And Vascular Health In U.s. Children And Adolescents: Nhanes 2003-2006**

Heather H. Betz<sup>1</sup>, Joey C. Eisenmann<sup>2</sup>, Kelly R. Laurson<sup>3</sup>, Katrina D. DuBose, FACSM<sup>4</sup>, James M. Pivarnik, FACSM<sup>5</sup>, Mathew J. Reeves<sup>5</sup>, Joseph J. Carlson<sup>5</sup>, Karin A. Pfeiffer, FACSM<sup>6</sup>. <sup>1</sup>Albion College, Albion, MI. <sup>2</sup>Helen DeVos Children's Hospital, Grand Rapids, MI. <sup>3</sup>Illinois State University, Normal, IL. <sup>4</sup>East Carolina University, Greenville, NC. <sup>5</sup>Michigan State University, East Lansing, MI.

(No relationships reported)

**PURPOSE:** To examine the main effects and combined association of physical activity (PA) and body mass index (BMI) percentile on resting blood pressure (BP) and C-reactive protein (CRP) in a nationally representative sample of United States (U.S.) children and adolescents from the National Health and Nutrition Examination Survey (NHANES).

**METHODS:** Cross-sectional analysis of the 2003-2004 and 2005-2006 NHANES was performed. Inclusion criteria included children and adolescents 8 to 18 years of age (1303 boys, 1282 girls) with BMI, BP, CRP, and PA data. BMI was calculated from measured height and weight (kg/m<sup>2</sup>). BMI percentiles were determined from Centers for Disease Control and Prevention growth charts. Resting BP was measured by standard procedure and mean arterial pressure (MAP) was calculated. CRP was analyzed from venous blood samples and log transformed for analysis. Subjects with CRP values greater than 10mg/L were excluded due to possibility of infection. PA [defined as minutes of moderate-to-vigorous PA (MVPA)] was assessed by accelerometry.

Subjects who wore the accelerometers  $> 10$  hours/day for  $> 4$  of the 7 measurement days were included in the analysis. Independent main and interaction effects of PA (MVPA minutes) and BMI percentiles with BP and CRP were analyzed separately using multivariate linear regression analysis. Separate analyses were undertaken in girls and boys.

**RESULTS:** A significant main effect for BMI percentiles was found in both boys and girls when examining CRP ( $\beta = 0.02$ ,  $p < 0.0001$ , boys;  $\beta = 0.02$ ,  $p < 0.001$ , girls) and systolic BP ( $\beta = 0.07$ ,  $p = 0.002$ , boys;  $\beta = 0.09$ ,  $p < 0.0001$ , girls). No main effect was found for PA. In either gender, there were no significant interactions between PA and BMI percentile on either BP (MAP, systolic BP, or diastolic BP) ( $p = 0.22-0.76$ , boys;  $p = 0.18-0.92$ , girls) or CRP ( $p = 0.96$ , boys;  $0.50$ , girls).



**CONCLUSION:** BMI percentile, but not MVPA minutes, was directly associated with CRP and systolic BP in a nationally representative sample of U.S. children and adolescents. No combined association was seen between PA and BMI percentile when examining BP or CRP. Our data suggest that a public health focus should be reducing fatness in children and adolescents with elevated BP and CRP.

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**2579** Board #254 MAY 31 3:30 PM - 5:00 PM

**Validity of Accelerometry During Free-Living Activity In Children**

Scott E. Crouter, FACSM<sup>1</sup>, Magdalene Horton<sup>1</sup>, David R. Bassett, Jr, FACSM<sup>2</sup>. <sup>1</sup>University of Massachusetts Boston, Boston, MA. <sup>2</sup>The University of Tennessee Knoxville, Knoxville, TN.

(No relationships reported)

Accelerometers are commonly used to assess free-living physical activity (PA). Most validation studies with accelerometers focus on structured activities; however it has not been determined how well they work under free-living conditions.

**PURPOSE:** The primary purpose of this study was to examine the validity of the Crouter vector magnitude 2-regression model (Cvm2RM) and the Crouter vertical axis 2RM (Cva2RM) for children, to estimate energy expenditure (EE) and time spent in sedentary behaviors (SB), light PA (LPA), moderate PA (MPA), and vigorous PA (VPA) during a 2-hr free-living measurement. A secondary purpose was to examine single linear regression equations for children under the same conditions.

**METHODS:** Twenty-seven boys and 15 girls (mean±SD; age, 12±0.8 yrs; BMI percentile, 73.1±28.4%) were monitored for 2-hrs of free-living activity. Activity data was collected using an ActiGraph GT3X+, positioned on the right hip, and measured EE (METs) was obtained using a Cosmed K4b<sup>2</sup>. ActiGraph prediction equations for children (Cvm2RM, Cva2RM, Freedson, Treuth, Trost, and Puyau) were compared against the Cosmed for mean METs and time spent in LPA, MPA, and VPA. Measured METs were calculated as measured activity VO<sub>2</sub> divided by measured resting VO<sub>2</sub>. For comparability all prediction equations were converted to METs using measured resting VO<sub>2</sub>.

**RESULTS:** On average, participants were monitored for 95.0±36.5 minutes. The Puyau equation was within 0.1±1.8 METs of measured METs; all other methods significantly underestimated measured METs (P<0.05). For SB, the Cvm2RM, Treuth and Trost equations were all within 7-min of measured values (P>0.05), the other equations overestimated measured SB time (P<0.05). Measured time spent in LPA and MPA was overestimated by the Cvm2RM (11.0 min) and Puyau (25.2 min) equations, respectively (P<0.05). All prediction equations significantly underestimated measured time spent in VPA. The Cvm2RM and Cva2RM had 95% prediction intervals that were 20-50% lower than the other equations for time spent in SB, LPA, and MPA.

**CONCLUSION:** Compared to the Cosmed, all prediction equations were significantly different from at least one PA intensity category, however the use of a 2RM in children reduced the individual errors compared to other equations.

Study supported by NIH grant 5R21HL093407-02

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**2580** Board #255 MAY 31 3:30 PM - 5:00 PM

**Actigraph Cut-Points for Sedentary Behaviour and Moderate-to-Vigorous Intensity Physical Activity in 2-3 Year Old Children**

Silvia S. N. Costa<sup>1</sup>, Stacy A. Clemes<sup>1</sup>, Sally Barber<sup>2</sup>, Paula Griffiths<sup>1</sup>, Noël Cameron<sup>1</sup>. <sup>1</sup>Loughborough University, Loughborough, United Kingdom. <sup>2</sup>Bradford Institute for Health Research, Bradford, United Kingdom.

(No relationships reported)

Whilst accelerometers have become the preferred instruments for objectively measuring physical activity (PA), the short/sporadic nature of young children's PA patterns requires the use of short (<15 seconds) sampling periods (epochs). There are currently no accepted cut-points for determining time spent in sedentary behaviour and time spent in moderate-to-vigorous intensity PA (MVPA) in toddlers, for epochs shorter than 15 seconds.

**PURPOSE:** To determine Actigraph cut-points for defining sedentary behaviour and MVPA in 2-3 year old children, for 5 and 10 second epochs.

**METHODS:** Twenty-two toddlers (age: 2.92 ± 0.55 years) were video recorded during a 25 minute structured activity session, whilst wearing an Actigraph GT3X+ accelerometer positioned on the right hip with an elastic belt. Children's PA was coded second-by-second using the Children's Activity Rating Scale (CARS). Receiver Operating Characteristic curve analysis was used to determine the sedentary behaviour and MVPA cut-points for accelerometer counts derived from the vertical axis at 5 and 10 second epochs, using the average CARS score per epoch. Epochs with an average CARS score ≤2 were classified as sedentary behaviour, while epochs with an average CARS score ≥4 were classified as MVPA.

**RESULTS:** The sedentary behaviour and MVPA cut-points for 5 second epochs are ≤29 counts/epoch (Se: 82.1%; Spec: 84.0%; Area under the curve (AUC): 0.914) and ≥178 counts/epoch (Se: 86.4%; Sp: 85.3%; AUC: 0.926), respectively.

For 10 second epochs, the sedentary behaviour and MVPA cut-points are ≤85 counts/epoch (Se: 81.9%; Sp: 82.2%; AUC: 0.894) and ≥365 counts/epoch (Se: 84.6%; Sp: 82.6%; AUC: 0.917), respectively.

**CONCLUSIONS:** To our knowledge, this is the first study to develop cut-points at shorter epochs for use in toddlers, using the new ActiGraph GT3X+. The proposed cut-points show high Se and Sp, and can be used to estimate time spent in sedentary behaviour, light and MVPA in 2-3 year old children, for the Actigraph GT3X+.

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**2581** Board #256 MAY 31 3:30 PM - 5:00 PM

**Active Commuting to School Predicts One-year Changes in Children's Physical Activity**

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(No relationships reported)

It has been suggested that children who actively commute to school tend to be more physically active than passive commuters. However, the longitudinal association of active commuting with overall physical activity (PA) has not been well established.

**PURPOSE:** To determine the one-year PA changes among 6-10 years old Chinese children and to examine whether PA levels in active commuters at baseline were less likely to decline than those in passive commuters.

**METHODS:** Participants were a subsample of a cohort in a longitudinal study Understanding Children's Activity and Nutrition (UCAN). PA was assessed by Actigraph accelerometers for 8 consecutive days at baseline and one year follow up. Time spent in moderate-to-vigorous PA (MVPA) was estimated based on the age- and gender-specific cut-off points. Children's usual travel mode to/from school was reported by their parents at baseline. Children were then categorized on the number of active commuting trips to and from school per week, i.e. active, ≥5; passive, 0-5. Changes in PA between baseline and one-year later were assessed using paired *t* test. The association between active commuting on changes in PA was determined using a generalized estimating equations adjusting for gender, age, parental education and baseline body mass index (BMI).

**RESULTS:** A final sample of 166 children (42.2% boys, 7.6 ± 1.0 yr) recorded sufficient ActiGraph data for both assessments, i.e. 10 hours per day during at least 3 weekdays, whilst their parents provided the complete information on the frequency of travel mode to school. MVPA on weekdays decreased at follow-up among 54% of the girls and 60% of the boys. On average, the girls reduced MVPA by 11.8 minutes (95%CI: 1.6, 21.9, P<0.05) while the boys reduced by 3.9 minutes (95%CI: -10.3, 18.1, NS). The active commuters at baseline were more likely to increase their PA participation at follow up compared with the passive commuters (B=19.5, 95%CI: 1.5, 37.4, P<0.05) after adjusting for gender, age, parental education, and baseline BMI.

**CONCLUSIONS:** PA participation decreased over a one year period among Chinese girls. Children who actively commuted to school at baseline were less likely to decrease the PA participation compared with the passive commuters.

2582 Board #257 MAY 31 3:30 PM - 5:00 PM

**Reliability Of Free-living Physical Activity Using Hip- And Wrist-worn Activity Monitors In Adolescents**

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(No relationships reported)

While stability reliability of hip-worn accelerometry-based activity monitors (HAM) has been reported in adolescents, currently there has been no research into the stability reliability of wrist-worn AMs (WAM).

**PURPOSE:** This study examined the stability reliability of physical activity (PA) variables measured by HAM and WAM in adolescents under free-living conditions.

**METHODS:** Eleven girls (Mean  $\pm$  SD: 14  $\pm$  2 yrs) and 10 boys (15  $\pm$  2 yrs) wore a HAM and WAM for 14 consecutive days. The PA variables included: total time (min/day) occurring at a sedentary ( $T_S$ ), light ( $T_L$ ) and  $\geq$  moderate ( $T_{MV}$ ) intensity PA, and the sum of activity energy expenditure (AEE; kcal/day) occurring at a light ( $AEE_L$ ) and  $\geq$  moderate intensity ( $AEE_{MV}$ ), and total AEE ( $AEE_T$ ). Stability reliability was assessed with intraclass correlation coefficients specific to a single day within the monitoring period ( $ICC_{DAY}$ ) calculated using variance values from a RM ANOVA, for all variables for both AM locations and minimum bout durations (BD) of 1-, 5-, and 10-min. The  $ICC_{DAY}$  values allowed for the necessary number of monitoring days to reliably measure ( $ICC_{DAY} \geq 0.80$ ) each variable to be determined. Additionally, 95% confidence intervals (CI) were calculated for all  $ICC_{DAY}$  values to determine if any significant differences existed between variables by AM location.

**RESULTS:** No significant differences in  $ICC_{DAY}$  values were found between HAM and WAM for any variable (i.e., overlapping CIs), however distinct trends were observed. Excluding  $T_L$  measured by the WAM,  $ICC_{DAY}$  values for all variables decreased as BD increased from 1- to 10-min. The number of monitoring days necessary to reliably measure  $AEE_L$ ,  $AEE_{MV}$ ,  $AEE_T$ ,  $T_L$ , and  $T_{MV}$  was greater for HAM versus WAM across BD, ranging from 2-26 versus 2-10 days, respectively. Conversely, the number of monitoring days to reliably measure  $T_S$  was lower for HAM (4-5 days) versus WAM (6-8 days). Among all variables,  $T_L$  measured by both HAM and WAM had the largest range of days necessary to reach an  $ICC_{DAY} \geq 0.80$  across all BDs, 6-26 and 7-10 days, respectively.

**CONCLUSION:** Reliability of PA variables changed with BD and AM location, and was generally higher for WAM. Practically, the results of the study suggest that a monitoring period of 7 consecutive days allows for WAM to reliably measure a variety of free-living PA variables in adolescents.

2583 Board #258 MAY 31 3:30 PM - 5:00 PM

**Comparison Between Sensewear Mini Armband And Actigraph Accelerometers In Classifying Physical Activity Intensities In Youth.**

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(Sponsor: Gregory J. Welk, FACSM)  
(No relationships reported)

**PURPOSE:** The purpose of this study was to compare the accuracy of SMA and Actigraph in classifying youth MVPA in relation to a criterion measure.

**METHODS:** A total of 42 youth ages 7 - 13 (male: 31, female: 11) performed a set of 12 different free living activities while wearing the SMA, an Actigraph and while being monitored with an Oxycon Mobile (OM) metabolic analyzer. The 12 activities (randomly selected from a set of 25) were of varying intensity (i.e. sedentary, light, moderate and vigorous) and were completed in a random order to simulate real world conditions. Each activity lasted 5 minutes, with 1 minute between activities. Six different Actigraph cut-points were applied to estimate MVPA from the Actigraph activity counts [Freedson/Trost (FT), Puyau (PU), Vanhelst (VH), Treuth (TH), Evenson (EV), Mattocks (MT)]. The SMA data were processed using the latest software (version 8.0, pre-released algorithm 5.2e). A metabolic equivalent (MET) of 4 was used to differentiate MVPA from non-MVPA for the OM and SMA. Weighted Cohen's kappa coefficient ( $\kappa$ ), sensitivity (Se) and specificity (Sp) were used to determine classification accuracy compared to the OM. The total recorded minutes of MVPA from OM, SMA and the Actigraph cut-points were also directly compared to one another.

**RESULTS:** SMA showed substantially better classification agreement ( $\kappa = .64$ ) than the various Actigraph cut-points (FT = .34; PU = .18; VH = .34; TH = .20; EV = .28; MT = .16). The Se for OM (.89) was greater than the 6 sets of Actigraph cut-points (range from .24 - .49). The Sp for OM (.75) was smaller than the Actigraph values (range from .97 - .99) but still acceptable. The estimated minutes of MVPA from SMA (48.4 $\pm$ 7.8min) were nearly identical to those from OM (48.7 $\pm$ 9.1min). In contrast, the 6 Actigraph cut-points all underestimated the OM values (FT = 23.5 $\pm$ 8.0min; PU = 13.3 $\pm$ 5.9min; VH = 23.5 $\pm$ 6.8min; TH = 14.3 $\pm$ 6.1min; EV = 19.7 $\pm$ 6.7min; MT = 11.6 $\pm$ 5.5min).

**CONCLUSION:** The SenseWear Mini Armband yielded better classification agreement for monitoring youth physical activity. The high specificity of the various Actigraph cut-points appears to underestimate the actual activity levels of children in simulated free living conditions.

2584 Board #259 MAY 31 3:30 PM - 5:00 PM

**A Comparison Of Weight Status And Health-related Fitness Between Canadian And English 10-yr Olds**

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<sup>2</sup>University of Essex, Colchester, Essex, United Kingdom.  
(No relationships reported)

Over the last few decades, Canada and England have witnessed accelerated increases in childhood obesity and have independently documented secular declines in health-related fitness. No study has directly compared these outcomes between contemporary samples of Canadian and English children.

**PURPOSE:** First, to describe the prevalence of overweight and obesity; and second, to compare health-related fitness - between Canadian and English 10-yr old boys and girls.

**METHODS:** We obtained institutional ethics approval and parental consent to assess Canadian (n = 771, 49% boys; 10.7 $\pm$ 0.6 yrs; Fall 2008) and English children (n = 1030, 51% boys; 10.7 $\pm$ 0.6 yrs; Fall 2008). Measures were: stature (cm), body mass (kg), BMI (kg $\cdot$ m<sup>-2</sup>), aerobic fitness (20 metre shuttle run; laps) and upper body strength (dominant arm hand grip; kg). BMI was used to classify children as overweight or obese as per International Obesity Task Force (IOTF) criteria. We conducted analyses by sex to determine between-cohort differences (Pearson's chi-square, independent t-tests or ANCOVA; PASW v. 18.0; significance set at p < 0.05).

**RESULTS:** Compared with English children, Canadians were significantly taller (boys: 145.8 $\pm$ 7.9 vs. 143.4 $\pm$ 7.5; girls: 146.1 $\pm$ 8.0 vs. 143.9 $\pm$ 7.7) and heavier (boys: 41.8 $\pm$ 11.4 vs. 38.7 $\pm$ 9.2; girls: 40.7 $\pm$ 10.0 vs. 39.1 $\pm$ 9.0); however, prevalence of IOTF weight categories did not differ significantly between countries. More than a quarter of children in Canada and England were overweight (22% vs. 20%) or obese (7% vs. 5%). English children completed significantly more laps in the shuttle run compared with their Canadian peers (boys: 40 $\pm$ 21 vs. 35 $\pm$ 17; girls: 30 $\pm$ 15 vs. 27 $\pm$ 13; respectively). Results did not change after adjusting for age and BMI. Canadian children were significantly stronger than their English counterparts (boys: 21.5 $\pm$ 4.8 vs. 16.8 $\pm$ 3.8; girls: 19.2 $\pm$ 4.7 vs. 15.8 $\pm$ 3.8; respectively). Results did not change after adjusting for age and body mass.

**CONCLUSION:** This is the first study to compare overweight/obesity patterns and fitness levels of Canadian versus English children. Importantly, health-related fitness differed between groups that had a comparable obesity burden. Research into the underlying mechanisms, which are likely to include differences in physical activity patterns, is warranted.

2585 Board #260 MAY 31 3:30 PM - 5:00 PM

**Comparison Of Accelerometer Cut-points In Physical Activity Assessment Of Rural South African Children And Adolescents**

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(No relationships reported)

Objective physical activity assessment is novel in rural Africa, little is known regarding volume or intensity of physical activity in this population and no studies have compared accelerometer cut-points.

**PURPOSE:** To compare accelerometer cut-points for assessing physical activity levels in South African children/adolescents.

**METHODS:** The study took place within the Africa Centre for Health and Population Studies surveillance area in rural KwaZulu-Natal, South Africa. 150 participants; 50 from each school

grade 1, 5 and 9 (7, 11 and 15 years) were randomly selected from a previous cross-sectional study of 1519 and invited to take part in 7 days objectively measured physical activity using ActigraphGT3X accelerometers. Data were analysed using Puyau and Evenson cut-points; levels of moderate to vigorous physical activity (MVPA) were compared between the methods. Data were analysed for participants who had at least 3 days accelerometry with a minimum of 6 hours each day.

**RESULTS:** Of 150 approached, 38 chose not to take part and 23 provided incomplete accelerometer data, therefore, data from 89 participants were available for analysis.

Comparison of levels of MVPA using two different accelerometer cut-points

|                    | School Grade 1 |         | School Grade 5 |         | School Grade 9 |         |
|--------------------|----------------|---------|----------------|---------|----------------|---------|
|                    | Puyau          | Evenson | Puyau          | Evenson | Puyau          | Evenson |
| n                  | 26             |         | 33             |         | 30             |         |
| Mean % MVPA        | 1.6            | 8.0*    | 1.5            | 5.1*    | 0.8            | 2.8*    |
| Mean MVPA Mins/day | 17             | 61*     | 11             | 39*     | 5              | 20*     |

\* significantly different to Puyau, in same grade  $p < .01$

Levels of MVPA were significantly higher using Evenson compared to Puyau cut-points, however compliance with international recommendations (60 minutes MVPA on most days) was extremely low irrespective of cut-point used. Applying Puyau cut-points no participants met the recommendations, for Evenson cut-points 7(27%) in grade 1, 2(6%) in grade 5 and 0(0%) in grade 9 met recommendations.

**CONCLUSION:** These results reveal an urgent need to determine which Actigraph cut-point is most accurate. However, using both cut-points, levels of engagement in MVPA were low in this sample.

**2586 Board #261 MAY 31 3:30 PM - 5:00 PM**  
**Establishing Wrist-based Cutpoints for the Actical Accelerometer in Elementary School Aged Children**

Christine A. Schaefer, Heidi J. Nace, Raymond C. Browning, FACSM. *Colorado State University, Fort Collins, CO.*  
*(No relationships reported)*

Accurate physical activity (PA) monitoring is crucial to understand the effectiveness of PA interventions. Wrist-mounted accelerometer (ACC) use is appealing, particularly in children for whom compliance is challenging. The Actical ACC has been validated and cutpoints established for wrist placement in 8-17 year-old children, but no study has validated its use in younger children performing typical activities.

**PURPOSE:** To establish wrist-based cutpoints for the Actical ACC in elementary aged children and to compare PA estimated by cutpoints using linear regression (LR) and Receiver Operator Characteristics, (ROC) curves.

**METHODS:** Metabolic and ACC data were collected in 6-11 year olds (n=22, mean age (SD), 8.73 (1.70) years, 55% female). Subjects completed 8 activities for 6 minutes each. METs were calculated by dividing measured  $\text{VO}_2$  by estimated resting values from Schofield's equation. LR and ROC were used to examine the relationship between METs and ACC counts. Cutpoints were established at 1.5, 3, 6 and  $\geq 6$  METs for sedentary (sed), light, moderate (mod) and vigorous (vig) activity, respectively. Each set of cutpoints was then applied to a large, multi-day sample (n=269, mean age (SD), 8.7 (1.8) years, 49% female) to examine differences in cutpoints on minutes of PA at each intensity.

**RESULTS:** LR yielded an  $r^2$  value of 0.83 ( $p < .001$ ). Cutpoints for sed, light, mod and vig activity using LR were 21, 2479, 7267, and  $\geq 7268$ , respectively. Cutpoints for sed, light, mod and vig activity using ROC were 208, 1551, 4843, and  $\geq 4844$ , respectively. ROC yielded areas under the curve of 0.95, 0.94 and 0.97 for sed, mod and vig intensities. When applied to a large multi-day sample, LR yielded 75 minutes of mod-vig PA (MVPA) and 63% of the sample met the guideline of 60 minutes of daily MVPA. ROC yielded 140 minutes of MVPA and 98% of the sample met the guideline.

**CONCLUSION:** In light of national data reporting children accumulate ~85 minutes of MVPA/day we recommend researchers use the LR cutpoints for the wrist-mounted Actical. These differences support adopting standardized methods for establishing cutpoints. Until then, within subjects and longitudinal study designs are most appropriate. A move toward collecting raw acceleration data is critical to improve estimates of PA.

**2587 Board #262 MAY 31 3:30 PM - 5:00 PM**  
**Sedentary Behavior And Overweight In Children And Adolescents**

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*(No relationships reported)*

Evidence on the harmful effect of sedentary behaviour on health is emerging. Further, sedentary behaviour in children and youth is a concern as it tracks from childhood into adulthood. Previous studies of sedentary behavior have often relied on self-reported measures of the behavior, such as time spent watching TV. More studies using objective methods to measure sedentary behavior are needed to further explore the association between sedentary behavior and health indicators, such as body mass index (BMI).

**PURPOSE:** The purpose of this study was to determine time spent in sedentary behaviour using accelerometers, and to study the association between time spent in sedentary behaviour and BMI in a population based sample of 9- and 15-year-olds.

**METHODS:** This is a part of the Physical Activity among Norwegian Children Study (PANCS). A total of 2299 9- and 15-year-olds participated in the study, giving a participation rate of 82%. Sedentary behaviour was measured using the Actigraph accelerometer. The sum of minutes at  $< 100$  cpm was used to define time spent at sedentary behavior. Differences between groups were analysed using independent-sample T-test.

**RESULTS:** Nine-year-old boys and girls spent 6.9 h/day and 7.1 h/day, respectively, in sedentary behaviour. The corresponding numbers in 15-year-old boys and girls were 8.8 h/day and 9.0 h/day, respectively. In both age groups, girls spent more time in sedentary behaviour than boys ( $p \leq 0.026$ ), and 15-year-olds spent 2h more per day in sedentary behaviour than 9-year-olds ( $p < 0.001$ ). There was no association between time spent in sedentary behaviour and BMI, with the exception of 9-year-old boys where a weak correlation was observed ( $r = 0.1$ ,  $p = 0.04$ ).

**CONCLUSIONS:** Both 9- and 15-year olds spend a large proportion of the day being sedentary. Girls were more sedentary than boys, and time spent in sedentary behaviour increased with increasing age. The latter suggest that early intervention may be needed to prevent this increase. An association was found between sedentary behaviour in 9-year-old boys only, suggesting that more research is needed.

**2588 Board #263 MAY 31 3:30 PM - 5:00 PM**  
**How Many Days of Accelerometry Monitoring Predict Sedentary Behavior in Preschool Children?**

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*(No relationships reported)*

Accelerometry is emerging as the device of choice for the objective measure of habitual activity in children. However, little research has been conducted to understand the reliability of accelerometry in measuring sedentary behavior in preschool children.

**PURPOSE:** To determine: (1) how many days of accelerometry monitoring are necessary to reliably estimate sedentary behavior in preschool children, and (2) whether the number of days necessary to reliably estimate sedentary behavior differs by application of different cutpoints.

**METHODS:** The participants of this study were preschool children who were enrolled in the Children's Activity and Movement in Preschool Study. We included a total of 212 children who had  $\geq 4$  days of in-school accelerometry data and 150 children who had  $\geq 6$  days (including weekend) of total day data. Sedentary behavior was measured using ActiGraph accelerometers. Accelerometry data were summarized as time spent in sedentary behavior (min/hr of observation) using three different cutpoints developed specifically for 3- to 5-year old children ( $< 37.5$  cts/15s,  $< 200$  cts/15s, and  $< 373$  cts/15s). PROC MIXED procedure was used to determine if the amount of time spent in sedentary behavior is different across days of the week. The ICCs and

95% confidence intervals (CIs) were calculated using variance estimates from repeated ANOVA model. The number of days of accelerometry monitoring required to reliably estimate sedentary was estimated using the Spearman-Brown prophecy formula.

**RESULTS:** On average, the children wore the accelerometers for a total of 12.1 hrs/d and 8.4 hrs/d while in school. Preschool children spent less time in sedentary behavior on weekend days compared to weekdays ( $P < .05$ ). Across different cutpoints, the ICCs ranged from 0.75 to 0.81 for total sedentary behavior, and from 0.81 to 0.92 for in-school sedentary behavior, respectively. To achieve the ICC of  $\geq 0.8$ , between 6.4 and 8.6 days, and between 1.8 and 4.4 days of monitoring was needed for total sedentary behavior, and in-school sedentary behavior, respectively.

**CONCLUSIONS:** The greatest reliability, and hence the lowest number of days needed for the ICC of  $\geq 0.8$ , was obtained using the cutpoints of  $<373$  cts /15s for total daily sedentary behavior (6.4 days), and  $<200$  cts /15s for in-school sedentary behavior (1.8 days) respectively.

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**2589** Board #264 MAY 31 3:30 PM - 5:00 PM

**Do Physically Active Young Children Maintain Their Activity Levels After The Preschool Day?**

Jennifer R. O'Neill<sup>1</sup>, Marsha Dowda, FACSM<sup>1</sup>, Karin A. Pfeiffer, FACSM<sup>2</sup>, Russell R. Pate, FACSM<sup>1</sup>. <sup>1</sup>University of South Carolina, Columbia, SC. <sup>2</sup>Michigan State University, East Lansing, MI.

(No relationships reported)

Increasing attention on young children's low levels of physical activity (PA) from expert panels and policy makers has highlighted the need to understand young children's PA, both in school and out of school.

**PURPOSE:** To determine if the most active children during the preschool day are the most active children outside of preschool.

**METHODS:** Participants were 351 children, mean age  $4.6 \pm 0.3$  years (50% male, 49% African American), from 16 preschools in central South Carolina. Children wore accelerometers for 5 consecutive weekdays. School day was defined by each preschool as the period of instruction. In-school and out-of-school min-hr<sup>-1</sup> of moderate to vigorous physical activity (MVPA) were calculated. Children in the highest quartile of in-school MVPA (*High Active*) were compared to those in the lower 3 quartiles of in-school MVPA (*Low Active*) using mixed model ANOVA, separately for males and females. Models controlled for race/ethnicity, and parental education; preschool was a random variable.

**RESULTS:** Children wore accelerometers for an average of 6.0 and 6.5 h-d<sup>-1</sup> in school and out-of-school, respectively. Children engaged in MVPA for  $6.9 \pm 2.6$  min-hr<sup>-1</sup> in school and  $8.7 \pm 3.3$  min-hr<sup>-1</sup> out-of-school. Males were more active than females during preschool ( $7.4 \pm 2.6$  vs.  $6.3 \pm 2.5$  min-hr<sup>-1</sup>;  $p < .05$ ) and outside preschool ( $9.0 \pm 3.3$  vs.  $8.3 \pm 3.2$  min-hr<sup>-1</sup>;  $p < .05$ ). *High Active* males obtained more in-school MVPA ( $10.5 \pm 0.5$  min-hr<sup>-1</sup>) than *Low Active* males ( $6.1 \pm 0.3$  min-hr<sup>-1</sup>;  $p < .05$ ). For out-of-school MVPA, there was no difference between *High Active* males ( $9.6 \pm 0.5$  min-hr<sup>-1</sup>) and *Low Active* males ( $8.7 \pm 0.3$  min-hr<sup>-1</sup>;  $p = .06$ ). *High Active* females accumulated more in-school MVPA ( $9.5 \pm 0.4$  min-hr<sup>-1</sup>) than *Low Active* females ( $5.3 \pm 0.3$  min-hr<sup>-1</sup>;  $p < .05$ ). *High Active* females obtained more out-of-school MVPA ( $9.5 \pm 0.4$  min-hr<sup>-1</sup>) than *Low Active* females ( $8.5 \pm 0.3$  min-hr<sup>-1</sup>;  $p < .05$ ).

**CONCLUSIONS:** The most active males in preschool had similar out-of-school MVPA compared to the least active males in preschool. The most active females during the preschool day were the most active females outside of preschool.

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**2590** Board #265 MAY 31 3:30 PM - 5:00 PM

**Parental Perception of Neighborhood Environments and Children's Physical Activity in Hong Kong**

Gang He, Wendy Y. Huang, Stephen H. Wong, FACSM. *The Chinese University of Hong Kong, Hong Kong, China.*

(No relationships reported)

**PURPOSE:** Examining neighborhood environments is important to explain and promote physical activity (PA) of children, but it is under-investigated among Chinese population. Therefore, the purpose of this study was to investigate the association between parental perception of neighborhood environments and PA in Hong Kong children.

**METHODS:** 280 children (143 boys) aged 6-10 years and their parents were recruited from 14 local schools. Children were instructed to wear an ActiGraph GT3X accelerometer for 8 consecutive days to determine their PA level. Average time (minutes/day) spent on moderate to vigorous PA (MVPA) was calculated based on Freedson's age-specific cut-off counts. Parental perceived neighborhood environments, namely supervision, safety, facilities and climate, were determined by a valid questionnaire. Data were collected as part of a longitudinal study; Understanding Children's Activity and Nutrition (UCAN). Gender differences in MVPA minutes were determined using independent samples T test. Association between neighborhood environmental variables and PA was determined by Pearson correlations. Variables with significant associations were further examined using multiple regression analyses adjusting for age and parental education.

**RESULTS:** Boys were more physically active than girls (MVPA:  $142 \pm 47$  vs.  $112 \pm 41$  minutes/day,  $P < 0.05$ ). No associations were found in any neighborhood environmental variables with boys' MVPA. For girls, supervision, facilities and climate were significantly related to PA level ( $P < 0.05$ ). Multiple regression analyses revealed that after controlling for age and parental education, supervision ( $b = 10.12$ ; 95%CI = 3.52 to 16.73) and climate ( $b = -9.47$ ; 95%CI = -17.13 to -1.81) were associated with girls' MVPA ( $P < 0.05$ ).

**CONCLUSIONS:** Parental perception of supervision and climates might influence PA participation amongst girls in Hong Kong.

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**2591** Board #266 MAY 31 3:30 PM - 5:00 PM

**Establishing Wrist-based Cutpoints For The GeneActiv Accelerometer In Elementary School Aged Children**

Raymond C. Browning, FACSM, Christine A. Schaefer, Heidi J. Nace, Paige E. Kyle. *Colorado State University, Fort Collins, CO.*

(No relationships reported)

Accurate physical activity (PA) monitoring is necessary to evaluate PA interventions. Wrist-mounted accelerometer (ACC) use is appealing, particularly in children for whom compliance is challenging. However, concern exists regarding the accuracy of the monitor at the wrist. The GeneActiv ACC has been validated and intensity cutpoints established for wrist placement in adults, but no study has validated its use in children performing typical activities.

**PURPOSE:** To establish wrist-based intensity cutpoints for the GeneActiv ACC in children performing typical activities.

**METHODS:** Metabolic and ACC data was collected in 6-11 year olds ( $n = 18$ , mean age (SD), 9.33 (1.0) years, 67% female) while they performed 9 activities for 6 minutes each. METs were calculated by dividing measured  $\text{VO}_2$  by estimated resting values. ACC data was collected at 75Hz and gravity subtracted summed vector magnitudes (SVM) were calculated for each second. Linear regression was used to examine the relationship between METs and SVM using all activities (AA) as well as after removing active gaming (NG). Cutpoints were established at 1.5, 3, 6 and  $\geq 6$  METs for sedentary (sed), light, moderate (mod) and vigorous (vig) activity, respectively.

**RESULTS:** AA and NG yielded  $R^2$  values of 0.73 and 0.88, respectively ( $p < .001$ ). Cutpoints for sed, light, mod and vig activity using AA were 5.2, 20.9, 52.4 and  $\geq 52.4$ , respectively. Cutpoints for sed, light, mod and vig for NG were 2.1, 17.4, 48.1 and  $\geq 48.1$ , respectively.

**CONCLUSION:** Active gaming involving significant wrist movement decreases the strength of the relationship between SVM and METs using LR. This highlights the need for activity specific intensity classification, particularly for activities involving wrist movement.

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**2592** Board #267 MAY 31 3:30 PM - 5:00 PM

**Relationship between Moderate-to-Vigorous Physical Activity and Daily Step Counts in Elementary School Children**

Chiaki Tanaka<sup>1</sup>, Maki Tanaka<sup>2</sup>, Shigeho Tanaka<sup>3</sup>. <sup>1</sup>J. F. Oberlin University, Tokyo, Japan. <sup>2</sup>Kyoto Seibo College, Kyoto, Japan. <sup>3</sup>National Institute of Health and Nutrition, Tokyo, Japan.

(No relationships reported)

Locomotion is one of the important parts of physical activity in free living conditions and daily step counts have been used as an index of physical activity in many studies. However, data on the relationship between total steps and minutes of engagement in moderate-to-vigorous physical activity including non-locomotive activities are lacking for elementary school children.

**PURPOSE:** The purpose of the present study was to evaluate moderate-to-vigorous physical activity using triaxial accelerometry in Japanese elementary school children. The relationship between daily step counts as a convenient measure of physical activity and minutes of engagement in moderate-to-vigorous physical activity was also examined.

**METHODS:** Physical activity was assessed using a triaxial accelerometer (Active style Pro : HJA-350IT, Omron Health Care) and daily steps for 6 consecutive days, including weekdays and weekend days, in 223 six- to twelve-year-old Japanese children attending elementary school. The algorithm for the classification of locomotive and non-locomotive activities and physical activity intensity (metabolic equivalents) of these activities has been developed for adults (Oshima, 2010; Ohkawara, 2011) and modified for elementary school children. Using the triaxial accelerometer, minutes of locomotive and non-locomotive activities and step counts for children can be evaluated, respectively.

**RESULTS:** Average daily moderate-to-vigorous physical activity (metabolic equivalents $\geq$ 3) and step counts were 60 ( $\pm$ 27) min/day and 11,814 ( $\pm$ 2,866) steps/day, respectively. A strong and significant correlation was observed between minutes of moderate-to-vigorous physical activity and step counts ( $r=0.83$ ,  $p<0.001$ ). The daily step counts corresponding to 60 min, 100 min, and 120 min of moderate-to-vigorous physical activity were 11,843, 15,362, and 17,121 steps/day, respectively.

**CONCLUSIONS:** These results suggest that approximately 12,000 steps/day are required for elementary school children to engage in more than 60 min of moderate-to-vigorous physical activity. Supported by Health Sciences Research Grants (Research on Health Science) from the Ministry of Health, Labor and Welfare (to C. Tanaka) and a grant from Sumitomo Life Health Foundation in 2010 (to C. Tanaka).

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**2593** Board #268 MAY 31 3:30 PM - 5:00 PM

**Associations between After-School Settings with Physical Activity and Sedentary Behavior in 5th Grade Children**

Sharon Ross<sup>1</sup>, Marsha Dowda, FACSM<sup>1</sup>, Natalie Colabianchi<sup>2</sup>, Ruth Saunders<sup>1</sup>, Russell Pate, FACSM<sup>1</sup>. <sup>1</sup>University of South Carolina, Columbia, SC. <sup>2</sup>University of Michigan, Ann Arbor, MI.

(No relationships reported)

**PURPOSE:** Amid a childhood obesity and inactivity epidemic, the after-school context has been identified as one setting that can be modified to increase children's physical activity (PA); however, little is known about how PA and sedentary behavior (SB) vary by after-school setting for children of different race/ethnicities. This study aims to determine the relative influence of time spent at home vs. in after-school programs on children's PA and SB during after-school hours (3-6pm), and differences by race/ethnicity.

**METHODS:** A total of 662 5th graders (n=297 boys, n=365 girls) participating in the Transitions and Activity Changes in Kids (TRACK) study provided accelerometer data for 5 weekdays; parents reported their child's location after school (i.e., home [with supervision or at a relative/friend's home] or after-school program [at school or other location]). Unadjusted and adjusted mixed-model ANOVA was used to test for mean differences in PA and SB by after-school setting, including interactions by race/ethnicity.

**RESULTS:** Boys who attended an after-school program (16.2%) spent less time in SB and had higher levels of moderate-to-vigorous (MVPA) and total PA (all  $p<0.05$ ) compared with those who were at home during after-school hours. A significant interaction effect was found for race and after-school setting for females; non-white (black and Hispanic) females who attended after-school programs (21.9%) accrued an additional 15 minutes of total PA and reduced their SB by 15 minutes per day compared to those who stayed at home during after school hours (3-6pm) ( $p<0.01$ ). Further, non-white females attending after-school programs engaged in an additional 7 minutes of MET-weighted MVPA and 3 minutes of MVPA per day compared to non-white females who stayed at home after-school ( $p<0.05$ ). There was no difference for White girls in the amount of time spent in SB, MVPA or total PA by after-school setting.

**CONCLUSIONS:** Boys and black and Hispanic girls attending after-school programs were more physically active than those who stayed at home during after-school hours. Efforts should focus on recruiting children into after-school programs, as well as examining the characteristics of after-school programs that promote physical activity in this group.

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**2594** Board #269 MAY 31 3:30 PM - 5:00 PM

**Validity of Family Day Care Providers' Proxy Reports on Children's Physical Activity**

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(No relationships reported)

Interventions to promote physical activity (PA) in children attending Family Day Care require valid, yet practical measurement tools. Among preschool-aged children, PA is typically measured using direct observation or motion sensors; however, the cost and participant burden associated with these methods make them difficult to implement in large surveillance studies and/or community-level program evaluations. For these scenarios, proxy-reports completed by Family Day Care Providers (FDCPs) may be a viable option; however, the validity of this approach has not been evaluated.

**PURPOSE:** To assess the concurrent validity of a brief caregiver proxy report instrument designed to measure PA in 2- to 5-year old children attending Family Day Care.

**METHODS:** FDCPs (N=39) completed a modification of the Burdette et al. (2004) parental proxy report. For each child under their care, FDCPs recalled the usual duration of outdoor play time from arrival to lunchtime and from lunchtime to departure. Responses were recorded on a 5-point scale consisting of 0 = 0 min, 1 = 1-15 min, 2 = 16-30 min, 3 = 31-60 min, and 4 = over 60 min. A single PA score was calculated by averaging the responses. 107 children (53.2% male) between the ages of 2 and 5 y (mean age = 3.4  $\pm$  1.2 yrs) wore the ActiGraph GT1M accelerometer for the duration of child care attendance during a single week. Time spent in moderate-to-vigorous PA (MVPA), and light- moderate-vigorous PA (LMVPA) was calculated using the intensity-related cut-points developed by Pate et al. (2006). Associations between FDCP-reported PA and objectively measured MVPA and LMVPA were assessed using Pearson product moment correlations. Additionally, one-way ANOVA was used to evaluate differences in objectively measured PA across levels of FDCP-reported PA.

**RESULTS:** Significant positive correlations were observed between FDCP-reported PA and objectively measured LMVPA ( $r = 0.31$ ,  $p < 0.01$ ) and MVPA ( $r = 0.33$ ,  $p < 0.01$ ). Across levels of FDCP-reported PA, both LMVPA ( $F(2, 104) = 7.82$ ,  $p = .009$ ) and MVPA ( $F(2, 104) = 8.71$ ,  $p = .0003$ ) increased significantly in a linear dose-response fashion.

**CONCLUSIONS:** Proxy PA reports completed by FDCPs were significantly correlated with objectively measured PA, and may be a valid assessment option in studies where more burdensome objective measures are not feasible.

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**2595** Board #270 MAY 31 3:30 PM - 5:00 PM

**Associations Of Physical Activity, Screen Time, And Bmi With Quality Of Life In Urban Children**

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(No relationships reported)

Health-related quality of life (HRQoL) includes measures of physical health, emotional functioning, and social functioning. Previous studies have shown that overweight children have lower quality of life scores when compared to healthy-weight children. However, limited research is available regarding the potential associations of HRQoL with physical activity (PA) and screen time (ST) in low socioeconomic children.

**PURPOSE:** The purpose of this study was to examine the associations of physical activity, screen time, and BMI with HRQoL in children from a racially diverse, low socioeconomic status area.

**METHODS:** Participants were 197 children (50% males, 64% African American) from four elementary schools (~80% eligible to receive free/reduced lunch) in/near Flint, Michigan. PA was assessed using pedometers (New Lifestyles, SW-200) and a survey question. ST was assessed using children's self-report for viewing television, playing video games, and online computer use. Quality of life was assessed using the Pediatric Quality of Life (PedsQL) inventory. Mann Whitney U tests were used to assess differences between sexes and/or weight status for HRQoL, PA, ST, and BMI. Spearman correlations were used to assess the relationships between HRQoL and physical activity (separately for pedometer and survey question), screen time and BMI.

**RESULTS:** Approximately 27% and 5% met guidelines for PA and ST, respectively, while 45% were overweight or obese. Approximately 33% did not meet the cut-off score for HRQoL (impaired HRQoL). No differences were found for PA, ST, BMI or HRQoL between sexes and/or weight status. No significant associations were found between HRQoL (76.0  $\pm$  15.9) and PA (4.0  $\pm$  2.0 days/week,  $r = -0.07$ ; 8848  $\pm$  399 steps/day,  $r = -0.02$ ), between HRQoL and screen time (19.1  $\pm$  13.9 hours/week,  $r = -0.01$ ), or between HRQoL and BMI (21.6  $\pm$  6.0  $r = -0.04$ ).

**CONCLUSION:** There were no associations between quality of life scores with physical activity, total screen time, or BMI. Results also did not show differences between overweight and normal weight children in HRQoL, which was contrary to existing literature (Williams et al., 2005; Riazzi et al., 2010). It is likely that variables aside from PA, ST and BMI are more relevant to minority/low-SES populations with regard to HRQoL.

This study was funded by the Crim Fitness Foundation

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2596 Board #271 MAY 31 3:30 PM - 5:00 PM

**Association Between Serum Sex Hormone and Obesity Status in Pubertal Chinese Boys**

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(No relationships reported)

Over the past decades, the prevalence of obesity in children and adolescents has increased dramatically. However, it is not clear whether sex hormone profiles are associated with obesity status in pubertal Chinese boys.

**PURPOSE:** To evaluate the association between sex hormone profiles and obesity status in pubertal Chinese boys.

**METHODS:** A total of 30 pubertal Chinese boys aged 13-15 years were recruited in this study, including 15 obese boys (obese group, BMI: 29.8 ± 2.4 kg/m<sup>2</sup>, age: 14.2 ± 0.8 years), and 15 normal weight boys (control group, BMI: 19.4 ± 2.0 kg/m<sup>2</sup>, age: 14.7 ± 1.0 years). Venous blood samples were collected in the morning after an overnight fast. Body fat (BF) and weight were measured using a body composition instrument (Model InBody 230, Biospace, Korea). Height was measured to the nearest 0.1 cm using a stadiometer. Serum sex hormones, i.e., testosterone (T) and estradiol (E<sub>2</sub>) were assessed through chemiluminescence immunoassay method.

**RESULTS:** The obese group had a higher BF than control group (30.4 ± 4.6 % vs. 15.6 ± 5.4 %, p<0.01). The serum T level was lower in the obese group compared with that in control group (2.8 ± 1.1 vs. 4.2 ± 1.8 ng/ml, p<0.05). There was no statistical difference between the two groups in E<sub>2</sub> level (obese group vs. control group: 26.5 ± 13.4 vs. 20.3 ± 9.4 pg/ml, NS). However, a higher ratio of E<sub>2</sub>/T was found in obese group compared with control group (9.7 ± 3.7 vs. 5.2 ± 2.3, p<0.01). BF was negatively associated with T level (r = -0.386, p<0.05), and positively associated with E<sub>2</sub> level (r = 0.439, p<0.05).

**CONCLUSIONS:** The results suggest that the 13-15 years old obese Chinese boys expressed lower serum T level and higher E<sub>2</sub>/T ratio compared with normal weight boys. The amount of adipose tissue may correlate with sex hormone metabolisms in Chinese boys. Future studies are needed to illustrate the possible mechanisms behind this.

Supported by National Natural Science Foundation of China, NO.: 30800541.

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2597 Board #272 MAY 31 3:30 PM - 5:00 PM

**Comparison of Peer and Instructor Assessment in a Physical Education Teacher Education Program**

Melissa M. Snyder, Beth J. Patton. Ashland University, Ashland, OH. (Sponsor: Randall F. Gearhart Jr., FACSM)  
(No relationships reported)

Peer assessment (PA) occurs in many higher education programs. However, there is no known research examining PA in physical education teacher education (PETE) in regards to student teaching experiences. PA may be a method to better prepare PETE students to assess their future students.

**PURPOSE:** The current observational investigation compared PETE students' assessment of a peer teaching to the instructor's assessment using a 13 item written tool.

**METHODS:** Subjects included nine sophomore PETE students completing their first field experience, five male and four female. The subjects were assigned in groups of two or three to a school. Subjects assessed one another teaching a physical education skill to various age groups. Two sessions for each subject were also assessed by the university instructor using the same 5-point Likert-type scale (excellent, very good, satisfactory, needs improvement, unacceptable). Each assessment consisted of 13 items. Frequencies of each assessment were compared for the student and university supervisor assessment.

**RESULTS:** There were a total of 468 items assessed over both teaching sessions (234 by the subjects, 234 by the instructor). Subjects were much more likely to assess a student as excellent (n = 93, 39.74%) or very good (n = 98, 41.88%) than the university instructor (n = 3, 1.28% and n = 89, 38.03%, respectively). The subjects infrequently assessed the student teacher as needing improvement (n = 1, 0.43%) as compared to the instructor (n = 5, 2.14%).

**CONCLUSIONS:** Subjects tended to assess their peers performance higher than the instructor. Further research is needed to determine how peer assessment can be improved. Factors such as training, previous experiences and interpersonal issues can affect the assessments peers provide. Teacher education students are required to learn numerous skills during their educational preparation and will be required to assess their students as a professional. Assessing others as a student may better prepare them to evaluate their students in the future. This, in turn, may help the students to become more competent teachers and benefit society.

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2598 Board #273 MAY 31 3:30 PM - 5:00 PM

**Youth Soccer Participation History in NCAA Division 1 Athletes**

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(No relationships reported)

**PURPOSE:** To investigate the youth soccer participation history of intercollegiate athletes across all sports at the University of California - Los Angeles.

**METHODS:** Observational survey of NCAA Division 1 intercollegiate athletes listed on the 2010-12 rosters. Data collected included sport participation history for subjects, levels of participation, and reasons for sport discontinuation.

**RESULTS:** 296 subjects (162 women, 134 men) from 12 different sports completed surveys. Included within this group were 26 athletes (9 women, 17 men) participating in collegiate soccer. Excluding those collegiate soccer athletes, 41.8% of females and 54.7% of males played soccer from the ages of 6 to 9. From the ages of 10 to 11, 35.9% of these women and 33.3% of the men participated in soccer. When evaluating those currently competing in individual sports (golf, gymnastics, tennis, swimming) compared to team sports (baseball, basketball, football, rowing, softball, volleyball, water polo), 36% of those competing in individual sports played soccer from the ages of 6 to 9 compared to 56.4% of those in team sports. Within the group of those competing in collegiate soccer, 34.4% of the women and 41.2% of the men did not participate on a travel/club soccer team prior to the age of 10.

**CONCLUSIONS:** 47% of non-collegiate soccer athletes participated in soccer as a child with 35% continuing until the ages of 10 to 11. Those currently participating in team sports were more likely to have been involved with youth soccer compared to those currently competing in individual sports. Over 40% of NCAA Division 1 soccer players surveyed were not involved in travel/club soccer until the age of 10.

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2599 Board #274 MAY 31 3:30 PM - 5:00 PM

**Landscape: Learning About The Needs And Desires Of A School And Community-based Activity Program Evaluation**

Kisha Virgil, Mary de Groot, Stephanie Greer, Sarah Herrera, NiCole Keith, FACSM. IUPUI, Indianapolis, IN.  
(No relationships reported)

Physical inactivity disproportionately affects low-income and ethnic minority urban residents. PARCS is a 9-year-old community-based exercise partnership between IUPUI and Indianapolis Public Schools (IPS) that strives to increase regular physical activity in urban residents at a membership price of \$20/year. Costs remain low by employing university exercise science and fitness studies majors as facility staff for academic credit. This model could be duplicated with other community and academic partners across the US.

**PURPOSE:** To characterize program participants, LANDSCAPE describes adult PARCS members who have enrolled in this study. Data describe the sociodemographic, health, attitudinal, quality of life and physical attributes of the LANDSCAPE sample.

**METHODS:** Our study sample consists of 154 adult PARCS members of Black or White race. Four questionnaires were completed by study participants. Anthropometric measures were collected as well as resting heart rate (RHR) and resting blood pressure (BP).

**RESULTS:** Data show that 68% of the study participants were Black, 48% had a household income of < \$40,000 per year, 48% found it financially difficult to make ends meet, while 43% reported making ends meet to be "not hard, not easy," 41% of the respondents owned a home and 56% worked outside of the home. Forty percent reported having hypertension, 31% high cholesterol, 19% diabetes, 18% physically inactive, and 15% smoked. Measured mean resting SBP and DBP were 125 ± 13 mmHg and 77 ± 8 mmHg, respectively. Mean RHR was 76 ± 12 BPM and the average BMI was 34.6. Resting SBP and BMI in study participants were higher than national recommendations of <120 mmHg and <25, respectively, while, resting DBP and RHR of study participants fell within recommended ranges of <80 mmHg and 60-100 BPM, respectively.

**CONCLUSION:** Results show that LANDSCAPE participants have limited discretionary income and several risk factors and/or comorbidities that could be managed by participating in

regular exercise. Community-based partnerships such as PARCS reduce financial barriers and could improve the exercise opportunities for populations with limited resources. Study data collection will continue in order to inform strategies to improve the existing PARCS program and potentially replicate similar partnerships locally and nationally.

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**2600** Board #275 MAY 31 3:30 PM - 5:00 PM

**Association Between Total Energy Expenditure And Body Kinematics During Active Video Gaming**

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(No relationships reported)

Active video gaming (AVG) has been suggested as an alternative for increasing total daily energy expenditure among adolescents. One of the challenges of using AVG to promote a physically active lifestyle is the selection of appropriate AVG with moderate-intensity level (3.0-5.9 METs) that produces sufficient energy cost for obtaining health-related benefits. There are many AVGs available in the market but their energy cost demand varies widely. However, very few studies have identified the factors contributing to this variation.

**PURPOSE:** To examine the association between total energy expenditure and body kinematics while playing the selected AVG.

**METHODS:** Sixty Hong Kong Chinese adolescents aged 15 to 17 years old, without physical and psychological illness, enrolled in the present within-subject study. Participants attended three AVG experimental sessions in a randomized fashion to perform AVG using: i) lower limb movement (soccer) ii) upper limb movement (table tennis) and iii) whole body movement (adventure), respectively. During the AVG sessions, participant's in-game metabolic energy expenditure (kcal/min) was measured using portable indirect calorimetry, and mechanical energy expenditure and in-game 3D motion were measured using a 14-camera motion capture system. Repeated measures ANOVA was used to examine the differences between the selected AVGs in terms of energy expenditure. Multiple regression analysis was conducted to examine the contribution of the movement of different body segments in predicting energy expenditure after adjusting for gender, age and maturation status.

**RESULTS:** The findings of the present study will provide empirical data concerning the contribution of the movement of different body segments (head, sacrum, foot, shoulder and wrist) to the variation in energy expenditure among the selected AVGs.

**CONCLUSIONS:** These results will be able to inform the choice on AVGs to meet the desired intensity for future AVG intervention studies.

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**2601** Board #276 MAY 31 3:30 PM - 5:00 PM

**Children's Physical Activity Levels and Their Psychological Correlates in Interactive Dance Versus Aerobic Dance**

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(No relationships reported)

**PURPOSE:** Comparisons on children's physical activity (PA) levels and PA psychological correlates (e.g., self-efficacy and enjoyment) between interactive video games and the corresponding traditional activities remain unanswered. Therefore, the purpose of this study was to examine differences in children's PA levels and PA correlates in interactive dance games (Dance Dance Revolution [DDR]) and aerobic dance.

**METHODS:** A total of 53 urban fourth grade children (29 girls;  $M_{age}=10.3$  yrs) participated in a year-long DDR-based exercise program. During each 30-min. session, participants were divided into two groups, with one group playing DDR and the other playing aerobic dance for 15 minutes. The groups then switched activities in the second 15 minutes. Participants wore NL-1000 pedometers in four consecutive sessions; and sequences for playing were count-ordered. They also responded to a questionnaire measuring their self-efficacy and enjoyment toward two dance activities (DDR and aerobic dance) at the end of each session. Outcome variables were children's moderate-to-vigorous physical activity time (MVPA), self-efficacy and enjoyment.

**RESULTS:** ANOVA with repeated measures for MVPA yielded a significant main effect for dance activity, Wilks' lambda = .51,  $F(1, 52) = 50.26$ ,  $p < .01$ . Specifically, children spent more MVPA time in performing aerobic dance ( $M_{time}=4.66$ ) than they did in playing DDR ( $M_{time}=3.16$ ). MANOVA with repeated measures for PA correlates also revealed a significant main effect for dance activity, Wilks' lambda = .70,  $F(2, 47) = 10.12$ ,  $p < .01$ . Follow-up univariate tests suggested children had significant higher self-efficacy in DDR ( $M=4.22$ ) than they had in aerobic dance ( $M=3.53$ ),  $F(1, 49) = 18.81$ ,  $p < .01$ . Similarly, they also reported significant higher enjoyment toward DDR ( $M=3.42$ ) than they did toward aerobic dance ( $M=2.96$ ),  $F(1, 49) = 10.57$ ,  $p < .01$ .

**CONCLUSIONS:** The findings indicated children had more MVPA time in aerobic dance. However, children demonstrated higher self-efficacy and enjoyment toward DDR as compared to aerobic dance. Thus, professionals may not replace the traditional physical activities and sports with interactive video games. Meanwhile, interactive video games (e.g., DDR) can be an excellent addition to promote PA.

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**2602** Board #277 MAY 31 3:30 PM - 5:00 PM

**Daily Physical Activity Levels of Young Adults with Autism Spectrum Disorder Who Are Low-Expressive**

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(No relationships reported)

The U.S. Department of Health and Human Services in 2008 released the Physical Activity Guidelines Advisory Committee Report that indicated that health benefits for adults can be achieved with 150 minutes a week of moderate-intensity physical activity (MPA). However, the literature suggest that individuals with disabilities may not be reaching that threshold and tend to engage in less activity than their peers without disabilities. There is also data to indicate that physical activity levels vary by type of disability. However, there is little information on physical activity patterns of individuals with the autism spectrum disorder, and even less on individuals with autism spectrum disorder who are low expressive in verbally (ASD-LE).

**PURPOSE:** To investigate physical activity levels of young adults with ASD-LE.

**METHODS:** Participants were 12 young adults without physical impairments: 6 (5M 1F, Age  $18.8 \pm 1.7$  yrs, Ht.  $70.8 \pm 2.1$  in, Wt.  $187.0 \pm 33.8$  lbs) with ASD-LE and 6 matched peers without disability (5M 1F, Age  $19.7 \pm .5$  yrs, Ht.  $70.4 \pm 2.6$  in, Wt.  $169 \pm 23.7$  lbs). There were no significant differences between matching variables (Age, Ht. & Wt.). Participants with ASD-LE were selected if they met two criteria on the Childhood Autism Rating Scale: 1) rating of "severely autistic" and 2) at least 3 out of 4 on Verbal Sub-Scale, which indicates a severe verbal disorder. Participants wore an omnidirectional accelerometer on the wrist for 6 continuous days. Prior to the study individuals were given time to become desensitized to the accelerometers on the wrist. Data were recorded into 1 minute epochs and raw counts were converted to MET values. Values of  $\geq 3$  METs were classified as MPA. An independent T-test, adjusted for unequal variances, in PASW Statistics 18 was used for the comparison between the two groups.

**RESULTS:** Individuals with ASD-LE had significantly lower minutes of MPA per day (78 mins) than their peers without disability (153 mins) ( $t=3.4, df 7.6, p=.01$ ). However, both groups were above the daily amount of MPA for health benefits.

**CONCLUSIONS:** This study indicates that young adults with ASD-LE may be getting enough MPA to receive a substantial health benefit. Unfortunately, there is a disparity in the amount of physical activity between the two groups. Because of the small sample size further research is needed.

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**2603** Board #278 MAY 31 3:30 PM - 5:00 PM

**Overweight and Central Obesity and its Association to Physical Activity in German Primary School Children**

Anja Schreiber, Susanne Kobel, Benjamin Koch, Dorothea Kesztyues, Verena Hundsdoerfer, Olivia Wartha, Tamara Wirt, Rainer Muehe, Tina Seufert, Juergen M. Steinacker, FACSM. University Ulm, Ulm, Germany.

(No relationships reported)

Recent studies suggesting relations between overweight and cardiovascular risk factors imply a strong correlation with central body fat mass, even in children. For an appraisal of a child's body weight status it is therefore advised to not only rely on Body-Mass-Index (BMI) but also consider measures of central obesity like the weight-to-height-ratio (WHtR).

**PURPOSE:** This study therefore aimed at assessing the prevalence of overweight and obesity in German primary school children on the basis of BMI as well as WHtR (central obesity). Furthermore, the prevalence of central obesity in active vs. less active children is determined.

**METHODS:** 157 classes took part in the evaluation of the school-based health promotion programme "Join the Healthy Boat" in south-west Germany. Written, parental consent for examination and data collection was obtained of 1968 children. Body weight and height, as well as waist circumference of 1892 children ( $7.1 \pm 0.6$  yrs; 50.3% male) were measured. In a subsample of 294 children physical activity was measured for 4 consecutive days using accelerometry combined with heart rate (Actiheart; CamNtech, UK).

**RESULTS:** An average BMI of  $16.0 \pm 2.2$  kg/sqm and a mean WHtR of  $0.45 \pm 0.04$  could be observed. On basis of German BMI classifications (Kromeyer-Hauschild et al, 2001) 7.8% of the examined children were underweight, 82.3% normal weight, 5.5% overweight and a further 4.4% obese. Central obesity (WHtR  $\geq 0.5$ ) was established at 9.5% of children. Also, 2.8% of normal weight children (based on BMI) showed a WHtR  $\geq 0.5$ , as well as 55.8% of overweight and 94.0% of obese children. In the subsample 10.5% are central obese. Of the 109 children achieving the guideline of 60 min moderately to vigorously physical activity (MVPA) only 6.4% are central obese compared to 13% of those not achieving the guideline.

**CONCLUSIONS:** These baseline data show an unusual high percentage of obese children within an otherwise rather small portion of overweight children compared to other German studies (9.9% including obesity). Nearly all obese children are affected by central obesity, which applies to just about half of overweight children and at least a small proportion of normal weight children. Moderate to vigorously active children show a slightly smaller prevalence of central obesity.

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**2604 Board #279 MAY 31 3:30 PM - 5:00 PM**

**Prevalence of Biomarkers of Vascular Disease in Young Adults**

Matt Feigenbaum, PhD, FACS, Andy O'Neill, Vincent Marsh. *Furman University, Greenville, SC.*

*(No relationships reported)*

**BACKGROUND:** Atherosclerotic vascular disease remains the leading cause of morbidity and mortality in the U.S. and is largely influenced by lifestyle choices. Detection and treatment of controllable risk factors (RFs) can prevent or deter the progression of vascular disease.

**PURPOSE:** To determine the prevalence of biomarkers and RFs of vascular disease in young adults.

**METHODS:** Biomarkers and RFs of vascular disease were assessed in undergraduates (N=416; age=19.3±0.9yrs; Caucasian=95.1%) enrolled in a required Wellness Concepts course. Students were risk stratified as low (0-2 RFs), moderate (3-5 RFs), or high risk (6+ RFs) according to AHA Guidelines (2009).

**RESULTS:** Data indicated that 93.7% and 6.3% are Low and Moderate Risk, respectively. Only 5.4% of the students have elevated LDL-C, 1.2% have hypertension, 1.3% have type 2 diabetes, and 2.6% indicate tobacco use. Gender differences exist ( $p \leq 0.05$ ) in HDL-C (mg/dL) (M=48.5±11.0; F=57.0±11.2), SBP (mmHg) (M=118.7±8.9; F=104.9±14.4), and BMI (kg/m<sup>2</sup>) (25-29.9: M=25.4%; F=17.7%; >30: M=8.3%; F=5.4%). When grouped by BMI categories, data indicate differences ( $p \leq 0.01$ ) in C-RP levels (mg/L) (acute phase protein associated with vascular inflammation) between underweight ( $0.04 \pm 0.59$ ), healthy weight ( $0.96 \pm 1.18$ ), overweight ( $1.17 \pm 0.79$ ), and obese students ( $2.88 \pm 2.30$ ).

**CONCLUSION:** While few young adults (in the population studied) are at increased risk for vascular disease, they should be aware that increases in BMI are accompanied by increases in biomarkers of vascular inflammation known to contribute to atherosclerotic lesions.

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**2605 Board #280 MAY 31 3:30 PM - 5:00 PM**

**7-day Physical Activity And Self-efficacy Toward Physical Activity Of Children With Developmental Coordination Disorder**

Sheng K. Wu<sup>1</sup>, Tsung-Yi Wu<sup>1</sup>, Hsien-Hui Lin<sup>1</sup>, Fu-Chen Chen<sup>2</sup>. <sup>1</sup>National Taiwan College of Physical Education, Taichung, Taiwan. <sup>2</sup>University of Minnesota, Minneapolis, MN.

*(No relationships reported)*

**PURPOSE:** To analyze the motor coordination and physical activity of school-aged children with and without developmental coordination disorder (DCD) in Taiwan.

**METHODS:** Participants including 34 children without DCD and 20 children with DCD aged 9-11 years old, were examined by the Movement Assessment Battery for Children (MABC) test, and measured and recorded their total physical activities within 7-day by the RT3 accelerometer. Children's Self-Perception of Adequacy in and Predisposition for Physical Activity Scale (CSAPPA scale) was used to measure the generalized self-efficacy toward physical activity of children.

**RESULTS:** Children with DCD scored higher in MABC test than children without DCD (18.5 vs. 7.0,  $p < 0.001$ ). The amounts of total physical activity and moderate to vigorous physical activities (MVPA) in 7-day were higher in the non-DCD group than the DCD group ( $p < 0.05$ ). Children with DCD had significantly lower scores in CSAPPA scale than children without DCD (47.9 vs. 56.2,  $p < 0.01$ ).

**CONCLUSIONS:** This study confirmed that children without DCD participated in more physical activities in 7 days and had higher MVPA and generalized self-efficacy toward physical activity than children with DCD in Taiwan. Comparing to children without DCD, it is essential to encourage children with DCD to participate in more physical activities and MVPA and concern their physical fitness and health.

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**D-30 Free Communication/Poster - Resistance Exercise II**

MAY 31, 2012 1:00 PM - 6:00 PM

ROOM: Exhibit Hall

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**2606 Board #281 MAY 31 2:00 PM - 3:30 PM**

**Acute Physiological Effects of Different Circuit Training Protocols in Young Adults**

Myosotis Massidda, Alessandra Caria, Lucia Cugusi, Carla M. Calò. *University of Cagliari, Cagliari, Italy.*

*(No relationships reported)*

Circuit training (CT) effectively reduces the time devoted to strength training. Nonetheless, few studies have focused on the differences in the acute physiological strain produced by free weight CT and weight CT compounded with aerobic exercise.

**PURPOSE:** The purpose of this study was to perform a comparison of 3 different training protocols (TP): Circuit Weight Training (CWT), Compounded Circuit Weight Training (weight CT and cycling) (CCWT) and Compounded Circuit Free Weight Training. (free weight CT and running) (CCFWT) in order to determine which of the 3 programs provides the best acute physiological responses in a young adult population.

**METHODS:** The sample consisted of 21 healthy sedentary individuals, 12 males and 9 females (age range 20-30 years). We have developed 3 CT Protocols. Sixty seconds (sec) sets of resistance exercises (30% of 1RM) for CWT have been established. Whereas in the CCWT, the subjects spent 30 sec on the same resistance exercises and 30 sec cycling on a bike (60%HRmax). Finally in the CCFWT, the subjects spent 30 sec on the free weight exercises and 30 sec running on a treadmill (60%HRmax). Each TP were on 3 separate days at least 48 hours apart. The rest intervals between the sets lasted 20 sec and the exercises rhythm were fixed at 60 beats per minute (bpm).

**RESULTS:** The CCFWT elicited a higher average HR response than CWT and CCWT for both genders (F=9.88;  $P < 0.001$ ). However, when males and females performed the CCFWT they spent a greater percent of training time within a high HR training zones (70-79% and 80-89% of HRmax) than CWT and CCWT (F=5.58;  $P < 0.001$ ). Similarly, the CCFWT required a greater training load than CWT and CCWT for both sexes (F=7.33;  $P > 0.001$ ). Moreover, the CCWT elicited a lower average HR response and training load than CWT and CCWT for both genders ( $P < 0.001$ ). Regarding inter-gender comparison, we did not find any significant differences ( $P > 0.05$ ) in energy expenditure, blood lactate concentration and cardiac response between males and females for all the TP.

**CONCLUSIONS:** CFWT produces measures that provided a significantly greater benefit of exercise for the 3 programs of interest and seems adequate to produce good training load and cardiovascular improvements for both genders, while CCWT seems not to produce sufficient responses for cardiovascular fitness improvement in both sexes.



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**2607** Board #282 MAY 31 2:00 PM - 3:30 PM  
**>Body Weight Resistance Training Improves Body Composition in Overweight Men and Women**

Brian Wu, USC, Los Angeles, CA.  
(No relationships reported)

Improving body composition and fitness is important in reducing the increased risk of obesity and associated diseases. Body weight resistance training (BWRT) may constitute a convenient, economical, and effective method to improve body composition and fitness for those who do not have access to traditional resistance training equipment.

**PURPOSE:** To examine the effects of a 10-week BWRT program with caloric restriction on body weight and composition.

**METHODS:** Twenty-six sedentary adults were assigned to one of two groups: exercise (n=14, 9 women, 5 men) or control (n=12, 8 women, 4 men). Exercising subjects were on average 34±4 years of age, weighed 91.3±32.0 kg, with a mean BMI of 32.1±8.9. Control subjects were 36±7 years of age, weighed 92.2±16.1 kg, with a mean BMI of 33.9±6.1. The exercise group completed 3 training sessions per week using the TotalGym XLS while reducing caloric intake by 500 kcal/day for 10 weeks. The training sessions followed a progression protocol to maintain appropriate intensities. The control group maintained a sedentary lifestyle with no change in caloric intake. Baseline and post-intervention anthropometric measurements and body composition were assessed. Body composition was evaluated in each subject by bioelectrical impedance using the InBody 520 (Biospace Co. Ltd, Los Angeles, CA.) Data was analyzed using the Statistical Package for Social Sciences (SPSS 16.0 Inc.).

**RESULTS:** Significant decreases in body weight (-3.4±4.1kg, p=0.013) and BMI (-1.2 index points, p=0.013) were observed in the exercise group, while the control group demonstrated no changes from baseline (p>0.05). Participants had a mean reduction of 472 kcal per day. Neck, waist, hip, thigh, relaxed biceps (arm), and flexed biceps (elbow flexed) circumference significantly decreased in the exercise group (p=0.003) while neck, waist, relaxed biceps, and flexed biceps circumference significantly increased in the control group (p=0.02). Between-group analyses revealed that decreases in the exercise group were significantly larger than the increases in the control group (p=0.001).

**CONCLUSION:** 10 weeks of body weight resistance training with the commercially available, home use Total Gym XLS, in combination with reduced caloric intake may promote weight loss and improve body composition.

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**2608** Board #283 MAY 31 2:00 PM - 3:30 PM  
**Effect of Resistance Training Programs on Body Composition and Local Subcutaneous Fat in Young Women**

Jason White, Christa Cocumelli, Sharon Rana. Ohio University, Athens, OH. (Sponsor: Fredrick C. Hagerman, FACSM)  
(No relationships reported)

It is not well understood if localized changes in subcutaneous (SC) fat occur due to resistance training (RT). It is also not known if different methods of RT have differing effects on localized SC fat loss.

**PURPOSE:** To compare the effects of 12-weeks of compound superset (CS) RT to traditional strength (TS) RT on body composition (BC) and localized SC fat.

**METHODS:** 20 untrained women (20.8±2.69 y) were randomly placed into two groups: TS RT or CS RT. All subjects were pre- and post-tested for SC fat via ultrasound (US), SC fat via skinfold (SF) calipers for the triceps (TRI), suprailiac (SI), and thigh (TH), percent body fat (FAT) via SF, fat mass (FM), lean body mass (LBM), total body mass (TBM), and body mass index (BMI). The CS and TS groups performed back squats (SQ) and leg press (LP) at matched intensities, volumes and cumulative rest time per session. The CS group's sets were SQ followed by LP and then rest. The TS group performed SQ with 1min rest between sets, and then LP with 1min rest between sets. Comparisons of all variables were made using repeated measures mixed model ANOVAs.

**RESULTS:** 2x2 mixed model ANOVAs showed no significant interactions or main effects for FM, TBM, FAT, TRI SF or SI SF. A main effect for BMI and LBM showed a significant (p<0.05) increase due to training (mean±SE) (BMI: 22.764±0.583 vs. 23.128±0.477 kg/m<sup>2</sup> and LBM: 44.126±1.172 vs. 45.617±1.021 kg) but no difference between groups. There was a significant interaction for TH SF, which was further analyzed via paired t-test for both groups, showing a significant (p<0.05) decrease in the TS group (mean±SD) (29.9583±2.90927 mm pre vs 24.4167±1.54826 mm post), but not the CS group. A 2 (group) x 2 (site) x 2 (time) ANOVA was used to compare the US SC fat thickness, which was measured at 2 sites on the thigh. There were no significant 3-way or 2-way interactions, and the only significant main effect was a significant (p<0.05) difference between the 2 measured sites (0.721±0.057 vs 1.043±0.078 cm).

**CONCLUSION:** There is little evidence to support a 12-week lower body RT effect on percent body fat or localized SC fat with the possible exception of the TH SF when using traditional strength training. The change in LBM demonstrates any body composition changes due to 12-week RT may be due to increases in muscle mass, not fat loss.

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**2609** Board #284 MAY 31 2:00 PM - 3:30 PM  
**Resistance Training Increases SHBG and Improves Glucose Tolerance in Overweight Sedentary Young Men**

Christian K. Roberts, FACSM, Nina Brandt, Daniel M. Croymans. University of California, Los Angeles, Los Angeles, CA.  
(No relationships reported)

**PURPOSE:** The prevalence of type 2 diabetes (T2D) in the US has rapidly increased in recent decades, with an estimated 26 million Americans being diagnosed. Recent evidence suggests that sex hormone-binding globulin (SHBG) independently predicts risk of T2D. Previously we demonstrated that a 12-week periodized resistance training (RT) program results in improvements in body composition, independent of weight loss in overweight, sedentary young adult men. In this randomized controlled trial, we investigated the effects RT on SHBG, testosterone, cortisol and glucose tolerance.

**METHODS:** 33 overweight, sedentary young adult males (BMI=31.8±0.5 kg/m<sup>2</sup>) were randomized in a 3:1 fashion to RT (12 wks training at 3 sessions/wk) or control (C, 12 weeks of no training) group. After an overnight fast and abstaining for exercise for 72 hrs, pre- and post-intervention whole body glucose tolerance was assessed during an oral glucose tolerance test (OGTT) and serum levels of testosterone, cortisol and sex hormone-binding globulin (SHBG) was determined. Subsequently, levels of free testosterone and free androgen index (FAI) were calculated.

**RESULTS:** In the RT group, SHBG increased by ~ 25% (16.09 ± 1.38 vs. 20.28 ± 1.74, P < 0.001). Levels of free testosterone (125.5 ± 6.5 vs. 106.0 ± 5.3 pg\*mL<sup>-1</sup>, P < 0.001) as well as FAI (1.19 ± 0.10 vs. 0.90 ± 0.07, P < 0.001) decreased in the RT group, while serum total testosterone (488 ± 21 vs. 468 ± 26 ng\*dl<sup>-1</sup>, P = 0.35) and cortisol (15.42 ± 1.08 vs. 13.78 ± 0.87 µg\*dL<sup>-1</sup>, P = 0.17) did not change. Additionally, the RT group exhibited a significant decrease in 2-hr glucose area under the curve (AUC) (4290.58 ± 427.35 vs. 3042.19 ± 394.65 mMol\*min, P < 0.01) and mean insulin (57.50 ± 5.86 vs. 49.87 ± 5.21 µU\*ml<sup>-1</sup>, P < 0.05) during the OGTT. Apart from serum cortisol levels, which increased by ~ 20% (15.06 ± 1.38 vs. 17.92 ± 0.88 87 µg\*dl<sup>-1</sup>, P < 0.05) none of the above mentioned variables changed in the C group.

**CONCLUSION:** Chronic RT increases SHBG in overweight, sedentary young men in concert with improved glucose tolerance. The improvement in whole body glucose tolerance by RT may be mediated, in part, by an increase in SHBG. Whether RT may decrease risk for T2D via increased SHBG requires further study.

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**2610** Board #285 MAY 31 2:00 PM - 3:30 PM  
**Changes in Muscular Strength and Endurance After 10 Weeks of Body Weight Resistance Training**

Tanya J. Gupta, Alberto F. Vallejo, Lindsey J. Anderson, Alan Gurler, Jesus Dominguez, Brian Wu, E. Todd Schroeder. University of Southern California, Los Angeles, CA.  
(No relationships reported)

Improving strength and muscular endurance promotes vitality and may protect against functional decline in late adulthood. However, research concerning the effects of resistance training has mainly been restricted to exercise protocols utilizing standard training equipment found in fitness facilities. Body-weight resistance training (BWRT) is a cost-effective, home-based exercise modality that may constitute a viable alternative to such traditional exercise protocols.

**PURPOSE:** To examine the effects of a 10-week BWRT program using the TotalGym XL S with caloric restriction on muscular strength and muscular endurance.

**METHODS:** Twenty-six sedentary adults were assigned to one of two groups: exercise and diet (n=14, 9 women, 5 men) or control (n=12, 8 women, 4 men). Exercising subjects were on average 34±4 years of age, weighed 91.3±32.0 kg, with a mean BMI of 32.1±8.9. Control subjects were 36±7 years of age, weighed 92.2±16.1 kg, with a mean BMI of 33.9±6.1. The exercise

group completed 3 training sessions per week using the TotalGym XLS while reducing caloric intake by 500 kcal per day for 10 weeks. Subjects performed two sets of 15 repetitions for each of the 18 exercises with 30 seconds of rest between sets. The Borg Rating of Perceived Exertion (RPE) scale was used to monitor and adjust resistance settings, ensuring continuous progression over the entire training period. Baseline and post-intervention maximal strength and muscular endurance were assessed via 1-RM testing and maximum repetitions to fatigue at 60% of 1-RM, respectively.

**RESULTS:** Exercising subjects demonstrated significant increases in maximal voluntary strength for the chest press ( $8.9 \pm 13.8\%$ ,  $p=0.014$ ), leg flexion ( $11.5 \pm 11.7\%$ ,  $p=0.003$ ), and latissimus dorsi pull-down exercises ( $10.1 \pm 5.2\%$ ,  $p=0.002$ ). The exercise group also demonstrated substantial increases in muscular endurance for the chest press ( $57.4 \pm 33.6\%$ ,  $p<0.001$ ), leg extension ( $43.5 \pm 16.9\%$ ,  $p<0.001$ ), leg flexion ( $25.1 \pm 9.3\%$ ,  $p<0.001$ ), and latissimus dorsi pull-down exercises ( $47.2 \pm 24.9\%$ ,  $p<0.001$ ). No significant changes were detected in the control group.

**CONCLUSIONS:** Body weight resistance training with the Total Gym XLS combined with a 500 kcal per day restrictive diet may enhance muscular strength and endurance.

Supported by the USC Clinical Exercise Research Center

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**2611** Board #286 MAY 31 2:00 PM - 3:30 PM

**Effect Of Free-weight And Machine-weight Training On Upper-body Strength Gains In Low- And High-strength College Women**

Thomas J. Pujol, FACSM<sup>1</sup>, Jerry L. Mayhew<sup>2</sup>, William F. Brechue<sup>3</sup>, Paul Reneau<sup>4</sup>. <sup>1</sup>*Southeast Missouri State University, Cape Girardeau, MO.* <sup>2</sup>*Truman State University, Kirksville, MO.* <sup>3</sup>*United States Military Academy, West Point, NY.* <sup>4</sup>*Fairmont State University, Fairmont, WV.*

(No relationships reported)

Anecdotal evidence suggests that women prefer to perform resistance exercises using machine weights as opposed to free weights. However, few studies have compared free weights and machine weights for women. Furthermore, little evidence is available relative to the effect of initial strength level on strength gain in women.

**PURPOSE:** To compare the effect of training modes on upper-body strength development in low- and high-strength women.

**METHODS:** Untrained women ( $n = 217$ , age =  $19.2 \pm 1.0$  y, body mass =  $64.6 \pm 15.6$  kg, %fat =  $23.0 \pm 5.3\%$ ) were selected from a larger cohort based on initial 1RM bench press performance on either free weights (FW,  $n = 69$ ), seated horizontal press machine (SHP,  $n = 81$ ), and supine vertical press machine (SVP,  $n = 67$ ). Body fat (%fat) and lean body mass (LBM) were estimated from skinfolds using a generalized equation. Subjects were matched for low-strength (LS;  $n = 106$ ; 1RM =  $27.8 \pm 2.1$  kg) and high-strength (HS;  $n = 111$ ; 1RM =  $45.6 \pm 6.1$  kg) on their specific training mode. Each subject completed a 12-wk linear periodization resistance training program (Wk 1-5: 3 x 10-12-RM; Wk 6-9: 3 x 6-8-RM; Wk 10-12: 3 x 3-5-RM) using either free weights or mode-specific weights.

**RESULTS:** Pre-training mode x strength level ANOVA indicated that HS had significantly greater body mass ( $72.8 \pm 17.9$  kg), LBM ( $54.0 \pm 10.0$  kg), and %fat ( $24.9 \pm 5.8\%$ ) than LS ( $56.8 \pm 6.7$  kg,  $44.7 \pm 4.5$  kg, and  $21.1 \pm 3.8\%$ , respectively). Following training, mode x strength level ANOVA on strength gain (Post 1RM - Pre 1RM) indicated SHP ( $10.1 \pm 4.2$  kg) was significantly greater than SVP ( $6.5 \pm 4.2$  kg;  $p<0.001$ ) which was greater than FW ( $4.5 \pm 4.3$  kg;  $p<0.001$ ). There was no significant difference ( $p>0.99$ ) in strength gain between strength groups (LS =  $7.2 \pm 4.3$ ; HS =  $7.2 \pm 5.3$  kg); however, the LS groups made a significantly greater percent gain ( $25.9 \pm 5.6\%$ ) compared to the HS groups ( $16.0 \pm 11.3\%$ ). None of the body composition parameters made significant changes following training.

**CONCLUSIONS:** Changes in muscular strength following resistance training in college women is likely to be greater for machine weights than for free weights and may differ between machine weight types. However, absolute strength gains will be similar between low- and high-strength women regardless of training mode.

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**2612** Board #287 MAY 31 2:00 PM - 3:30 PM

**The Effects Of Four Weeks Home-Based Isometric Exercise Training On Resting Blood Pressure**

Natalie Goldring, Jonathan D. Wiles, Damian A. Coleman. *Canterbury Christ Church University, Canterbury, United Kingdom.*

(No relationships reported)

Research demonstrates that isometric exercise training can reduce resting blood pressure (BP). However, most training studies involve the use of expensive laboratory-based equipment to complete the training, which is ultimately neither cost nor time effective as a treatment method for hypertension. A home-based isometric exercise program would be cheaper and simpler to perform, and could potentially make this form of exercise more accessible to the general population.

**PURPOSE:** The aim of this study was to assess whether resting BP (systolic - SBP, diastolic - DBP, and mean arterial pressure - MAP) could be reduced after 4 weeks of home-based isometric wall squat exercise (IWSE) training.

**METHODS:** Thirty healthy normotensive males were examined using a crossover study design. Participants were initially randomly assigned to either an IWSE training group or a control group for a 4 week period. After a 4 week 'washout' period, participants then changed to the other condition. The IWSE training consisted of 3 exercise sessions per week performing 4 x 2 minute wall squat exercises in each session. Before training, all participants performed a continuous incremental IWSE test to determine training intensity (equivalent to 95% peak heart rate (HR)). The control period required participants to maintain a normal daily routine for the 4 week period. BP and HR were measured 48 hours pre- and post- both conditions. Resting BP was measured using a non-invasive hemodynamic monitor and HR was measured via ECG using a bipolar lead II configuration.

**RESULTS:** During training, participants exercised at a HR of  $121.2 \pm 24.5$  beats·min<sup>-1</sup> (mean  $\pm$  SD). After 4 weeks of IWSE training, significant reductions in resting SBP  $-3.5 \pm 3.7$ , DBP  $-4.0 \pm 2.7$  and MAP  $-3.8 \pm 2.7$  mmHg were demonstrated ( $P<0.05$ ) when compared to the control period (SBP  $0.7 \pm 1.1$ , DBP  $0.7 \pm 1.8$  and MAP  $0.7 \pm 1.3$  mmHg). Resting HR also reduced significantly ( $P<0.05$ ) with training ( $-8.9 \pm 6.7$  beats·min<sup>-1</sup>) compared to the control period ( $-0.1 \pm 6.0$  beats·min<sup>-1</sup>).

**CONCLUSION:** 4 weeks of home-based IWSE training can reduce resting BP in a simple, cost and time effective way, allowing an individual to exercise privately, in familiar surroundings and at their own convenience. This novel method of exercise prescription should be investigated further with borderline hypertensive participants.

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**2613** Board #288 MAY 31 2:00 PM - 3:30 PM

**Unilateral Strength Training With Maximal Velocity Improves Lower Body Power Outcome And Movement Velocity**

Johan Petersson<sup>1</sup>, Kenneth Riggberger<sup>2</sup>, Sofia Brorsson<sup>1</sup>, M. Charlotte Olsson<sup>1</sup>. <sup>1</sup>*School of Business and Engineering, Halmstad University, Sweden.* <sup>2</sup>*Malmö Sports Academy, Stadionkontoret, Malmö, Sweden.*

(No relationships reported)

In many sports development of power is considered to be one of the most important physiological qualities for success. Despite many studies in the area, research investigating unilateral power training methods for elite athletes is lacking.

**PURPOSE:** The purpose of this study was to examine the effects of unilateral explosive strength training on lower body power output and movement velocity after six weeks of training.

**METHODS:** 17 elite male handball players (age  $22 \pm 4$ ), experienced in resistance training, participated in a six week intervention study. The players were divided into a training group (TR)  $n=11$ , and control group (CTL)  $n=6$ . The TR group performed 15 supervised training sessions during six weeks, involving ballistic weightlifting exercises performed unilateral with heavy loads ( $>80\%$  1RM) and maximal intended movement velocity in both the concentric and eccentric phases of the lifts. The CTL group performed bilateral strength training with heavy loads without movement velocity consideration. Loaded vertical squat jumps with absolute loads of 20, 40, 60, 80 and 100 kg were made before and after the training period. A linear encoder attached to the barbell measured average concentric power (APc), average eccentric power (APe), peak velocity and time to peak velocity (tpV) to evaluate power output and movement velocity. To keep results brief but clear, average load was calculated as the mean change of all five loads from pre- to post intervention. T-tests were used to analyze differences between the two groups.

**RESULTS:** The unilateral power training improved APc ( $p<0,05$ ) on average with  $3 \pm 1$  W/kg (18%) in TR vs.  $-1 \pm 2$  W/kg (-3%) in CTL. Similarly, for APe, average load increased significantly ( $p<0,05$ ) in TR  $3 \pm 2$  W/kg (36%) compared to  $-1 \pm 1$  W/kg (-1%) in CTL. Moreover, TR decreased their tpV with  $-0,18 \pm 0,08$  ms (-40%), compared to CTL  $0,01 \pm 0,06$  ms (2%:  $p<0,05$ ).

**CONCLUSION:** The TR group showed improvements after only a short period of structured unilateral maximal velocity training which indicates that unilateral training principles could be effective for improving lower body power output in elite athletes involved in sports where unilateral movements predominate. Longer studies are needed to evaluate further potential benefits of unilateral strength training.

Funding: BLESS, Halmstad University, Sweden

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2614 Board #289 MAY 31 2:00 PM - 3:30 PM

**Comparison of Shoulder Training Techniques for Strength Improvements in Collegiate Volleyball Players**

Anthony Clapp<sup>1</sup>, Emilee Traxler<sup>1</sup>, John L. Walker, FACSM<sup>2</sup>. <sup>1</sup>Augsburg College, Minneapolis, MN. <sup>2</sup>Texas State University, San Marcos, TX.  
(No relationships reported)

Shoulder strength is frequently touted as a key factor for volleyball performance. Although resistance bands are often employed in rehabilitating athletes, their use for the purpose of making significant strength gains is viewed as tributary compared to that of weight training.

**PURPOSE:** The purpose of this study was to compare the level of strength gains in the female collegiate volleyball player employing either a resistance training protocol with free weights or resistance bands, to determine which training technique would be most beneficial for shoulder strength.

**METHODS:** Eight intercollegiate athletes from a NCAA Division III Women's Volleyball team (Age=19.3 ± 1.3 yrs, Ht. = 177.0± 8.8 cm, Wt.=71.8 ± 9.0 Kg) were matched by position and then randomly assigned to either a resistance band strength training group (RB, n=4) or a free weight strength training group (FW, n=4). The participants' shoulder strength was measured with a Chattanooga Hydraulic Push-Pull Dynamometer with a digital gauge, in four different shoulder positions: flexion, extension, abduction, and adduction. After the completion of the measurements, the athletes completed a six week training program consisting of four different training exercises; flexion, extension, abduction, and adduction. All athletes performed these exercises 20 min/day, three times a week. Following six weeks of training, the participants' shoulder strength was measured again.

**RESULTS:** All of the athletes improved their shoulder strength over the length of the exercise program. Mean(x) strength was calculated from the four measurements and the average strength score for the FW group improved from 14.55 ± 2.3 lb. to 18.33 ± 1.9 lb. The average strength score for the RB improved from 15.18 ± 2.9 lb. to 18.67 ± 2.4 lb. Both groups were significantly stronger than the initial measurements ( $p < 0.05$ ). There were no differences between the groups.

**CONCLUSIONS:** This study revealed that participation in a shoulder strengthening program, using either elastic bands or free weights, can significantly improve the athlete's shoulder strength. Ultimately, this should lead to an increase in performance and a decrease in the risk of injury to the shoulder.

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2615 Board #290 MAY 31 2:00 PM - 3:30 PM

**Effects of Magnesium-Creatine Chelate and Protein Supplementation on Strength and Power Measures in Recreationally Trained Individuals**

David N. Suprak, Rory Callahan, Lorrie R. Brilla, FACSM. Western Washington University, Bellingham, WA.  
(No relationships reported)

Creatine is the most effective supplement available for increasing high-intensity exercise capacity and muscle mass, and is often "stacked" with protein supplementation. Magnesium enhances creatine absorption into muscle. The efficacy of these supplements in combination has not been established.

**PURPOSE:** To compare the effects of supplementation with magnesium-creatine chelate (C), C with whey protein stack (W), and placebo (P), combined with resistance training (RT), on measures of strength, power and acceleration.

**METHODS:** Twenty-three healthy, recreationally active participants completed the study. Strength and power testing was conducted before and after an 8-week RT and supplementation program. Strength testing consisted of 1-repetition maximum (1RM) bench press (BP) and back squat (BS). Power testing included the standing broad jump (SBJ), vertical jump (VJ), and seated medicine ball (MB) chest throw. Acceleration was tested via a 10-m sprint. Participants were randomly assigned to one of three supplementation groups, in a double-blind format. The C group was given 5-g creatine chelate equivalent and 400-mg magnesium equivalent per day. The W group received 35 g of whey protein per day, in addition to that given to the C group. The P group received dextran. The eight-week RT was designed to progressively increase strength and power in the major muscle groups involved in movements being tested in a linearly periodized fashion. The effects of time and group were assessed with a two-way repeated measures ANOVA for each outcome measure.

**RESULTS:** There were no group by time interactions or group effects for any outcome measure ( $p > .05$  for each). Across groups, the following changes were observed. 1RM BS increased by 13.64 kg, while BP increased by 5.74 kg ( $p < .001$  for each) over time. MB throw increased by .21 m, while SBJ increased by .11 m ( $p < .001$  for each). 10-m sprint time decreased by .04 s ( $p = .005$ ), while VJ did not change ( $p = .828$ ).

**CONCLUSION:** In healthy, recreationally active individuals, participation in periodized RT to improve strength and power of major muscle groups has a greater effect on improving strength, power, and acceleration than does supplementation with either C or W.

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2616 Board #291 MAY 31 2:00 PM - 3:30 PM

**Timed Protein Supplementation Following Resistance Training in Young Women**

Heather C. Heidebreicht, Jessica Stallings, Jennifer L. Caputo, Richard S. Farley, Don W. Morgan, FACSM. Middle Tennessee State University, Murfreesboro, TN.  
(No relationships reported)

The combination of resistance training (RT) and appropriately-timed protein supplementation yields additional gains in lean body mass, muscular strength, and muscular endurance in adult males compared to RT alone. However, limited research is available concerning the effects of timed protein supplementation among young adult females who engage in RT.

**PURPOSE:** To determine the effects of timed protein supplementation immediately post-RT and 1-hour post-RT on lean body mass and muscle strength in young adult women.

**METHODS:** Females (N = 29; age = 21.6 ± 2.1 yrs; body mass = 63.5 ± 7.4 kg; protein intake = 1.10 ± 0.23 g/kg) participated in a 10-week RT program featuring exercises targeting upper- and lower-body muscle groups. Participants were randomly assigned to one of three groups: immediate post-RT supplementation (IMPRT), 1-hour post-RT supplementation (1HPRT), or a control group (RT only; CTLRT). RT was conducted three days per week in a supervised environment. Lean body mass (LBM) was assessed using dual-energy x-ray absorptiometry (DEXA) and muscle strength was assessed using a 1-repetition maximum bench press (1RMBP) and leg press (1RLMP). Intake of dietary protein was assessed through 24-hour diet recall. The IMPRT group consumed the protein supplement immediately post-RT, the 1HPRT group returned one hour after RT to consume the protein supplement, and the CTLRT group consumed water immediately following RT. Participants in the IMPRT and 1HPRT groups were given 24 grams of a whey isolate protein mixed with water, irrespective of body mass.

**RESULTS:** When participant data from the three RT groups were combined, significant ( $p < .05$ ) increases in LBM (2.3%) and 1RMBP and 1RLMP (21% and 20%, respectively) were observed following RT. However, no group-by-time interaction was detected for LBM, 1RMBP, or 1RLMP.

**CONCLUSION:** Ten weeks of resistance training increases lean body mass and upper- and lower-body muscle strength in women, regardless of whether a protein supplement is ingested within one hour following RT workouts.

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2617 Board #292 MAY 31 2:00 PM - 3:30 PM

**The Effects of Protein and Carbohydrate Supplementation on Resistance Training Induced Gains in Fat Free Mass and Strength**

Robert S. Santana, Ralph E. Graham, Michael P. Godard, FACSM, Timothy J. Piper, Loran D. Erdmann. Western Illinois University, Macomb, IL.  
(No relationships reported)

**PURPOSE:** The purpose of this study was to compare the gains in strength and fat-free mass achieved by novice weight lifters who participated in a 9-week resistance training program, and who consumed either a protein and carbohydrate supplement drink or a non-caloric placebo drink immediately after each resistance training bout.

**METHODS:** Twenty-one participants (Supplement: 12, Placebo: 9) completed the 9-week resistance-training program. Body fat percentage (BF%) and fat-free mass (FFM) were assessed via air displacement plethysmography at baseline and again at the end of the 9-week training period. Pre- and post-training strength was also assessed via 1-repetition maximum tests on three different lifts.

**RESULTS:** Food diaries collected and analyzed at 3 time points during the study indicated that the protein intake (without post-exercise supplementation) of the subjects in both groups exceeded the RDA for protein of 0.8 g/kg. Both groups exhibited significant increases in FFM and strength over the 9-week training period (FFM increased from 66.0 kg to 67.9 kg and from 62.8 kg to 64.4 kg, and total 1-rep max increased from 359.1 kg to 455.3 kg and from 356.3 kg to 458.1 kg in the Supplement and Placebo groups, respectively). However, no significant between-group differences in FFM or strength gains were observed.

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**CONCLUSIONS:** The results of this study suggest that if protein intake is already adequate to meet daily protein requirements, post-exercise protein supplementation may not be associated with additional training-induced improvements in FFM and strength in novice lifters participating in a relatively short-term program of resistance training. (The whey protein and dextrose used in this study were provided by Bioplex Nutrition and NOW Foods respectively.)

**2618** Board #293 **MAY 31 2:00 PM - 3:30 PM**

**Effects Of Strength Training On Parameters Of The Power-Duration Relationship Using Linear And Non-linear Models**

Brandon J. Sawyer<sup>1</sup>, David G. Stokes<sup>2</sup>, R Hugh Morton<sup>3</sup>, Arthur Weltman, FACSM<sup>2</sup>, Glenn A. Gaesser, FACSM<sup>1</sup>. <sup>1</sup>Arizona State University, Phoenix, AZ. <sup>2</sup>University of Virginia, Charlottesville, VA. <sup>3</sup>Massey University, Palmerston North, New Zealand.  
(No relationships reported)

**PURPOSE:** Strength training has been shown to improve the capacity for high-intensity exercise, but it is uncertain whether it can improve critical power (CP). The purpose of this study was to determine the effects of strength training on CP and the curvature constant ( $W'$ , or Anaerobic Work Capacity) of the hyperbolic power-duration relationship using linear and non-linear models.

**METHODS:** Before and after 8 weeks of whole-body strength training, 14 males (age  $20.6 \pm 2.0$  years; weight:  $78.2 \pm 15.9$  kg) performed an incremental exercise test on a cycle ergometer for determination of  $VO_{2peak}$  and lactate threshold. In addition, on separate days each subject performed 4 randomly assigned constant-power exercise bouts (P1-P4, lowest to highest) to exhaustion on a cycle ergometer. CP and  $W'$  were estimated using nonlinear 2-parameter [ $t = W'/(P-CP)$ ] and 3-parameter [ $t = (W'/(P-CP)) - k$ ] models, and two linear models [Work (W):  $W = W' + CP(t)$ ; Power:  $P = W'/t + CP$ ].

**RESULTS:** Significant ( $p < 0.05$ ) improvements were found for upper and lower body strength (mean increase = 20%), power output at peak lactate (218 to 235 W), and time to exhaustion (TTE) during all 4 constant-power tests (P1: 17.9 to 21.0 min; P2: 9.1 to 13.4 min; P3: 4.4 to 6.1 min; P4: 1.9 to 2.8 min). Parameter estimates for CP and  $W'$  could not be obtained with the 3-parameter model.  $W'$  significantly ( $p < 0.001$ ) improved with the other 3 models (2-parameter nonlinear: 20.1 to 32.5 kJ; W: 16.7 to 24.0 kJ; P: 13.8 to 19.3 kJ). By contrast, CP showed a significant decrease with the 2-parameter nonlinear model (162 to 157 W,  $p = 0.023$ ) and no change ( $p > 0.05$ ) with the 2 linear models (W: 167 to 166 W; P: 175 to 175 W).

**CONCLUSIONS:** The improvement in  $W'$  is consistent with previous findings of increased capacity for high-intensity exercise after strength training. However, CP was not improved, and paradoxically decreased as estimated from the nonlinear 2-parameter model. These results suggest that strength training alters the power-duration hyperbola such that  $W'$  is enhanced at the (apparent) expense of CP. Because significant increases in exercise tolerance within the severe exercise intensity domain were observed, our results suggest that current models of the power-duration hyperbola cannot reliably estimate changes in CP after strength training.

**2619** Board #294 **MAY 31 2:00 PM - 3:30 PM**

**Effect Of Core Strength and Endurance Training On Performance In College Students: Randomized Pilot Study**

Jim Schilling, Jeff Murphy, John Bonney, Jacob Thich. *University of Southern Maine, Gorham, ME.* (Sponsor: Karen Croteau, FACSM)  
(No relationships reported)

The evidence is inconsistent regarding benefits in performance acquired through core muscle training. Few investigators have considered utilizing nonathletes and none have compared the effects of core strength training with core endurance training and their influence on various functional measures.

**PURPOSE:** To examine the effectiveness of a core endurance and a core strength training protocol on endurance, basic strength, and specific performance measures.

**METHODS:** Ten college students (age  $21 \pm 7.0$ ) were randomly assigned to either a core endurance trained group ( $n = 5$ ) or a core strength trained group ( $n = 5$ ). Training consisted of 3 specific exercises and training protocols for each group which took place 2 days per week for 6 weeks. Core muscle endurance was assessed using flexion, extension, and lateral tests. Strength tests were a back squat and bench press conducted on a smith machine. Performance tests consisted of a vertical jump, 10 yard sprint, and pro agility test.

**RESULTS:** A significant improvement in flexor ( $153.40$  sec.  $\pm 91.31$  to  $175.60$  sec.  $\pm 94.45$ ,  $p < 0.05$ ) and back extensor ( $124.80$  sec.  $\pm 42.72$  to  $151.40$  sec.  $\pm 40.40$ ,  $p < 0.05$ ) endurance times along with strength values with both the back squat ( $54.99$  kg.  $\pm 27.34$  to  $62.27$  kg.  $\pm 25.14$ ,  $p < 0.05$ ) and bench press ( $34.09$  kg.  $\pm 14.82$  to  $37.73$  kg.  $\pm 15.63$ ,  $p < 0.05$ ) occurred with the strength trained group. Also, a significant improvement in flexor ( $87.40$  sec.  $\pm 37.25$  to  $150.20$  sec.  $\pm 53.62$ ,  $p < 0.05$ ) and right lateral ( $65.40$  sec.  $\pm 35.68$  to  $104.60$  sec.  $\pm 45.37$ ,  $p < 0.05$ ) endurance times along with strength values in the back squat ( $61.82$  kg.  $\pm 32.83$  to  $72.73$  kg.  $\pm 32.42$ ,  $p < 0.05$ ) were found with the endurance trained group. No significant differences were discovered with either group in functional performance measures.

**CONCLUSION:** Although the results from this limited sample cannot be considered conclusive, they suggest that both core endurance and strength training may improve selected core muscle endurance parameters and possibly assist in increasing strength with specific movements. Also, the endurance training protocol was not superior to the strength training protocol, and they both lacked effectiveness in improving functional performance.

**2620** Board #295 **MAY 31 2:00 PM - 3:30 PM**

**Effects of Short-term Core Endurance Training on Running Economy**

Kelsey Figg, Colleen Kirk, Kelcie Wittman, Kathryn Appel, Ashleigh Handorff, Gary Van Guilder, Jeffrey Janot. *University of Wisconsin-Eau Claire, Eau Claire, WI.* (Sponsor: Mark Blegen, FACSM)  
(No relationships reported)

The core musculature assists in stabilizing the spine during dynamic movement. Poor core endurance has been shown to increase the risk of spinal injury and may be linked to movement inefficiency. Therefore, improving core endurance may produce favorable changes in body posture and stability leading to improved health and exercise performance. With respect to performance, previous research has produced conflicting results regarding the potential benefits of core training on running economy (RE).

**PURPOSE:** The aim was to determine if short-term, core endurance training improves RE in healthy young adults.

**METHODS:** Three males and 13 females, age 18-25 years, participated in a 4-wk (30-min, 3 days/wk) core training program (12 sessions total). A total of 13 exercises were employed to train the anterior, lateral, and posterior core musculature. Measurements of anthropometry, core endurance, and RE were performed prior to and following the 4-wk program. Dependent t-tests were used to compare outcome variables pre- and post-training.

**RESULTS:** Right and left side bridge, flexor, and back extensor endurance times were significantly ( $p < .05$ ) increased following training. Interestingly, despite increases in core endurance, a significant ( $p < .05$ ) decrease in RE was observed.

| Variables  | Pre-training      | Post-training      |
|--|-------------------|--------------------|
| Left side bridge (s)   | 56.7 $\pm$ 13.3   | 86.6 $\pm$ 21.6*   |
| Right side bridge (s)  | 56.0 $\pm$ 11.3   | 86.8 $\pm$ 24.1*   |
| Flexor endurance (s)   | 152.9 $\pm$ 118.6 | 318.8 $\pm$ 258.2* |
| Back extensor (s)  | 110.3 $\pm$ 24.6  | 151.1 $\pm$ 30.1*  |
| Oxygen consumption (ml·kg <sup>-1</sup> ·min <sup>-1</sup> ) | 14.3 $\pm$ 2.2    | 15.2 $\pm$ 2.6*    |

\*Post-training significantly ( $p < .05$ ) greater than pre-training

**CONCLUSION:** These results showed that an inverse relationship between improvements in core endurance and oxygen uptake may exist during a given submaximal running workload. Further research is warranted to examine the impact of endurance training on RE with and without core training and the overall impact of core endurance improvements on energy expenditure.

2621 Board #296 MAY 31 2:00 PM - 3:30 PM

### Impact of 6 Months Intervention Program on Cardiovascular Fitness in Overweight and Obese People

Ana B. Peinado, Miguel A. Rojo-Tirado, Pedro J. Benito, on behalf of the PRONAF Study Group. *Technical University of Madrid, Madrid, Spain.*  
(No relationships reported)

The effects of diet and exercise on physical capacity in weight loss programs (WLP) for overweight (W) and obese (O) people has been studied in few studies, concluding that physical capacity measures improve after intervention, although it is unknown the most effective exercise training.

**PURPOSE:** To determine which protocol is the most effective to improve the cardiovascular fitness in W and O in WLP.

**METHODS:** One hundred eighty-nine W and O (body mass index [BMI] 25-34.9 kg/m<sup>2</sup>), aged from 18 to 50 years, performed an incremental test until exhaustion on a treadmill, using a modified Bruce protocol, before (pre) and after (post) the 24 weeks intervention. Subjects were randomized to one of the following training groups: strength training (S), endurance training (E), a combination of S and E (SE) (Training frequency: 3 times per week) and control group (C). All of them in combination with a 25 % calorie restriction diet. Two-way ANOVA with repeated measures was used to determine differences between pre and post intervention in each training group. The significant level was set at 0.05.

**RESULTS:** Maximum oxygen uptake (VO<sub>2max</sub>) increased significantly in all groups in W (Pre and post values, respectively; S: 2466.1 ± 728.6 vs. 2742.5 ± 921.1; E: 2420.9 ± 635.7 vs. 2745.6 ± 655.3; SE: 2725.1 ± 802.7 vs. 3134.7 ± 888.1; C: 2447.1 ± 704.6 vs. 2735.8 ± 753.9 mL·min<sup>-1</sup>), although in O the increase was only significant in SE (3102.8 ± 691.8 vs. 3405.2 ± 906.7 mL·min<sup>-1</sup>). The position of aerobic threshold respect to VO<sub>2max</sub> changed in all groups in W (S: 44.6 ± 7.1 vs. 49.5 ± 7.6; E: 41.2 ± 7.5 vs. 55.1 ± 11.3; SE: 43.3 ± 8.7 vs. 48.6 ± 8.6; C: 44.3 ± 6.2 vs. 52.3 ± 7.8 %, p<0.05), although in O the change was only significant in E (48.1 ± 7.6 vs. 52.7 ± 8.1 %) and C (47.9 ± 10.7 vs. 52.4 ± 8.4 %). There were no significant changes in the position of anaerobic threshold respect to VO<sub>2max</sub>, only E in O showed a significant increase (81.7 ± 7.9 vs. 85.7 ± 7.8 %).

**CONCLUSION:** The proposed protocols improved the cardiovascular fitness in W while in O only SE increased VO<sub>2max</sub> and E changed the thresholds position.

The PRONAF Study takes place with the financial support of the *Ministerio de Ciencia e Innovación, Convocatoria de Ayudas I+D 2008, Proyectos de Investigación Fundamental No Orientada, del VI Plan de Investigación Nacional 2008-2011.*

2622 Board #297 MAY 31 2:00 PM - 3:30 PM

### Effects Of A Training Program On Sedentary Graphic Arts Workers

Andre Luiz Mores<sup>1</sup>, Felipe Borges Trama<sup>2</sup>, Laurinda Abreu<sup>3</sup>, Daniel Alexandre Boulosa Alvarez<sup>1</sup>. <sup>1</sup>Universidade Catolica De Brasilia, Brasilia, Brazil. <sup>2</sup>Universidade Catolica De Brasilia, Sao Paulo, Brazil. <sup>3</sup>Lavadores, Vigo, Spain.  
(No relationships reported)

**PURPOSE:** The aim of this study was to evaluate the changes in physical and anthropometric parameters in a group of sedentary workers after joining a physical training program.

**METHODS:** Fifty graphic arts workers (37.7 ± 8.6 yrs; 82.1 ± 15.3 kg) volunteered for participation on this study. The training program consisted of concurrent strength and endurance training sessions of moderate intensity (i.e. 70% RM and 70% HR reserve, for strength and endurance exercises, respectively) that were performed 2-3 times a week. The workers were divided into four groups depending on the number of sessions completed: G1 (n=12) ~ 10-21 sessions; G2 (n=14) ~ 22-35 sessions; G3 (n=14) > 36 sessions; and control group (n= 10). Handgrip dynamometry, scapular dynamometry, shoulder abduction strength, shoulder flexion strength, and anthropometric measures (i.e. % body fat, and excess of weight) were evaluated before and after the completion of each training period.

**RESULTS:** G1, G2, and G3 showed significant improvements (from -45% to +114%; p=0.000-0.041) in all physical tests parameters (except for scapular dynamometry in G2, p=0.104-0.186) and anthropometric measures over the training period. Analysis of variance showed that only G3 demonstrated significant percentage changes in physical performance parameters with respect to the control group (p values ranged from 0.001 to 0.045). In contrast, there were no differences among experimental groups with respect to the control group in any anthropometric variable (p > 0.05).

**CONCLUSION:** Few sessions (i.e. 10-21) of regular moderate resistance and aerobic training could rapidly improve health-related parameters in a group of sedentary graphic arts workers, with more than 36 sessions being necessary for experiencing the greater benefits. Implementation of a training program in graphic arts workers could be effective for a greater fitness which may improve employees' productivity and quality of life.

2623 Board #298 MAY 31 2:00 PM - 3:30 PM

### Association of IPAQ-S, Body Composition, and Lipid Profile Response To Exercise

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(No relationships reported)

The International Physical Activity Questionnaire-Short Form (IPAQ-S), a non-invasive seven-question assessment of physical activity, has received considerable recent international attention. The reliability and validity of the individual IPAQ-S questions with body composition and the lipid profile response to exercise are unclear.

**PURPOSE:** To determine the association of the individual IPAQ-S components with body composition and the blood lipid profile response to exercise in young adults.

**METHODS:** Twenty healthy recreationally trained college students (13M, 7F; 20.1±1.3 yr; 82.0±24.4 kg; BMI 27.4±6.7, respectively) enrolled in a resistance training activity class participated. All were free of any illness or medication that might affect lipid profile. Total body water (TBW), extracellular water (ECW), intracellular water (ICW), basal metabolic rate (BMR), BF %, fat-free mass (FFM) and fat mass (FM) were obtained via bioelectrical impedance analysis. Fasting seated blood samples were taken immediately before (pre) and after (post) a class exercise session and measured for total cholesterol (TC), high-density lipoproteins (HDL), low-density lipoproteins (LDL), triglycerides (TG) and TC/HDL ratio.

**RESULTS:** Correlations between the IPAQ-S, body composition, and lipid profile were generally weak to moderate. The strongest correlations for body composition and IPAQ-S were FFM vs. IPAQ-5 (r = -0.65), and TBW vs. IPAQ-5 (r = -0.64); weakest were ECW vs. IPAQ-3 (r = -0.01), and BMR vs. IPAQ-7 (r = 0.07). Strongest correlations for lipid profile and IPAQ-S were post TC vs. IPAQ-3 (r = 0.46), and post LDL vs. IPAQ-3 (r = 0.45). Strongest negative correlations were post TC/HDL ratio vs. IPAQ-5 (r = -0.36), and post TC vs. IPAQ-6 (r = -0.34).

**CONCLUSION:** Our data suggest that the strongest correlations for IPAQ-S and body composition were with IPAQ-5, while for lipid profile and IPAQ-S were post-exercise with IPAQ-3, IPAQ-5, and IPAQ-6. To better understand the association and validity of the individual IPAQ-S questions, future research may associate these with body composition and lipid profile response across age, gender, ethnicity, and training status.

Supported by a Grant from the TAMUK College of Education.

2624 Board #299 MAY 31 2:00 PM - 3:30 PM

### The Effects of Short-Term Power Training on Vertical Jump Performance

Matthew Miltenberger<sup>1</sup>, Todd Miller<sup>2</sup>, Shala Davis, FACSM<sup>1</sup>, Frank Pullo<sup>1</sup>. <sup>1</sup>East Stroudsburg University, East Stroudsburg, PA. <sup>2</sup>George Washington University, Washington, DC.  
(No relationships reported)

It has been well established that power is a major distinguishing factor in the ability to be successful in athletics. Olympic lifts are common techniques that are employed by exercise professionals; the question of specificity arises when determining the use of push vs. pull exercises.

**PURPOSE:** To assess the effects of short term power training using the power clean (PC) and the ground base jammer (GBJ) on vertical jump performance.

**METHODS:** After familiarization of exercises, the experimental protocol consisted of a 2 group design (PC and GBJ). Each group trained for 10 sessions over a 20 day period with 5 sets of 3 repetitions at approximately 85-90% of calculated 1RM. Subjects (n=9) were college age males defined as untrained and free from injury that would prevent or inhibit participation. Vertical jump height was assessed using the Vertec® system for both the countermovement vertical jump (VJCM) and the non-countermovement vertical jump (VJNCM). The VJCM consisted of the subject quickly squatting to 90° of knee flexion followed by an explosive upward movement. The VJNCM consisted of a 3 second pause at 90° of knee flexion before the concentric phase of

the jump was initiated. Each subject performed 3 jumps; maximal jump height was recorded and converted to watts for comparison. Descriptive statistics were used to illustrate emerging trends within the data.

**RESULTS:** The findings of this study suggest that the PC training group increased their VJCM and VJNCM performances by 231 watts or 4.6% and 29 watts or .6% respectively. The GBJ group also increased their performances in both the VJCM and VJNCM by 92 watts or 2% and 124 watts or 3% respectively.

**CONCLUSIONS:** Although a small sample was used, data suggests a trend toward specificity of push vs. pull exercises. The push (GBJ) appeared to affect the VJNCM while the pull (PC) affected the VJCM. In the perspective of specificity, sports involving movement without a countermovement (football lineman) may benefit more from training with the GBJ while sports involving countermovement ability (volleyball) may benefit more from training with the PC. In addition, the data also suggests that short term power training in general may be enough to elicit some adaptation increasing performance across conditions.

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## D-31 Free Communication/Poster - Sedentary Behavior

MAY 31, 2012 1:00 PM - 6:00 PM

ROOM: Exhibit Hall

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2625 Board #300 MAY 31 3:30 PM - 5:00 PM

### The Importance Of Sitting Time And Physical Activity On BMI In Hard To Reach Men

Andy J.W Smith, Stephen Zwolinsky, Andy Pringle, Jim Mckenna, Steve Robertson, Alan White. *Leeds Metropolitan University, Leeds, United Kingdom.*

(A.J. Smith: Contracted Research - Including Principle Investigator; contracted research was undertaken for the Football Foundation.)

Both physical inactivity and sedentary time are important risk factors for obesity in men. Recent UK activity guidelines have stated the importance of minimising time men spend being sedentary while also undertaking enough health-enhancing physical activity. Within interventions for hard-to-reach men it is vital that there is clear advice on the importance of each behaviour.

**PURPOSE:** To investigate the relevant importance of the amount of physical activity and time spent sitting on the risk of being overweight or obese in hard-to-reach men.

**METHODS:** Data were collected from the Mens' Premier League Health Programme delivered through soccer stadia, club training venues and community facilities in England. After providing ethical clearance and consent, participants completed validated, population-specific, self-report measures for height, weight, total daily time spent sitting and levels of physical activity (number of 30+ minutes sessions of MVPA per week). Based on established cut points individuals' sitting risk was classed as low (<4.7 hours per day, coded '1'), moderate (4.7 to 7.4 hours, '2') or high (>7.4 hours per day, '3').

**RESULTS:** A total of n=2214 participants engaged the evaluation; 574 contributed data for time spent sitting, levels of physical activity and BMI. Of these men, 224 were classed as healthy weight (BMI 18.5-24.9, coded '0'), with 344 identified as overweight/obese (BMI $\geq$  25, coded '1'). Six participants were excluded from the analysis due to being underweight (BMI <18.5). A binary logistic regression found no effect on weight classification according to the number of physical activity sessions completed per week (OR=0.99, 95% CI 0.89 to 1.12). Risk for being classified as overweight/ obese increases by 33% for each increment of additional sitting behaviour (OR=1.33, 95% CI 1.06 to 1.66).

**CONCLUSION:** Self-reported sitting time is a better predictor of overweight/obesity than physical activity. Prospective studies are needed to establish the value of focussing on reducing sitting time to manage weight status in programmes delivered to hard-to-reach men.

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2626 Board #301 MAY 31 3:30 PM - 5:00 PM

### Daytime Patterns Of Time Spent In Sedentary Behaviors Among Us Middle-aged Adults

Youngdeok Kim, Saori Ishikawa, Anah R. Smith, Joel D. Reece, Ryan T. Connors, Rose M. Carter, Minsoo Kang, FACSM. *Middle Tennessee State University, Murfreesboro, TN.*

(No relationships reported)

**PURPOSE:** Sedentary behaviors (SBs) have been recognized as an independent risk factor of chronic diseases in the adult population. Despite of the increasing importance of SBs for maintaining healthy life in later years, few studies have explored the trajectory of time spent in SBs throughout a day. The purpose of this study, therefore, was to examine the patterns and changes in time spent in SBs during the day among US middle-aged adults.

**METHODS:** Data from the 2003 to 2006 National Health and Nutrition Examination Survey (NHANES) were analyzed for this study. A total of 1,038 middle-aged adults (40-60 years of age) who provided valid data of accelerometer activity counts for at least three days of weekdays and a day of weekend days were included. The average minutes of SBs (<100counts/min) for each time block of the 11-hour daytime period (8:00am-6:59pm) was calculated for a weekday and a weekend. The exploratory factor analyses (EFA) and the piecewise latent growth models (LGM) were employed using Mplus v6.11 to examine the patterns and changes in minutes of SBs during the daytime.

**RESULTS:** For both weekday and weekend day, four latent factors (i.e., time periods) were extracted by EFAs (8:00am-10:59am, 11:00am-12:59pm, 1:00pm-3:59pm, and 4:00pm-6:59pm for weekday; 8:00am-11:59am, 12:00pm-1:59pm, 2:00pm-4:59pm and 5:00pm-6:59pm for weekend). The four-piecewise LGMs for both weekday and weekend day were all well fitted. For weekday, the initial minute of SBs at 8:00am was 33.13. Decreasing trends were found with slope estimates of -0.78 and -0.14 in the first two time periods, while increasing trends were found in the third and fourth time periods with slope estimates of 0.28 and 0.93, respectively. For weekend day, the initial minute of SBs at 8:00am was 36.44. The minutes of SBs was decreased in the first time period with the slope estimates of -1.80 and increased throughout the last three time periods with the slope estimates of 0.27, 0.45, and 1.88, respectively.

**CONCLUSIONS:** This study investigates the patterns of SBs during daytime among US middle-aged adults. Those transition points where the minutes of SBs increase should be targeted in future research in order to reduce the total amount of SBs among middle-aged adults.

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2627 Board #302 MAY 31 3:30 PM - 5:00 PM

### Physical Activity Level According to Sitting Time in Adults

Timoteo L. Araujo<sup>1</sup>, Victor KR Matsudo<sup>2</sup>, Sandra MM Matsudo<sup>1</sup>. <sup>1</sup>CELAFISCS - Agita São Paulo Program, São Paulo, Brazil. <sup>2</sup>CELAFISCS - Agita São Paulo Program, São Paulo - SCS, Brazil.

(No relationships reported)

**PURPOSE:** to determine physical activity level according to the sitting time in Brazilian adults.

**METHODS:** Representative population samples from 3 cities of Metropolitan region of São Paulo were collected. Physical activity (PA) level and sitting time (ST) was determined using the IPAQ, short version, last week form, obtained by a home-based interview. Sample consisted of 1066 subjects, 524 men and 543 women, over 18 yrs-old. Sample was randomized according to gender, age, socio-economic, and educational status. 1- Insufficient active (IS): those who were: Sedentary: no report of PA for more than 10 minutes during last week; or Irregularly active: subjects below the current PA recommendation; 2- Sufficient active (SA): people who met the: moderate activity (MPA): 5d.wk-1 30 min per day; or vigorous physical activity (VPA): 3d.wk-1, 25 min per day; or walking 150 min.wk-1; or any accumulation of 150 min.wk-1, 5 times per week of VPA, MPA and/or walking. The sitting time during the week day was analyzed in the four groups (Bauman A et al 2011) in minutes/wk, with an range of 0-179, 180-240, 241-360 and >360 minutes/wk. Statistical analysis used was a t-test for comparing two proportions, and the level of significance adopted was p<.05.

**RESULTS:** sitting time mean was significantly (p<.01) higher (271.9 + 177.6) in the IS group than in the SA one (236.7 + 153.2 minutes/wk). Similar trend was observed when it was compared the percentage of the IA (42.3%) that stayed more than 4 hours sitting to the SA group (30.4%). The Q square analysis found a significant association between lower prevalence of IA people and higher values of sitting time.

**CONCLUSION:** Data clearly showed an inverse relationship between physical activity level and sitting time.

2628 Board #303 MAY 31 3:30 PM - 5:00 PM

**Objective Assessment Of Sedentary Behaviour And Light Physical Activity In Free Living Activities**

Sveinung Berntsen<sup>1</sup>, Rune Hageberg<sup>2</sup>, Anders Aandstad<sup>2</sup>, Sigmund Alfred Anderssen<sup>2</sup>, Lars Bo Andersen<sup>3</sup>. <sup>1</sup>University of Agder, Kristiansand, Norway. <sup>2</sup>Norwegian School of Sport Sciences, Oslo, Norway. <sup>3</sup>University of Southern Denmark, Odense, Denmark.  
(No relationships reported)

Sedentary behaviours, those that involve sitting and low levels of energy expenditure, have emerged as a new focus for research on physical activity and health. Therefore, there is the need to identify the validity of objective measures of sedentary behaviour for epidemiological, genetic, behavioural and population health studies.

**PURPOSE:** To examine the validity of SenseWear™ Pro2 Armband (Armband) in assessing sedentary behaviour and light physical activity in free living activities in adults.

**METHODS:** 14 men and six women (19-56 yrs) with Body Mass Index of 20-36 kg-m<sup>-2</sup> wore Armband (BodyMedia Inc., Pittsburgh, PA, USA) and a portable oxygen analyser (Metamax II, Cortex Biophysic, Leipzig, Germany) for 120 minutes doing various activities including sitting activities. Resting metabolic rate (RMR) was measured with indirect calorimetry according to international guidelines. The cut off points defining sedentary behaviour and light physical activity were 1.0-1.5 and 1.6-2.9 times RMR, respectively. The data from the Armband was downloaded and analysed with software developed by the manufacturer (SenseWear Professional Research Software v.6.1). Bland-Altman plots were constructed and limits of agreements were calculated. Intra class correlation analyses were performed to evaluate the extent of agreement.

**RESULTS:** Mean differences and limits of agreement from the Bland-Altman plots were 40.3 ±51.5 and -28.4 ±43.4 min for sedentary behaviour and light physical activity, respectively. Armband significantly overestimated sedentary behaviour by 134% (p<0.0001) and underestimated light physical activity by 83% (p<0.0001). Several minutes in light physical activity (according to indirect calorimetry) were classified as "sedentary behaviour" by Armband. There was no statistical agreement (35 (-10, 68) %) in sedentary behaviour assessed with Armband vs. indirect calorimetry. 48 (6, 76) % of the variation in light physical activity was explained by differences among individuals.

**CONCLUSION:** Compared to indirect calorimetry in a free living situation, the use of Armband to assess sedentary behaviour in adults is not recommended using the existing algorithms.

2629 Board #304 MAY 31 3:30 PM - 5:00 PM

**Dietary Quality And TV Viewing In Adults And Children In The U.S.**

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(No relationships reported)

Higher TV viewing (TVV) is generally associated with unhealthy dietary behaviors. Few studies have examined TVV and composite measures of dietary quality.

**PURPOSE:** To examine the relationship between TVV and dietary quality.

**METHODS:** Participants in the 2003-06 National Health and Nutrition Examination Survey were included (analyses conducted in fall 2011). Dietary quality was determined by Healthy Eating Index (HEI)-2005 calculated from two 24-hour recalls. TVV was reported as low (≤1hr/day), middle (2-3 hr/day), and high (≥4 hr/day; referent). Multivariate linear regression models were used to analyze TVV and HEI-2005, adjusted for body mass index (percentile for children 2-18 years), age, ethnicity and physical activity. Analyses were conducted separately for sex and age [preschool=2-5 years (n=1423), school-age=6-11 years (n=1749), adolescent=12-18 years (n=3343), and adult≥19 years (n=8222)].

**RESULTS:** Lower volumes of TVV were significantly associated with healthier HEI for all age groups including preschool boys (low β=3.85, p=0.04) preschool girls (low β=4.08, p=0.003, middle 2.75, p=0.01), school-age boys (low β=3.39, p=0.02), school-age girls (low β=3.65, p=0.002), adolescent boys (low β=2.28, p=0.004, middle β=1.04, p=0.004) and adolescent girls (low β=2.41, p=0.03) as well as adult men (low β=1.89, p=0.003, middle β=1.73, p<0.0001) and women (low β=3.17, p<0.0001).

**CONCLUSIONS:** Excessive TVV (≥4 hr/day) is associated with a less healthy diet determined by a composite dietary formula for each age and sex group. Research is needed to determine the most effective interventions to target both behaviors as well as the combined effect of poor diet and excessive TVV on disease risk.

2630 Board #305 MAY 31 3:30 PM - 5:00 PM

**Physical Activity and Screen Time in Relation to BMI and Cardiometabolic Risk Among U.S. Adolescents**

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(No relationships reported)

**PURPOSE:** Previous research with adults demonstrate differences in physical activity (PA) and sedentary behaviors (SB) between BMI-cardiometabolic risk (CR) groups (normal weight normal, NWN; metabolically obese normal weight MONW; metabolically healthy obese, MHO; obese abnormal, OA). Available data indicate less SB and more moderate and vigorous physical activity (MVPA) in NWN and greater MVPA in MHO than OA, suggesting possible intervention strategies to reduce chronic disease risk even within BMI groups. In this report, we compare PA and SB by BMI and CR among adolescents.

**METHODS:** Data from the National Health and Nutrition Examination Survey (2003-2004 and 2005-2006) were analyzed; participation was limited to 12-18 year olds, without diabetes, pregnancy or non-fasting blood analysis. Abnormal CR was identified as top 10% of homeostasis model of insulin resistance or ≥2 risk factors (triglycerides ≥150mg/dL; HDL-C <40/50mg/dL for boys/girls; blood pressure ≥90<sup>th</sup> %ile for age, gender, and height; glucose ≥100mg/dL). BMI (kg/m<sup>2</sup>) was classified as normal weight (15-85<sup>th</sup> %ile) or overweight/obese (>85<sup>th</sup> %ile). Youth self-reported MVPA, strength training, and screen time (computer and television/videos). Adjusting for age, sex, race, smoking, and total kilocalories of dietary intake, PA and SB differences by BMI and CR were analyzed with ANOVA. All analyses were weighted to represent adolescents nationally.

**RESULTS:** Adolescents (n=1024) were 50% male, 64% non-Hispanic white, and age (mean±SE) 14.9±0.1 years. Fifty-nine percent were NWN, 4% were MONW, 24% were MHO, and 12% were OA. Overall mean MVPA was 70.3±4.5 mins/day, screen time was 3.4±0.1 hrs/day, and strength training was 9.8±0.6 times/30days. After adjustment, MHO and OA adolescents reported more screen time than NWN adolescents (3.6±0.2 and 3.9±0.3 respectively, vs. 3.0±0.2; p<0.01). However, no differences were found between CR groups within BMI group for screen time, MVPA or strength training.

**CONCLUSION:** Overweight/obese adolescents spend more time viewing TV/video/computer than NWN, but unlike adults, MVPA, screen time and strength training did not differ by CR within BMI. Thus, targeting SB may be a useful strategy for obesity reduction in adolescence, but modifying PA or SB may not be sufficient to alter CR within BMI group.

2631 Board #306 MAY 31 3:30 PM - 5:00 PM

**Associations Between Sitting Time And The Prevalence And Clustering Of Lifestyle Risk Factors In Men**

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(S. Zwolinsky: Contracted Research - Including Principle Investigator; Contracted research was undertaken for the Football Foundation.)

Men's health is adversely influenced by the amplification effect of multiple problematic lifestyle risk factors (LRFs), including smoking, poor diet, inactivity and excessive alcohol consumption. Further, too much sitting, independent of time spent in physical activity (PA), is linked to all-cause mortality, CVD, obesity, type 2 diabetes and the metabolic syndrome.

**PURPOSE:** To determine associations between sitting time and the prevalence of LRFs.

**METHODS:** Men aged 18+ (n=584) provided data for analysis. Data was collected prior to engagement in interventions at professional UK soccer clubs. Analysis identified LRFs totals; men sitting <4.7 hours (classified as low risk sitting, LRS), are compared with those spending >4.7 hours sitting daily (higher risk sitting, HRS). LRFs were recorded for men who did not achieve (i) 30+ minutes of MVPA five days per week, (ii) ate less than 5+ portions of fruit/vegetables daily, (iii) drank ≥21 units of alcohol weekly and (iv) were current smokers. Associations between LRS and HRS groups were examined by calculating odds ratios (OR, 95% CI). Statistical differences in LFR prevalence were identified using independent t-tests.

**RESULTS:** HRS men (n=375) were almost twice as likely to report all four LFRs (OR=1.94, 95% CI=1.06-3.56) than men in LRS; 10.9% of all men self-reported all four LRFs, while the most prevalent combination of LRFs was under consumption of fruit/vegetables and too few weekly PA sessions (n=219, 37.5%); this was linked to both sitting risk groups (Table 1). Men at HRS reported significantly more LFRs (2.41 ±0.92) than those at LRS (2.21 ±0.89) p<0.05.

Table 1

| Number of LRFs | Identified LFRs |          |         |         | Sitting Category |       |
|----------------|-----------------|----------|---------|---------|------------------|-------|
|                | Diet            | Activity | Smoking | Alcohol | LRS %            | HRS % |
| 4              | +               | +        | +       | +       | 7.2              | 13.2  |
|                |                 |          |         |         | Total 7.2        | 13.2  |
| 3              | +               | +        | +       | -       | 15.3             | 14.9  |
|                | +               | +        | -       | +       | 10.5             | 13.3  |
|                | +               | -        | +       | +       | 1.9              | 1.6   |
|                | -               | +        | +       | +       | 0.0              | 0.3   |
|                |                 |          |         | Total   | 27.7             | 30.1  |
| 2              | +               | +        | -       | -       | 36.3             | 38.2  |
|                | +               | -        | +       | -       | 2.4              | 1.1   |
|                | +               | -        | -       | +       | 5.3              | 2.1   |
|                | -               | +        | +       | -       | 2.4              | 0.8   |
|                | -               | +        | -       | +       | 1.0              | 1.3   |
|                | -               | -        | +       | +       | 0.4              | 0.5   |
|                |                 |          |         | Total   | 47.8             | 44.0  |
| 1              | +               | -        | -       | -       | 7.7              | 3.7   |
|                | -               | +        | -       | -       | 5.3              | 6.1   |
|                | -               | -        | +       | -       | 1.0              | 0.5   |
|                | -               | -        | -       | +       | 0.0              | 0.0   |
|                |                 |          |         | Total   | 14.0             | 10.3  |
| 0              | -               | -        | -       | -       | 3.3              | 2.4   |
|                |                 |          |         |         | Total            | 3.3   |

+ = RF present, - = RF absent

**CONCLUSIONS:** HRS time was significantly associated with increased LRFs in men engaging the intervention.

**2632 Board #307 MAY 31 3:30 PM - 5:00 PM**  
**Time Spent In Sedentary/Light Activities Reported By Adolescent Girls Between 6th, 8th, And 11th Grades**

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*(No relationships reported)*

Reducing sedentary/light behaviors (SLB) is a recommended obesity prevention strategy. Understanding the types of SLB that adolescent girls participate in over time may help to target obesity prevention interventions.

**PURPOSE:** To examine time spent in SLB among two cohorts of adolescent girls between 6th and 8th grade and 8th and 11th grade.

**METHODS:** Three random samples of girls participated in the Trial of Activity in Adolescent Girls (TAAG) in the 6th grade (2003) and 8th grade (2005 and 2006). In 2010 Maryland TAAG girls participated in TAAG II in 11th grade. Girls completed a modified version of the 3-Day Physical Activity Recall (3DPAR). The number of 30-minute blocks over 3 days spent in the following activities was calculated and expressed as a percentage of awake time: 8 SLBs (personal care, eating, screen time, riding in a vehicle, socializing, homework, listening to music/reading, and attending church), physical activity (PA), school, and work (e.g. part-time job, babysitting).

**RESULTS:** 1,362 girls completed the 3DPAR in both the 6th and 8th grade and 587 did so at both 8th and 11th grade. The percent of awake time spent in SLB decreased from 58.2% in 6th grade, 59.1% in 8th grade, and 55.1% in 11th grade. The percent of awake time spent in PA also decreased: 15.6% in 6th grade, 12.5% in 8th grade, and 11.2% in 11th grade. Time in school and riding in a vehicle remained stable while time at work increased (6th: 0.5%; 8th grade: 0.6%; 11th grade 4.8%). Among the 8 SLBs, awake time spent in screen time decreased (6th: 15.7%; 8th: 14.9%; and 11th: 10.1%). Time socializing increased (6th: 10.3%; 8th: 13.1%; 11th: 13.2%), as did time spent doing homework (6th: 4.2%, 8th: 5.1%; 11th: 7.9%). Percent of time in all other SLB activities remained relatively stable.

**CONCLUSIONS:** Overall, time spent in sedentary and light behaviors as well as physical activity decrease between 6th and 11th grade, however, time spent in some individual SLBs increases over time.

**2633 Board #308 MAY 31 3:30 PM - 5:00 PM**  
**Is Sedentary Behavior Associated With Metabolic Syndrome In Adults? The Cardiovascular Risk In Young Finns Study.**

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*(No relationships reported)*

**PURPOSE:** We have shown that sitting (sedentary behavior) per se increases BMI and waist circumference, and that it is associated with individual cardiometabolic risk markers in adults. This study investigated, how leisure-time sedentary behavior in adults is associated with metabolic syndrome (MetS), defined by different criteria.

**METHODS:** In the Cardiovascular Risk in Young Finns study, MetS was defined by: 1) EGIR (European Group for the Study of Insulin Resistance), 2) IDF (International Diabetes Federation), and 3) HARM (according to harmonized criteria, Alberti et al. 2009) in 1084 women and 909 men aged 30-45. Data on total leisure-time sedentary behavior (i.e. time spent watching TV, computing, reading, listening to music/radio, etc), physical activity (leisure-time physical activity and active commuting), occupational physical activity, and smoking were collected with a questionnaire. Food frequency questionnaire was used to study diet composition, energy intake, and alcohol consumption. Linear regression analysis was used to study the association of leisure-time sedentary behavior with MetS.



**RESULTS:** Increased total leisure-time sedentary behavior was independently associated with increased prevalence of MetS in males (EGIR  $p < 0.02$ , IDF  $p < 0.008$ , HARM  $p < 0.009$ ), but not in females. Adjustment with physical activity, occupational physical activity, energy intake, diet composition, alcohol, smoking, BMI, and age did not affect the result.

**CONCLUSIONS:** Leisure-time sedentary behaviour is directly associated with MetS among men, as defined by three different MetS criteria. Reduction of sedentary behavior can be one important clinical tool in preventing metabolic syndrome.

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**2634** Board #309 MAY 31 3:30 PM - 5:00 PM

**Relation between Physical Activity, Sedentary Behaviour and Selected Cardiovascular Disease Risk Factors in Adolescent Female**

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(No relationships reported)

**BACKGROUND:** Cardiovascular disease risk factor (CVRF) levels for an individual tend to track over time in a given rank within the distribution of the population. Long term exposure to multiple CVRF and lifestyle behaviours confers a lifelong burden of CVD risk resulting in the development of early systemic atherosclerosis. Measurement of carotid intima-media thickness (CIMT) and large artery stiffness (LAS) are commonly used to determine the extensiveness and severity of asymptomatic disease and potential future risk.

**PURPOSE:** To examine the relation between both physical activity (PA) and sedentary behaviour (SB) and i) selected CVRF and ii) subclinical disease in adolescent females.

**METHODS:** Data are presented as mean  $\pm$  standard deviation, except where otherwise indicated. Participants ( $n=35$ ; age =  $14.4 \pm 1.1$  yrs.; BMI =  $22.6 \pm 2.9$  kg/m<sup>2</sup>; percentage body fat  $31.2 \pm 3.0$ ; mean arterial pressure (MAP) =  $85.0 \pm 8.3$  mmHg) were randomly selected from 4 high-schools in Ireland. Height, weight, percentage body fat, blood pressure, CIMT, and LAS data was obtained for each participant. SB and PA were recorded for 4-6 days using an ActivPAL<sup>TM</sup> physical activity monitor. The amount of time spent sedentary, standing, and in both light and moderate to vigorous PA (MVPA) was calculated. Sedentary data was also examined to identify sedentary bouts of specific duration.

**RESULTS:** The mean left and right-sided CIMT score was  $0.47 \pm 0.0$  cm and the mean LAS index was  $5.20 \pm 0.58$ . Participants spent  $19.42 \pm 0.94$  h/d in sedentary activities ( $9.93 \pm 1.03$  waking sedentary h/d),  $3.08 \pm 0.74$  h/d standing,  $0.73 \pm 0.17$  h/d in light activity and  $0.78 \pm 0.26$  h/d in MVPA. There was a significant inverse relation between light physical activity levels (independent of standing time) and mean arterial pressure (MAP), ( $r = -0.5$ ;  $p < 0.05$ ), BMI ( $r = -0.5$ ;  $p < 0.01$ ) and percentage body fat ( $r = -0.4$ ;  $p < 0.05$ ). There was no relation between other PA variables and CIMT or LAS. There was no significant relation between SB and CVRF, CIMT or LAS.

**CONCLUSIONS:** Objectively measured light PA (independent of standing time) is correlated with MAP, BMI and percentage body fat, but not CIMT or LAS in this population of adolescent females. Although a large amount of time was spent sedentary (9.93 hr), SB were not related to CVRF, CIMT or LAS in this population of adolescent females.

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**2635** Board #310 MAY 31 3:30 PM - 5:00 PM

**Associations Between Physical Activity, Sedentary Behavior, Waist Circumference And Alanine Aminotransferase In Youth: NHANES 2003-2006**

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(No relationships reported)

Pediatric non-alcoholic fatty liver disease (NAFLD) is a significant public health issue, as NAFLD leads to cirrhosis, hepatocellular carcinoma, and cardiovascular disease in adults. At least 8% of U.S. youth have elevated alanine aminotransferase levels (ALT), a biomarker for NAFLD. Regular physical activity (PA) improves ALT in adults with NAFLD, but information is scarce for youth.

**PURPOSE:** To examine associations between PA, sedentary behavior (SED), waist circumference (WC) and ALT in youth.

**METHODS:** Data were obtained from youth ( $N=2088$ , aged 12-19 years) in the National Health and Nutrition Examination Survey (NHANES) 2003-2006. Traditional statistical methods (linear and logistic regression) were compared with quantile regression to examine associations between accelerometer-measured moderate-to-vigorous physical activity (MVPA), vigorous physical activity (VPA), SED, and ALT. Variables with previously reported associations to ALT (age, race, gender, WC) were *a priori* included in all models as covariates, along with SED (for PA models) or MVPA (for SED models). WC also was examined after adjusting for all other variables.

**RESULTS:** The results of the linear regression showed a small positive ( $\beta=0.001$ ) significant association between MVPA and log transformed ALT ( $p=0.02$ ). For the logistic regression, each observation was dichotomized and the odds of observing ALT  $\geq 30$  U/L was modeled. Results of the logistic regression suggested that a 1 minute increase in VPA results in the odds of ALT  $\geq 30$  changing by a factor of 1.02 ( $p=0.04$ ). No other PA or SED associations were found for the linear or logistic regression models ( $p > 0.05$ ). The results of the quantile regression suggest significant, positive, but clinically-negligible associations between the 40<sup>th</sup>, 50<sup>th</sup>, and 60<sup>th</sup> adjusted ALT percentiles and MVPA ( $\beta=0.02$ , 0.03, and 0.03, respectively). No significant associations were found for VPA or SED across adjusted ALT percentiles. A strong positive association was found for all three models between WC and ALT.

**CONCLUSION:** Neither PA nor SED were clinically associated in NHANES youth of whom the majority (92%) were within normal ALT levels. Further studies need to examine whether PA or SED affects above normal ALT levels in larger samples of youth with NAFLD.

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**2636** Board #311 MAY 31 3:30 PM - 5:00 PM

**A Comparison Of Sedentary Behavior Between A Self-report Diary And Accelerometers**

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(No relationships reported)

Research has demonstrated negative impacts on health related to increased time spent engaging in sedentary behavior (SB). Older adults engage in significantly more SB than other age groups. Currently there are a few methods being used to assess SB but little research has examined these methodologies in older adults.

**PURPOSE:** The purpose of this project was to compare three SB assessment methods in a sample of older adults.

**METHODS.** Seventy-three older adults (73.5 $\pm$ 6years) participated in this study. Concurrently, each participant completed a previously piloted self-report diary over a three-day period (one weekend day and two weekdays) and wore two triaxial accelerometers (AG; Actigraph GT3X, Pensacola, FL; AP, activPal<sup>TM</sup>, Glasgow, Scotland). Sedentary behavior was classified as minutes per day (mins/d) of activities that are done while sitting/lying down in the diary and SB was classified in mins/d with accelerometry (AG =  $\leq 50$  cts/min; AP = sitting/lying posture). Means  $\pm$  SD is presented for all measures of time spent in SB. Pearson correlation coefficients between methods were determined. Two-tailed paired sample t-tests were conducted.

**RESULTS.** Participants self-reported engaging in 618.2 $\pm$ 90.5 mins/d of SB, the AG and AP recorded 613.1 $\pm$ 86.6 mins/d and 603.9 $\pm$ 110 mins/d, respectively. The SB recorded by the AG and the diary ( $r=-0.02$ ,  $p=0.87$ ) or the AG and AP ( $r=-0.19$ ,  $p=0.12$ ) was not significantly correlated. However, the SB recorded by the AP was significantly correlated to the SB reported in the diary ( $r=0.62$ ,  $p<0.05$ ). There were no significant differences in SB recorded with the AG and AP [ $t(70)=-0.52$ ,  $p=0.61$ ], the AG and diary [ $t(71)=-0.36$ ,  $p=0.72$ ], or the AP and the diary [ $t(71)=1.25$ ,  $p=0.22$ ].

**CONCLUSION.** The older adults in this sample engaged in approximately 10.1-10.3 hours of SB when reporting their behavior in a diary or when it was objectively measured with accelerometry. Upon examining the relationship between methods, only the SB measured with the AP and diary were significantly related however there were no difference in mins/d of SB when examined between methods. These results suggest that a diary can capture SB similarly to accelerometry in older adults.

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2637 Board #312 MAY 31 3:30 PM - 5:00 PM

**Sedentary Marathoners: The Multi-context Sitting Time Questionnaire and Reported Sitting among Highly Active Runners**

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(No relationships reported)

Interest in the health effects of excessive sitting has increased in recent years. Recent evidence suggests that participation in vigorous or moderate-intensity physical activity (PA) may not fully protect against the risks of prolonged sitting. Unfortunately, existing instruments to assess sitting are often single-item or proxy-based measures which may introduce misclassification.

**PURPOSE:** To develop and validate the Multi-context Sitting Time Questionnaire (MSTQ) and use the new instrument to describe usual sitting behavior of recreational runners.

**METHODS:** 25 volunteers were recruited for the questionnaire validation (Phase 1) and twice completed the on-line MSTQ, separated by one week. Participants wore an accelerometer on a workday and non-workday. Test-retest reliability was assessed with intra-class correlation coefficients (ICCs). Convergent validity (accelerometry as standard) was assessed with correlation coefficients ( $\rho$ ). In Phase 2, 199 participants in the 2011 Livestrong<sup>™</sup> Austin Marathon and Half-Marathon were recruited to complete the new questionnaire.

**RESULTS:** In Phase 1, the MSTQ demonstrated good reliability with ICCs of 0.76 and 0.72 for workday and non-workday total sitting, respectively. Only two sitting contexts had ICCs <0.60. Convergent validity was strongest with accelerometry adjusted for accelerometer wear time ( $\rho = 0.34$  and  $0.61$  for

workday and non-workday respectively). In Phase 2, 195 and 199 participants reported workday and non-workday sitting time, respectively. Total sitting did not differ between marathon and half-marathon participants, but was significantly higher on workdays than non workdays (645 and 480 min respectively,  $p < 0.0001$ ). Most workday sitting was done during work activities while most non-workday sitting was composed of TV/movie watching. Median reported training time was  $6.5 \text{ h-wk}^{-1}$  and was higher in marathoners.

**CONCLUSIONS:** Preliminary validation of the MSTQ indicates good potential for assessing usual sitting across several contexts. Despite far exceeding PA guidelines, this sample of recreational runners reported sitting over 10 hr on workdays and 8 hr on non-workdays, suggesting endurance athletes may be an appropriate population for investigating the interaction between PA and sedentary behavior on health.

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2638 Board #313 MAY 31 3:30 PM - 5:00 PM

**Reliability And Validity Of A Self-report Scale Of Sedentary Time In Children**

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(No relationships reported)

**PURPOSE:** Sedentary behavior (SB) is an independent risk factor for negative health consequences. The most common self-report SB instruments are based on screen time, which is not sufficient for capturing most SB in youth. Therefore, the purpose of this study was to determine the reliability and validity of a comprehensive self-report SB scale.

**METHODS:** A convenience sample included 18 children (16 girls, 2 boys) aged 7-11 years from an ongoing training study. The self-report SB scale was administered on days one and eight, encompassing one week of Actical accelerometer-based monitoring. Identical scale administration and Actical monitoring were repeated after eight weeks. Twelve items from the SMART Student Questionnaire were used to assess six SB components at the four time points: watching TV, playing video games, computer use, homework, art, and quiet games indoors. The Heil (2006) equation for Actical was used to derive the accelerometer-based SB criterion measure. Comparisons were made between the SB criterion measure, SB scale, and time spent in very light intensity free-time activity from the Previous Day Physical Activity Recall (PDPAR). Cronbach's alpha was used to assess SB scale internal consistency. Intraclass correlations (ICC) were used for test-retest reliability. Spearman's rho was used to determine convergent and discriminant validity.

**RESULTS:** Internal consistency for the 12-item SB scale ranged from  $\alpha = 0.392 - 0.711$  across the four time points. The two assessments of one-week test-retest reliability showed ICC =  $-0.02$ , 95% CI =  $-1.73 - 0.62$  and ICC =  $0.77$ , 95% CI =  $0.37 - 0.92$ . For convergent validity, the SB scale correlations ranged from  $\rho = 0.18$  ( $p = 0.58$ ) to  $\rho = 0.19$  ( $p = 0.49$ ) with Actical, and  $\rho = 0.11$  ( $p = 0.68$ ) to  $\rho = 0.44$  ( $p = 0.09$ ) with the PDPAR. For discriminant validity, the SB scale correlations were  $\rho = -0.52$  ( $p = 0.04$ ) to  $\rho = -0.42$  ( $p = 0.09$ ) with time spent outside.

**CONCLUSION:** Our findings showed that the internal consistency, test-retest reliability, and convergent validity ranged widely, and for the most part, were not acceptable. These findings suggest that the 12-item scale has limited reliability and validity as a measure of sedentary behavior in school-aged children. Further research is needed to develop a more reliable and valid self-report scale for sedentary behavior.

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2639 Board #314 MAY 31 3:30 PM - 5:00 PM

**Validity Of Accelerometer-derived Estimates Of Sedentary Behaviour**

Stacy A. Cledes<sup>1</sup>, Jennifer Connelly<sup>1</sup>, Theodoros Konstantinidis<sup>1</sup>, Robert Koivula<sup>1</sup>, Charlotte Edwardson<sup>2</sup>, Thomas Yates<sup>2</sup>, Trish Gorely<sup>1</sup>, Stuart JH Biddle<sup>1</sup>.

<sup>1</sup>*Loughborough University, Loughborough, United Kingdom.* <sup>2</sup>*University of Leicester, Leicester, United Kingdom.*

(No relationships reported)

Accelerometers are gaining popularity as an objective measure of sedentary behaviour. Limited evidence exists however on the validity of different cut points used to define sedentary time, or on the inclinometer function seen in newer models of the ActiGraph accelerometer.

**PURPOSE:** To determine the concurrent validity of the ActiGraph GT3X+ inclinometer and different counts per minute (cpm) cut points for detecting sedentary behaviour in free-living adults.

**METHODS:** 52 participants (54% male, age =  $26.3 \pm 6.2$  years) wore an activPAL3 inclinometer (the criterion) and an ActiGraph GT3X+ accelerometer whilst continuing with their normal routine for 1 day. The activPAL3 was attached to the right thigh, whilst the ActiGraph was positioned on the right hip using an elastic belt. Both devices displayed data in 15-second epochs. Accelerometer-determined sedentary time was calculated using the inclinometer function of the ActiGraph, and by multiple cut points (<50, 100, 150 and 200 cpm) applied to activity counts derived from the vertical axis. Accelerometer-determined sedentary times were compared to sedentary time measured by the activPAL3 using a repeated measures ANOVA and Bland-Altman plots. Associations between the different measures were examined using Pearson correlation coefficients.

**RESULTS:** Time spent sedentary did not differ significantly between the ActiGraph inclinometer function and the activPAL3 ( $532 \pm 95$  vs  $522 \pm 125$  mins,  $p = 0.51$ ). There was a significant moderate correlation between these measures ( $r = 0.52$ ), however the limits of agreement were large ( $-207 - 227$  mins). Sedentary time was significantly overestimated, relative to the activPAL3, when calculated using the four cut points ( $p < 0.001$ ). The <50 cpm cut point provided the closest estimate of sedentary time ( $582 \pm 86$  mins). This cut point had a stronger correlation ( $r = 0.60$ ) and narrower limits of agreement ( $-137 - 258$  mins) relative to the criterion, when compared to data derived from the ActiGraph inclinometer.

**CONCLUSION:** The findings suggest that the inclinometer function of the ActiGraph GT3X+ provides a good overall estimate of sedentary time when compared to the activPAL3. The present findings also suggest that the <50 cpm cut point may provide a better estimate of sedentary behaviour in comparison to the widely used <100 cpm cut point.

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2640 Board #315 MAY 31 3:30 PM - 5:00 PM

**Convergent Validity Of Self-report Sedentary Behavior And Accelerometry: Comparing Multiple Cut Points**

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(No relationships reported)

Sedentary behavior (SB) is related to obesity, chronic disease, and adverse metabolic profiles independent of physical activity, but assessment methods of SBs are not well developed, particularly for Spanish speaking individuals.

**PURPOSE:** To (i) evaluate the convergent validity of a Spanish language self-report measure of SB (SBSR) compared to an objective measure (ActiGraph GT3X accelerometer) of sedentary time, and (ii) examine how associations between self reports of SB and objective data vary as a function of the accelerometer cut point used to define sedentary time.

**METHODS:** A community sample of 71 female participants ( $M_{age} = 41.61$ ;  $SD = 9.28$ ;  $M_{BMI} = 30.07$ ;  $SD = 5.60$ ) recruited to a PA intervention completed a 12 item SBSR and wore an accelerometer for 600 minutes/day for 5 days or 3000 minutes total. Data presented here were collected prior to the start of the intervention. Almost half of the participants were born in Mexico (47%) and the majority of participants self-identified as Latino (79%), was married (62%), and employed for wages (75%). A total SBSR score was computed as mean SB minutes per day

across transportation, television, computer, and 'Other' domains during work and non-work days. SBSR domain scores were log transformed to approximate normality. Objective sedentary time was computed as the average number of minutes per day (i) <50 counts/minute (SB50), (ii) <100 counts/minute (SB100), and (iii) <150 counts/minute (SB150).

**RESULTS:** Mean SB min.dy<sup>-1</sup> was 374 (±72) for SB50, 443 (±74) for SB100, and 486 (±72) for SB150. SBSR total time was marginally correlated with SB50 ( $r=.22$ ;  $p=.07$ ). Correlations between total SBSR and SB100 and SB150 were ( $r=.19$ ;  $p=.12$ ) and ( $r=.20$ ;  $p=.10$ ), respectively. The only SBSR domain significantly correlated with accelerometer min.dy<sup>-1</sup> was computer time ( $r$ 's range 0.24-0.29 across cut points,  $p<.05$ ). Accelerometer sedentary time was not related to BMI whereas total SBSR was marginally related ( $r=.22$ ,  $p=.07$ ). TV viewing was the only SBSR domain related to BMI ( $r=.35$ ,  $p<.01$ ).

**CONCLUSION:** Self-reported SB showed poor convergent validity with objective accelerometry. Total self-reported SB was most closely linked to SB50, the lowest cut point of objective SB tested.

Funded by a research grant (1R18DP002138-01) from the Centers for Disease Control and Prevention.

**2641 Board #316 MAY 31 3:30 PM - 5:00 PM**

**Effects Of Sedentary Behavior And Steps/day On Insulin Sensitivity**

Corianne Oliver, Sarah Kozey-Keadle, Richard Viskochil, Barry Braun, FACSM, Patty S. Freedson, FACSM. *University of Massachusetts Amherst, Amherst, MA.*  
(No relationships reported)

The benefits of physical activity (PA) on insulin sensitivity have been previously established. However, the effects of sedentary behavior (SB) on insulin sensitivity are not well understood.

**PURPOSE:** To determine the association between habitual SB, steps/day, and insulin sensitivity in non-exercising, overweight/obese individuals.

**METHODS:** Fifty-seven non-exercising, overweight/obese (mean ± SD: BMI = 35.1 ± 4.6 kg·m<sup>-2</sup>) participants 43.6 ± 9.9 yrs wore an inclinometer to measure free-living SB (time sitting/lying, expressed as % of wear time [%sed]) and steps for 7-days. Plasma insulin and glucose concentrations were measured during a 2-hour oral glucose tolerance test following the wear time and the composite insulin sensitivity index (CISI) was calculated. The independent effects of SB and steps overall, on weekdays and weekends on CISI were evaluated using linear regression. Correlations ( $r$ ) between SB and steps/day with CISI were also calculated.

**RESULTS:** SB was not associated with CISI. Steps/day on the weekend, controlling for SB and BMI, was positively associated with CISI ( $p<0.05$ ).

|           | % Sed Overall | % Sed Weekday | % Sed Weekend | Steps Overall   | Steps Weekday   | Steps Weekend   |
|-----------|---------------|---------------|---------------|-----------------|-----------------|-----------------|
| Mean ± SD | 68.6 ± 8.0    | 70.8 ± 7.8    | 64.2 ± 12.2   | 5987.8 ± 1998.8 | 6011.8 ± 2135.6 | 5905.8 ± 2711.6 |
| $r$       | 0.181         | 0.284         | 0.157         | 0.393*          | 0.283           | 0.486*          |
| $p$       | 0.748         | 0.322         | 0.164         | 0.070           | 0.184           | 0.009^          |

\*  $p<0.01$ ; ^  $p<0.05$  controlling for % Sed and BMI

**CONCLUSION:** In a group of overweight/obese men and women who do not exercise, SB was not related to insulin sensitivity. However, steps/day, particularly on the weekend, was significantly associated with insulin sensitivity. Both SB and steps were more variable on the weekend compared to weekdays, which may play a role in the sensitivity differences observed.

Funded by NIH RC HL099557

**D-32 Free Communication/Poster - Skeletal Muscle Physiology**

MAY 31, 2012 1:00 PM - 6:00 PM

ROOM: Exhibit Hall

**2642 Board #317 MAY 31 2:00 PM - 3:30 PM**

**NAD(P)H Kinetics At Onset Of Contractions In Single Myofibers: Effect Of Prior Contractions**

Paulo Gandra, Leonardo Nogueira, Amy A. Shiah, Michael C. Hogan, FACSM. *UCSD, La Jolla, CA.*  
(No relationships reported)

**INTRODUCTION -** Evidence supports the notion of delayed respiratory activation occurring in skeletal muscle mitochondria during the transition from rest to exercise. NAD(P)H autofluorescence can be used to measure changes in mitochondrial activity since it reflects the mitochondrial potential energy status.

**PURPOSE:** Determine the changes in NAD(P)H fluorescence in single myocytes at the onset of successive contractile bouts and in the absence of the cross-bridges cycling.

**METHODS:** Intact *Xenopus* single fibers were stimulated to contract repetitively at maximal tetanic tension (1 contraction/2 sec) for 2 min and both isometric tension and NAD(P)H autofluorescence were measured ( $n=7$  fibers). A second bout of contractions was performed 5 min (5-min rest) after the first bout. In a different set of fibers ( $n=4$  fibers), a contractile bout was performed in the presence and in the absence of the specific cross-bridge inhibitor N-benzyl-p-toluene sulfonamide (BTS, 15 μM) with a 60 min interval between each bout.

**RESULTS:** For the first bout of contractions, the NAD(P)H autofluorescence demonstrated a decrease during stimulation after a time delay of 14.1 ± 1.3 sec. In the second contraction period (after 5 min of rest), NAD(P)H decreased immediately after the first contraction. The time constant of the NAD(P)H kinetics was shorter during the second contractile period (3.3 ± 0.3 sec) vs the first period (5.0 ± 0.3 sec;  $P<0.05$ ). Interestingly, when cross-bridge cycling was inhibited by BTS, the time-delay of NAD(P)H fluorescence kinetics at the onset of contractions was slightly increased in 3 of the 4 fibers compared to control (i.e., no BTS) while the time constant of NAD(P)H fluorescence was significantly increased with BTS (8.1 ± 0.7 sec) compared to control (3.5 ± 0.8 sec  $P<0.05$ ).

**CONCLUSION:** Priming skeletal muscle by a previous contractile activity results in a faster adjustment of NAD(P)H oxidation at the onset of contractions. In addition, reduction of the energy cost by the inhibition of cross-bridges cycling resulted in a slower rate of NAD(P)H oxidation. Thus, mechanisms directly related to the mitochondrial potential energy as well as other mechanisms, such as a regulation parallel to the cross-bridge cycling regulate mitochondrial activity at the onset of contractions.

Supported by NIH grant 5R01AR040155-17.

**2643 Board #318 MAY 31 2:00 PM - 3:30 PM**

**Influence of MHC Hybrid Isoform Protein Proportions on Single Muscle Fiber Function in Humans**

James R. Bagley, Kevin A. Murach, Kiril Minchev, Robert A. Standley, Todd A. Trappe, Scott W. Trappe, FACSM. *Human Performance Laboratory, Ball State University, Muncie, IN.*  
(No relationships reported)

Human skeletal muscle contains pure myosin heavy chain (MHC) fiber types (I, IIa, and IIx) along with hybrid fibers expressing multiple MHC isoforms (I/IIa, IIa/IIx, and I/IIa/IIx). Although hybrid fibers represent a common component of human muscle, little research exists on their relative MHC protein distribution or single fiber functional profiles.

**PURPOSE:** Quantify the proportion of co-expressed MHC isoforms in hybrid fibers and determine its influence on single muscle fiber function.

**METHODS:** Human muscle fibers (n=68) were isolated from vastus lateralis biopsies, analyzed for single fiber physiology (size, strength, speed, power), typed electrophoretically, digitally imaged, and identified as one of three hybrid fiber types [MHC I/IIa (n=47), MHC IIa/IIx (n=20), and MHC I/IIa/IIx (n=1)]. Two researchers independently quantified (in duplicate) the proportion of MHC isoforms expressed in these fibers via densitometry.

**RESULTS:** Significant correlations in densitometry measures existed between observations from the same researcher ( $r \geq 0.995$ ) and different researchers ( $r = 0.998$ ,  $ICC = 0.997$ ), indicating strong test-retest and inter-rater reliability. Proportions of MHC IIa isoform expressed in I/IIa and IIa/IIx hybrid fibers ranged between 7-94% and 28-83% of total MHC protein, respectively. MHC IIa isoform percentage positively correlated with strength ( $P_0$ ,  $R^2 = 0.40$ ), speed ( $V_0$ ,  $R^2 = 0.78$ ), and normalized power ( $R^2 = 0.76$ ) in MHC I/IIa fibers. No significant correlations were observed between MHC isoform proportions and IIa/IIx hybrid fiber function.

**CONCLUSION:** These initial results indicate hybrid fibers exist on a morphological and functional continuum. More research is needed to elucidate the physiological significance of hybrid muscle fibers in humans and their adaptability with changes in physical activity patterns.

Supported by grants from the National Institutes of Health (AG038576) and the National Aeronautics and Space Administration (NNJ06HF59G).

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2644 Board #319 MAY 31 2:00 PM - 3:30 PM

**Severe Atrophy of Slow Fibers in Aging Muscle is Masked by Myosin Heavy Chain Co-expression**

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(No relationships reported)

Although it is widely considered a fact that slow twitch muscle fibers are less susceptible to atrophy in aging muscle, two key points raise the possibility that atrophy of slow twitch fibers has been underestimated in the past. Firstly, the marked atrophy of the aging rat soleus (Sol) muscle cannot be explained by atrophy and loss of only the fast fibers, due to their very low abundance in this muscle. Secondly, recent immunolabeling evidence reveals a high abundance of small fibers co-expressing both fast and slow myosin heavy chain (MHC) isoforms in the aging rat Sol, and that their accumulation occurs at the expense of the pure MHC slow fiber population.

**PURPOSE:** To determine whether slow twitch muscle fibers are less susceptible to atrophy in aging muscle, after accounting for the size and proportion of MHC co-expressing fibers that derived from formerly pure MHC slow fibers.

**METHODS:** Young adult (YA) and senescent (SEN) rat Sol muscles were immunolabeled for MHC slow and MHC fast expression. We then examined the size and proportion of MHC slow, MHC fast, and MHC fast-slow co-expressing fibers. To explain the atrophy behavior, we also probed *in situ* for MAFbx, a protein involved in protein degradation by the proteasome machinery and necessary for muscle atrophy under a variety of conditions.

**RESULTS:** In the Sol, whereas the abundance of pure MHC fast fibers was unchanged between YA ( $1.3 \pm 0.2\%$ ) and SEN ( $2.9 \pm 1.3\%$ ;  $P = 0.10$ ), there was a marked increase in MHC co-expressing fibers from  $3.9 \pm 0.9\%$  in YA to  $46.8 \pm 5.3\%$  in SEN, and this was accompanied by a proportional decline in pure MHC slow fibers between YA ( $94.7 \pm 0.9\%$ ) and SEN ( $50.3 \pm 4.9\%$ ). This suggests that MHC co-expressing fibers represent a subclass of formerly MHC slow fibers. Strikingly, the co-expressing fibers exhibited a marked amount of atrophy (58%) when compared to the size of MHC slow fibers in YA, and this was coincident with an increase in MAFbx expression.

**CONCLUSIONS:** Our results indicate that MHC co-expressing fibers represent a population of formerly pure MHC slow fibers in the SEN Sol muscle that exhibit a marked amount of atrophy with aging. These results redefine the impact of aging on slow fiber atrophy, and emphasize the necessity of addressing the atrophy potential of both fast and slow fibers in seeking treatments for aging muscle atrophy.

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2645 Board #320 MAY 31 2:00 PM - 3:30 PM

**Small Angular Mhc Co-expressing Fibers In Copd Muscle: Evidence Of Premature Aging?**

Sophia Kapchinsky<sup>1</sup>, Norah J. MacMillan<sup>1</sup>, Fennigie M. Purves-Smith<sup>1</sup>, Nicolas Sgarito<sup>1</sup>, Jacinthe Baril<sup>1</sup>, Vincent Mainguy<sup>2</sup>, Steve Provencher<sup>2</sup>, Thomas Jagoe<sup>1</sup>, Tanja Taiavassalo<sup>1</sup>, Russell Hepple<sup>1</sup>. <sup>1</sup>McGill University, Montreal, QC, Canada. <sup>2</sup>Universite Laval, Quebec, QC, Canada.

(No relationships reported)

Exercise intolerance in Chronic Obstructive Pulmonary Disease (COPD) results from a complex interplay of a shift to less aerobic fiber types, fiber atrophy, and other peripheral muscle disturbances, superimposed on the primary ventilatory limitation seen in this population. While the root cause of the muscle dysfunction is unclear, several of the phenotypes reported resemble those seen with normal aging, albeit on an accelerated time-course. In this respect, another interesting feature reported in COPD muscle is an elevated abundance of fibers expressing more than one myosin heavy chain (MHC) isoform (co-expressing fibers). Although MHC co-expressing fibers which are very small in size and having angular shape have recently been shown to result from long-term denervation in aging muscle, whether denervation is the cause of MHC co-expression in COPD muscle has not been examined.

**PURPOSE:** To investigate whether MHC co-expressing fibers in peripheral muscle of COPD patients exhibit features of long-term denervation.

**METHODS:** A muscle biopsy of the vastus lateralis was collected from three severe COPD patients ( $65 \pm 1$  y,  $FEV_1 = 37.7 \pm 1.5\%$  pred) to investigate fiber size, fiber circularity (calculated as  $4\pi \times \text{area}/\text{perimeter}^2$ , where a perfect circle = 1.0), and fiber type using immunolabelling for type I, IIa, and IIx MHC isoforms. For comparison, a biopsy was also collected from a healthy age-matched subject (CTRL; 64 y).

**RESULTS:** Fiber size distribution in COPD muscle showed a pronounced leftward shift towards an increased abundance of smaller fibers compared to CTRL. Similarly, COPD patients also exhibited a leftward shift towards less circular fibers, and in contrast to the CTRL subject, exhibited several very angular fibers (circularity  $\leq 0.4$ ) with a very low cross-sectional area ( $\leq 2000 \mu\text{m}^2$ ). All but one of these small angular fibers was co-expressing MHC IIa and IIx.

**CONCLUSIONS:** The presence of small, severely angular MHC co-expressing fibers in COPD muscle suggests these are the result of long-term denervation. Since these fibers were exclusive to COPD, but are also known to accumulate with more advanced age, our results are consistent with other evidence suggesting that COPD may accelerate key aspects of aging. Additional markers of denervation are currently being investigated to support these findings.

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2646 Board #321 MAY 31 2:00 PM - 3:30 PM

**High-Frequency Acupuncture Represses the Atrophy of Fast-Fiber Rich Skeletal Muscle**

Shin Fujimaki, Masanao Machida, Kohei Takeda, Tohru Takemasa. University of Tsukuba, Ibaraki, Japan.

(No relationships reported)

**PURPOSE:** Electroacupuncture has been utilized for preventing skeletal muscle atrophy. The target muscle of previous studies was slow-fiber rich soleus muscle, so effects have not been elucidated on fast-fiber rich gastrocnemius and plantaris muscles. The atrophy of fast fibers is great loss for power-athletes specializing in sprint, throwing and so on. This study aimed to investigate the effects of electroacupuncture on these muscles controlling the stimulus frequencies of electroacupuncture.

**METHODS:** Eight-week-old male ICR mice were randomly divided in four groups; Con (Control), Den (Denervation), Den-H (Denervation + High-frequency electroacupuncture) and Den-L (Denervation + Low-frequency electroacupuncture). Den, Den-H and Den-L mice were subjected to surgical removal of the sciatic nerves and Den-H and Den-L mice received electroacupuncture for 15 min per day, twice in the experimental period (5days), with high- (100Hz; Den-H) or low (10Hz; Den-L) frequency waves.

**RESULTS:** Sciatic denervation significantly reduced muscle mass of gastrocnemius and plantaris muscles. The denervation-induced reduction of gastrocnemius muscles was repressed in Den-H and Den-L mice, whereas that of plantaris muscles was only repressed in Den-H mice. We found that the phosphorylation levels of mTOR signaling proteins, which accelerates to muscle hypertrophy, were unchanged by denervation. We also found that the expressions of E3 ubiquitin ligases, which accelerate to muscle atrophy, were significantly increased by denervation. However, the redundant expressions of E3 ubiquitin ligases by denervation were repressed in Den-H mice.

**CONCLUSIONS:** Therefore, it is suggested that electroacupuncture stimulation with high frequency waves represses the atrophy of fast-fiber rich gastrocnemius and plantaris muscles, via downregulation of E3 ubiquitin ligases.

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2647 Board #322 MAY 31 2:00 PM - 3:30 PM

**Selective Embedding of Capillaries within Murine Slow Twitch Skeletal Muscle Fibers Visualized Using In Vivo Microscopy**

Brian Glancy, Li-Yueh Hsu, Lam Dao, Matthew Bakalar, Stephanie French, David J. Chess, Joni L. Taylor, Mathew P. Daniels, Shervin Esfahani, Robert S. Balaban.  
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(No relationships reported)

Maximal aerobic energy production is limited by the ability to deliver and transfer oxygen (O<sub>2</sub>) to mitochondria (MITO) within skeletal muscle. As such, the spatial relationship between capillaries (CAP), MITO, and the muscle fiber plays an important role in determining the aerobic capacity of a muscle. Most skeletal muscle morphology knowledge comes from electron (EM) and/or light microscopy studies and show that both MITO content and CAP density increase with the aerobic capacity of a muscle. However, these studies are typically done by analyzing single 2D slices of muscle fibers and require a fixative which can alter morphology.

**PURPOSE:** Evaluate the *in vivo*, 3D spatial relationship between CAP, MITO, and three fiber types within murine Tibialis anterior (TA) muscle.

**METHODS:** Two photon excitation microscopy was utilized for simultaneous imaging of MITO (NADH autofluorescence), vasculature, and interstitial space using selective dyes. ~825 x 825 x 280 μm volumes of the TA were analyzed *in vivo* with flowing blood. A custom contour drawing and analysis program was used to trace fiber boundaries and determine the contact and volume ratios between CAP and muscle fibers for 98 fibers. Fiber type (slow (ST), intermediate (IT), fast-twitch (FT)) was determined based on the relative intensity of the NADH signal and fiber size. EM was performed on cross-sections and longitudinal slices of fixed TA samples for further validation.

**RESULTS:** Microscopy revealed that a significant fraction of ST fiber CAP (51.7 ± 4.0%) had at least 50% of their circumference embedded in a groove in the sarcolemma, *in vivo*. Embedded CAP were tightly associated with dense MITO populations lateral to the CAP grooves and nearly absent below the groove where fibrils dominated. CAP embedding was significantly lower in IT (25.7 ± 4.5%) and FT (14.1 ± 2.1%). EM images confirmed ST embedded CAP and MITO localization. 35.1 ± 1.5% of ST fiber surface area (SA) was in contact with CAP, whereas IT and FT fiber SA contact was only 13.2 ± 1.4% and 8.4 ± 0.7%, respectively.

**CONCLUSIONS:** A specialized sarcolemma/CAP groove is present in murine ST fibers resulting in the embedding of CAP in a MITO rich region of the cell. This structure optimizes the CAP O<sub>2</sub> delivery to highly aerobic ST fibers as well as selectively restricts the O<sub>2</sub> delivery to FT fibers in these mixed fiber muscles.

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2648 Board #323 MAY 31 2:00 PM - 3:30 PM

**Fiber Type Comparison Between Wild-type And Desmin Knock-out Mice**

Allen C. Parcell, FACSM, Brenda Benson, Michael Leavitt, Daniel Nelson, Derek Stewart. *Brigham Young University, Provo, UT.*  
(No relationships reported)

Proteins of the muscle cytoskeleton are important for the transmission of forces and appear to be a component of the adaptive response to chronic overload. Questions remain as to how cytoskeletal proteins may mediate the translation of a contractile stimulus to an adaptive response.

**PURPOSE:** As an initial phase to approach these questions the purpose of this research was to conduct a contemporary examination of muscle morphology in a desmin knockout mouse with regard to muscle fiber-type composition.

**METHODS:** The gastrocnemius and tibialis anterior muscles were dissected from wild-type and desmin knockout mice. Tissue cross-sections were stained for myosin ATPase with an acid preincubation pH of 4.45. Sections were assessed for type I and type II cells by two independent evaluators after which fiber counts and distributions were calculated.

**RESULTS:** Wild type (WT) mice possessed and fiber-type distribution in the gastrocnemius of 7% type I, 7% type IIa/IIx, and 86% type IIb cells. WT tibialis anterior muscle was composed of 34% type I, 11% type IIa/IIx, and 55% type IIb cells. Desmin knockout (KO) mice had a gastrocnemius muscle composition of 11, 7, and 82% type I, IIa/IIx, and type IIb fibers, respectively. KO tibialis anterior muscle was composed of 40% type I, 10% type IIa/IIx, and 50% type IIb cells. Fiber type composition values were not different between WT and KO.

**CONCLUSIONS:** The absence of the protein desmin appears to have no impact on fiber type distribution in the gastrocnemius or tibialis anterior muscle of mice.

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2649 Board #324 MAY 31 2:00 PM - 3:30 PM

**A Model For Understanding Eccentric Contractions-induced Muscle Damage: Bupivacaine-induced Elevations In Intramyocyte Ca<sup>2+</sup>**

Tadakatsu Inagaki<sup>1</sup>, Takashi Sonobe<sup>2</sup>, David C. Poole, FACSM<sup>3</sup>, Yutaka Kano<sup>1</sup>. <sup>1</sup>University of Electro-Communications, Chofu, Japan. <sup>2</sup>National Cerebral and Cardiovascular Center Research Institute, Suita, Japan. <sup>3</sup>Kansas State University, Manhattan, KS.  
(No relationships reported)

The mechanistic bases for eccentric exercise (ECC)-induced muscle damage is thought to involve dysregulation of stretch-activated channels leading to loss of intramyocyte Ca<sup>2+</sup> homeostasis and elevated intramyocyte Ca<sup>2+</sup> concentration ([Ca<sup>2+</sup>]<sub>i</sub>) which induces muscle damage via calpain activation (Sonobe et al. *Am J Physiol* 294:R1329-37, 2008). However, to determine the effects of elevated [Ca<sup>2+</sup>]<sub>i</sub> in separtum from the mechanical stress of ECC a pharmacological means of perturbing [Ca<sup>2+</sup>]<sub>i</sub> would be valuable.

**PURPOSE:** To test the hypothesis that the anesthetic bupivacaine (BPV) would cause prolonged elevation of [Ca<sup>2+</sup>]<sub>i</sub> in "whole" muscle and single fibers of rat spinotrapezius muscle.

**METHODS:** Adult male Wistar rats (n=12) were divided randomly into 1) ECC (500 contractions in 10 sets, 100 Hz, 700 ms duration, 20/min) and 2) BPV treatment (1 mg/0.2 ml, 5 min exposure) groups. Contractions induced by surface electrode stimulation during synchronized muscle stretch of 10% resting length. The spinotrapezius muscle was exteriorized with vascular and neural connections intact for intravital microscopic observations and incubated with FURA2-AM (20 μM) to estimate [Ca<sup>2+</sup>]<sub>i</sub> and changes thereof. Before and following each set of ECC or BPV treatment the fluorescence ratio (F340/F380 nm) was resolved for ~ 1 hour to determine [Ca<sup>2+</sup>]<sub>i</sub>.

**RESULTS:** Following ECC and BPV "whole" muscle [Ca<sup>2+</sup>]<sub>i</sub> increased significantly and to a similar magnitude (ECC, 22.0±6.7%; BPV, 19.0±4.9%, p<0.05 vs. baseline for both) and this remained true for the 1 hour post-treatment recovery period. However, there was substantial heterogeneity of the [Ca<sup>2+</sup>]<sub>i</sub> and its subsequent time course within and among individual muscle fibers during recovery.

**CONCLUSIONS:** Bupivacaine-induced [Ca<sup>2+</sup>]<sub>i</sub> elevations offer a potentially powerful mechanistic tool to determine the precise linkage (e.g., degree of perturbation of [Ca<sup>2+</sup>]<sub>i</sub> and the duration necessary) between [Ca<sup>2+</sup>]<sub>i</sub> and damage within individual myocytes. These are key steps to resolving the mechanisms responsible for ECC-induced muscle damage.

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2650 Board #325 MAY 31 2:00 PM - 3:30 PM

**Sources of Variation in Maximal Dorsiflexor Muscle Strength in Young and Older Adults**

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(No relationships reported)

Muscle specific strength (voluntary torque per unit muscle) is determined by a number of factors. On the neural side, recruitment of muscle fibers and the rate at which fibers are active play a key role in torque generation. At the level of the muscle, variations in size have been shown to account for ~2/3 of the variations in strength. Given the changes that occur in the neuromuscular system in old age, it is possible that there are differences in the sources of specific strength variation in young and older adults.

**PURPOSE:** To investigate whether there is a relative difference in neural and muscular contributions to variations in strength in young (Y) and older (O) adults.

**METHODS:** Eight Y (5F, 3M, 23±1 yr, mean±SE) and 11 O (4F, 7M, 73±2 yr) healthy, sedentary adults performed maximal isometric contractions of the ankle dorsiflexor muscles. Full voluntary activation of the muscle was determined using the central activation ratio. MRI was used to calculate maximal fat-free muscle cross-sectional area (mCSA). Specific strength was calculated as peak isometric torque / maximal mCSA (Nm·cm<sup>-2</sup>). Maximal motor unit discharge rates (MUDR) were measured using four-wire, needle electromyography.

**RESULTS:** There were no differences between Y and O in specific strength (p=0.56) or MUDR (p=0.36), and all participants had complete voluntary activation. Size and strength were linearly related in both Y (r=0.87, p<0.01) and O (r=0.58, p=0.06). There was no association between specific strength and maximal MUDR in either group (Y: r=0.02, p=0.96; O: r=0.08, p=0.81).

**CONCLUSIONS:** Specific strength, voluntary activation, and MUDR were similar in Y & O, indicating no impairment in isometric torque generation with old age. The observation that 76% of the variation in muscle strength was accounted for variation in muscle size in Y, but only 34% in O, suggest that the sources of strength variation do vary by age, but are independent of activation and rate coding. The remaining variation may be due to differences fiber type or muscle architecture.

Support: NIA R01 AG21094

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**2651** Board #326 MAY 31 2:00 PM - 3:30 PM

**Evidence for PGC-1 Mediated Angiogenesis in Human Muscle: Insights from Energetic Deficiency in Mitochondrial Myopathy**

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(No relationships reported)

Human mitochondrial myopathy (MM) can result from inborn mutations of mitochondrial (mt)-DNA, impairing respiratory chain function and energy production. Patients with high levels of mutation in skeletal muscle present with debilitating exercise intolerance and an exaggerated cardiopulmonary response to exercise. Recently, abnormally high levels of capillaries - the interface for oxygen delivery and utilization in muscle - have been reported in MM, particularly around respiratory-deficient fibers, despite normal muscle levels of oxygen delivery and low capacity for oxygen extraction. This is surprising given that a low cellular oxygen level, through the stabilization of Hypoxia Inducible Factor 1 $\alpha$  (HIF-1 $\alpha$ ), is considered the main driver of new capillary growth in skeletal muscle. Interestingly, recent findings from transgenic animals have indicated that fluctuation in cellular energy intermediates could induce angiogenesis through the metabolic regulator PGC-1 $\alpha$ , independently of the canonical HIF-1 $\alpha$  pathway.

**PURPOSE:** To evaluate the hypothesis that elevated PGC-1 $\alpha$  in response to a myofiber energy deficit is the mechanism leading to capillary proliferation surrounding fibers containing oxidatively impaired mitochondria in MM muscle.

**METHODS:** A 52 y old male with a single, large-scale mt-DNA deletion causing Cytochrome C Oxidase (COX)-deficiency was studied. In-situ labeling was performed in serial cross-sections obtained from a vastus lateralis muscle biopsy to identify at the single cell level: oxidatively-deficient fibers (histochemical stain for COX); capillary number around a fiber ( $N_{CAF}$ ; lead-ATPase); PGC-1 content; and fiber type (based on myosin heavy chain protein expression)

**RESULTS:** Findings revealed that COX-deficient fibers were exclusively type IIa. Interestingly, both  $N_{CAF}$  ( $5.70 \pm 1.5$  vs.  $4.1 \pm 0.8$ ,  $p < 0.05$ ) and PGC-1 content ( $2628 \pm 563$  vs.  $2122 \pm 98$  AU,  $p < 0.05$ ) were significantly increased in COX-deficient compared to COX normal myofibers.

**CONCLUSIONS:** These results suggest that enhanced myofiber angiogenesis in MM patients is mediated by an increase in PGC-1 expression secondary to energy insufficiency resulting from the severe mt-DNA defect. As such, they provide the first experimental support for the non-canonical regulation of angiogenesis via PGC-1 in humans.

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**2652** Board #327 MAY 31 2:00 PM - 3:30 PM

**Stimulation Current Does Not Influence NIRS Measured Metabolic Rate**

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(No relationships reported)

Near infrared spectroscopy (NIRS) has been used to evaluate skeletal muscle oxygen levels and metabolic rates.

**PURPOSE:** This study tested the effect of different electrical stimulation current levels on NIRS measured metabolic rate.

**METHODS:** Healthy subjects (7 F, 1 M, ages 23-32) were tested. A dual channel NIRS device (Oxymon, Artinis) was used with separation distances between 3.0 and 4.5 cm, placed over either the medial gastrocnemius or vastus lateralis. Surface electrical stimulation produced muscle activation. Each subject was stimulated for three 2 minute stimulation periods at 4 Hz with randomized current levels (for example: 40, 50, 60 mAmps). Between levels, a 10 second ischemic period was used to measure metabolic rate. A 5 minute duration ischemic cuff with reactive hyperemia was used to calibrate NIRS signals.

**RESULTS:** Oxygen saturation during stimulation was not different between current levels ( $69.8 \pm 9.0\%$ ,  $68.6 \pm 9.8\%$ ,  $69.6 \pm 8.2\%$  low, med, high current) and was similar to resting oxygen saturation ( $69.3 \pm 10.2\%$ ). Metabolic rate was not significantly different between current levels (96%, 107%, 117% of resting metabolic rate for low, med, high current). Longer separation distances gave results similar to those reported for shorter separation distances. In conclusion small differences in current levels at or above 50 mA did not influence, on average, muscle oxygen saturation or metabolic rate following electrical stimulation. Separation distance also did not influence these measurements.

**CONCLUSIONS:** This suggests that electrical stimulation is a feasible method of activating skeletal muscle for NIRS-based measurements of muscle metabolism.

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**2653** Board #328 MAY 31 2:00 PM - 3:30 PM

**Effects of FES-Cycling Parameters on Oxygen Uptake after Spinal Cord Injury**

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(No relationships reported)

Functional electrical stimulation (FES) cycling is an effective therapeutic intervention in attenuating skeletal muscle atrophy and cardiovascular de-conditioning after spinal cord injury (SCI). Previously it was shown that lengthening the pulse duration increases skeletal muscle activation during isometric actions. However, it is not known whether adjusting the stimulation parameters could influence oxygen uptake to match the metabolic needs of increasing skeletal muscle activation during FES-cycling.

**PURPOSE:** To determine the effects of different pulse durations (P200, P350 and P500  $\mu$ s) on oxygen uptake during FES-cycling in men with SCI

**METHODS:** Ten (9 men and 1 woman) individuals with motor complete SCI ( $44 \pm 10$  years,  $25 \pm 4$  Kg/m<sup>2</sup>) participated in three cross-over randomized visits separated by a week. The FES cycling (RT300 bike) parameters were kept constant (33 Hz, amplitude of the current to maintain cycling at 40-45 RPM, resistance at 1Nm) across the three visits and the participants cycled until fatigued. Pulse durations (P200, P350 and P500  $\mu$ s) were randomized across the three visits. Bilateral surface adhesive electrodes were placed on knee extensor, flexor and hip extensor muscle groups. Oxygen uptake was measured using COSMED K4b2 (COSMED USA, Chicago, IL) portable metabolic unit. A repeated measure ANOVA (within and between designs) was used to analyze the data.

**RESULTS:** Across the three visits, absolute and relative oxygen uptake significantly ( $P < 0.001$ ) increased during the warm up period ( $3.17 \pm 0.95$  ml/kg/min) and exercise ( $4.9 \pm 1.8$  ml/kg/min) compared to the rest ( $2.7 \pm 0.85$  ml/kg/min) period. Both absolute and relative oxygen uptake remained higher in the recovery period ( $3.8 \pm 1.12$  ml/kg/min) compared to both rest and warm-up periods but lower than the exercise period ( $P < 0.0001$ ). The relative oxygen uptake was not statistically different among the P200 ( $4.5 \pm 1.8$  ml/kg/min), P350 ( $5.2 \pm 1.9$  ml/kg/min) and P500 ( $4.9 \pm 1.8$  ml/kg/min) cycling protocols ( $P = 0.7$ ).

**CONCLUSION:** Administering different pulse durations did not influence oxygen uptake during FES-cycling in men with SCI. Clinicians may likely use 200 or 350  $\mu$ s, because there are no additional benefits from using 500  $\mu$ s on oxygen uptake.

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**2654** Board #329 MAY 31 2:00 PM - 3:30 PM

**Effect of Body Composition on Electromyography Using a Vibration Platform**

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(No relationships reported)

**PURPOSE:** Previous research has demonstrated that excess sub-cutaneous adipose tissue muscles could act as an insulator to electrical signatures. Electromyography (EMG) is used to record and evaluate electrical signals produced by skeletal muscles measured in microvolts. However, it is unclear whether excess adipose will cause a discrepancy in results of the biofeedback from EMG. This investigation used EMG to compare the biofeedback throughout exercise of recreationally trained women with different body composition while exercising on a vibration platform.

**METHODS:** Twenty women (mean age  $20 \pm 1.04$  yrs; body fat  $21.95 \pm 4.418\%$ ) volunteered to participate in this study. The group was divided evenly based on the average % BF for the whole group (lower % BF (L%BF) and higher % BF (H%BF)). The experimental trial consisted of dynamic squat exercise on the vibration platform at three different vibration frequencies (i.e.

Hz = 20, 30, 40) on a stable surface in two groups for 30 seconds per trial. The resistance used during the three different vibration frequencies or on stable ground was the individual's body weight. The EMG electrodes were placed on the Vastus Medialis to measure biofeedback during all trials. The conditions were presented in counterbalanced order and a rest period of three minutes occurred between each trial. A T-test was used to compare the three conditions in relation to body composition.

**RESULTS:** L%BF's mean body fat percentage was  $18.5 \pm 2.79\%$  and H%BFs body fat percentage was  $25.4 \pm 2.63\%$ . The biofeedback was slightly higher with resistance training on the platform in H%BF compared to L%BF in all trials. Standard deviation of H%BF in all trials had a greater range and mean compared to L%BF but was not significant. At 20 Hz ( $p < .69$ ), 30 Hz ( $p < .71$ ) and 40 Hz ( $p < .83$ ).

**CONCLUSIONS:** Electromyography in relation to body composition of young recreational trained women was not significantly different during a vibration platform training program.

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**2655** Board #330 MAY 31 2:00 PM - 3:30 PM

#### Neuromuscular Parameters For Ramp And Step Incremental Cycle Ergometer Tests

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(No relationships reported)

**PURPOSE:** The purpose of the study was to examine the patterns of electrical (EMG) and mechanical (MMG) responses, as well as submaximal mean values for step (30 W increments every two min) versus ramp ( $15 \text{ W} \cdot \text{min}^{-1}$ ) incremental cycle ergometer tests.

**METHODS:** Seven male and seven female (age and body mass =  $23.36 \pm 3.34$  years and  $71.65 \pm 11.10$  kg) visited the laboratory on three separate occasions. The initial visit was an orientation session and the next two visits were randomly ordered step (30 W increments every 2 min) and ramp ( $15 \text{ W} \cdot \text{min}^{-1}$  increments, 1 W increase every 4 s) incremental cycle ergometer tests. The EMG and MMG signals were collected from the vastus lateralis of the dominant leg. In addition, the work performed (kJ) during each protocol was calculated. Two-way repeated measures ANOVAs were used to analyze the data. Polynomial regression analyses were used to determine the patterns of responses for the EMG and MMG signals. A paired t-test was used to analyze the difference in the work performed (kJ) during each protocol. All the data was analyzed using the common power outputs (i.e., 30, 60, 90, 120, and 150 W).

**RESULTS:** The polynomial regression analyses showed that most subjects had the same patterns of responses for the ramp and step incremental tests for EMG amplitude (79%), but different patterns for MMG amplitude (57%). The ramp incremental cycle ergometer test resulted in significantly ( $p = 0.03$ ) lower mean (ramp =  $127.2 \pm 45.1 \mu\text{Vrms}$  and step =  $137.5 \pm 39.9 \mu\text{Vrms}$ ) EMG amplitude values (collapsed across power output) than the step protocol. Furthermore, there was a significantly ( $p = 0.001$ ) greater amount of work performed at the common power outputs for the step ( $54.20 \pm 0.08$  kJ) vs. the ramp ( $45.66 \pm 0.06$  kJ) incremental cycle ergometer test.

**CONCLUSION:** The results of the present study indicated that the different pattern of responses for MMG amplitude associated with changes in motor unit recruitment may be due to the different workload increments (step vs. ramp). Furthermore, the greater mean EMG amplitude values for the step than the ramp protocols suggest that there was an increase in motor unit activation (i.e., recruitment and firing rate) in response to the greater work performed for the step vs. ramp incremental cycle ergometer test.

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**2656** Board #331 MAY 31 2:00 PM - 3:30 PM

#### Effects Of Superoxide, Nitric Oxide And Peroxynitrite On Skeletal Muscle Mitochondrial Function

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(No relationships reported)

The intramuscular accumulation of nitric oxide (NO) and reactive oxygen species (ROS) can lead to reactive nitrogen species formation (RNS; peroxynitrite). NO is a competitive inhibitor of mitochondrial complex IV, and ROS can oxidize complex I, III or outer membrane proteins; each of which can limit ATP provision and impair muscle function. RNS, however, causes complex I nitrosation and widespread cytotoxicity that may exaggerate mitochondrial dysfunction. How the combination of these inhibitors affects mitochondrial respiration in intact skeletal muscle is currently unknown.

**PURPOSE:** To determine the effects of NO, ROS, and their combination (RNS) on skeletal muscle mitochondrial respiration *in situ*.

**METHODS:** Oxygen consumption ( $\text{JO}_2$ ) of ~8 mg soleus muscle from 8, 2-month-old, rats was measured by high-resolution respirometry (Oroboros). Respiratory state 3 (RS3) was measured after the addition of Krebs cycle substrates and 2.5 mM ADP. Outer-membrane integrity was assessed by 10  $\mu\text{M}$  cytochrome c.  $\text{JO}_{2\text{max}}$  was measured after 10 mM succinate, and complex II-IV function by FCCP and rotenone.  $\text{JO}_2$  values in this protocol (CON) were compared to those measured after the addition of 100  $\mu\text{M}$  pyrogallol (ROS), 100  $\mu\text{M}$  S-nitroso-N-acetyl penicillamine (NO) or both (RNS).

**RESULTS:** ADP-stimulated  $\text{JO}_2$  was lower in NO, ROS and RNS ( $15.4 \pm 9.0$ ,  $18.3 \pm 7.5$  and  $12.7 \pm 3.7$  nmol $\text{O}_2$ /s/mg; mean  $\pm$  SD) than CON ( $48.5 \pm 14.2$  nmol $\text{O}_2$ /s/mg;  $p < 0.05$ ).  $\text{JO}_{2\text{max}}$  was lower in ROS than CON ( $p < 0.05$ ), but both were greater than NO and RNS ( $p < 0.05$ ). The ADP flux control ratio ( $\text{RS3}/\text{JO}_{2\text{max}}$ ) was not different between NO ( $0.45 \pm 0.15$ ) and CON ( $0.46 \pm 0.11$ ), but was lower ( $p < 0.05$ ) in ROS ( $0.25 \pm 0.14$ ) and RNS ( $0.32 \pm 0.13$ ).  $\text{JO}_2$  increased by 75  $\pm$  49% and 51  $\pm$  44% after cytochrome c addition in ROS and RNS ( $p < 0.01$ ), suggesting outer-membrane damage. The flux control ratio for rotenone was higher for ROS and RNS compared to CON and NO ( $p = 0.052$ ).

**CONCLUSION:** As expected, NO resulted in a proportional reduction in  $\text{JO}_2$  across all titration steps. ROS and RNS exposure resulted in complex I dysfunction and outer-membrane damage. However, RNS did not result in an exacerbated mitochondrial dysfunction compared to NO and ROS alone. It remains to be determined whether the effect of the combination of NO and ROS on mitochondrial function *in situ* is reversible.

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**2657** Board #332 MAY 31 2:00 PM - 3:30 PM

#### Child-adult Differences In The Variability Of Torque Kinetics

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(No relationships reported)

Boys demonstrate slower torque kinetics than men. Correspondingly, boys typically have lower agility, speed, and power capacities, although their performance appears to be more widely varied than men's.

**PURPOSE:** To examine whether torque-kinetics variability is likewise greater in boys than in men, and whether differences, if any, can be attributed to age or maturity level.

**METHODS:** Participants included minimally active boys ( $n=20$ ;  $10.1 \pm 1.3$  yrs) and men ( $n=19$ ;  $22.9 \pm 4.4$  yrs). Tanner stage and years from peak height velocity ( $\text{YRS}_{\text{PHV}}$ ) were determined for the boys. All subjects performed maximal, explosive, isometric knee extensions (Biodes System-3 dynamometer). Filtered traces of best 5 contractions were averaged and peak torque (MVC), elapsed time to 30% MVC ( $T_{30}$ ), %MVC at 100ms (%MVC<sub>100</sub>), normalized peak rate of torque development ( $\text{RTD}_{\text{pk}}$ ), and time to  $\text{RTD}_{\text{pk}}$  ( $T_{\text{RTDpk}}$ ) were determined.

**RESULTS:** Body-mass-normalized MVC was lower in the boys and all kinetics parameters were consistent with the boys' slower torque kinetics ( $p < 0.02$ ). Notably, the coefficients of variation in all kinetics parameters ( $T_{30}$ , %MVC<sub>100</sub>,  $\text{RTD}_{\text{pk}}$ ,  $T_{\text{RTDpk}}$ ) were, respectively, 43, 45, 37, and 56% larger in the boys compared with the men. When boys were divided into fast and slow groups (based on  $T_{30}$ ), torque kinetics of the faster group was similar to the men's. The groups did not differ in age or in sexual or somatic maturity (Tanner stage,  $\text{YRS}_{\text{PHV}}$ ).

**CONCLUSIONS:** In addition to being slower than men, boys' force kinetics is highly variable. This variability cannot be explained by age or the standard measures of biological maturity.

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2658 Board #333 MAY 31 2:00 PM - 3:30 PM

**Anti-catabolic Effects Of Cla/n-3 In Resting And Loaded Muscles Of A High Fat Diet-fed Mice**

Sang-Rok Lee, Andy V. Khamoui, Edward Jo, Bong-Sup Park, Michael C. Zourdos, Neema Bakhshalian, Samuel C. Grant, Bahram H. Arjmandi, Michael J. Ormsbee, Jeong-Su Kim. *The Florida State University, Tallahassee, FL.* (Sponsor: Lynn B. Panton, FACSM)  
(No relationships reported)

Conjugated Linoleic Acid (CLA) and Omega-3 polyunsaturated fatty acids (n-3) have attracted interest due to their health enhancing benefits. However, their efficacy in attenuating high fat diet (HFD)-induced impairments in skeletal muscle remains poorly understood.

**PURPOSE:** To determine the combined effects of CLA and n-3 intake on muscle morphology as well as transcript levels of catabolic factors in resting and loaded muscle during 20 wks of a HFD.

**METHODS:** After sacrificing eight randomly selected C57BL/6 male mice (age= 9 mo.) for baseline *in vitro* tissue, the remaining animals were randomly allocated to five experimental groups (n=10/group): 1) normal diet (CON), 2) high fat diet (HFD), 3) HFD + resistance training (HFD/RT), 4) HFD + CLA/n-3 (HFD/CN), or 5) HFD + RT + CLA/n-3 (HFD/RT/CN). Progressive RT was administered on a ladder climbing device 3d/wk for 20 wks. The supplement consisted of 1% CLA (0.5% of c9, t11 and 0.5% of t10, c12) and 1% n-3. Muscle wet weight, myofiber dimensions [eigen values and fractional anisotropy (FA) determined from diffusion tensor imaging (DTI)] and transcript levels of catabolic factors were assessed. Data were analyzed with ANOVAs, and significance was set at p<0.05.

**RESULTS:** There were significant group effects in wet weight. Gastrocnemius wet weight significantly decreased in CON (-27%), HFD (-37%) and HFD/CN (-25%) from baseline while remaining in HFD/RT and HFD/RT/CN. Soleus wet weight significantly decreased in HFD (-21%) but was maintained in CON, HFD/CN, and HFD/RT. In contrast, soleus wet weight increased in HFD/RT/CN (+19%). While no changes in DTI eigen values were observed, FA was significantly decreased in HFD/RT/CN (-21%). This indicates a positive effect of CLA/n-3 administration on myofiber hypertrophy as FA is inversely correlated with cross-sectional area. Interestingly, there were trends for greater mRNA expression associated with muscle wasting (i.e. Atrogin-1, MURF1, Cap-3, and Cap-9) in HFD/CN compared to baseline with no change in HFD/RT/CN.

**CONCLUSION:** Twenty-wks of HFD-induced muscle wasting. However, daily CLA/n-3 intake partially attenuated HFD-induced impairments while facilitating RT-induced muscle hypertrophy.

Study partly supported by Sekwang Inc., Vital Pharmaceuticals, and Ocean Nutrition

2659 Board #334 MAY 31 2:00 PM - 3:30 PM

**Association Between Knee Extension Power and Functional Performance in Patients After Total Knee Arthroplasty**

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(No relationships reported)

Lower extremity functional ability in patients after total knee arthroplasty (TKA) is largely attributed to quadriceps strength, which is generally obtained during isometric tests. However, during functional tasks knee extension contractions are not static, but dynamic and require muscle power, as can be tested with isokinetic contractions.

**PURPOSE:** The aims of this study were; 1) to compare peak knee extension power during isokinetic contractions between the surgical (SL) and non-surgical limbs (NSL) of patients' six-months after undergoing TKA, and 2) to evaluate the associations between tests of lower extremity performance and peak knee extension power of the SL.

**METHODS:** Performance-based tests and knee extension power during isokinetic contractions were assessed in patients, six-months after undergoing unilateral TKA. Paired t-tests were used to compare peak knee extension power of the SL and NSL (normalized to body mass) at three isokinetic speeds (60, 90, 120 deg/s). The functional relevance of knee extension power was assessed with Pearson's correlation analyses between peak knee extension power by the SL and performance measures.

**RESULTS:** Preliminary data are presented (N=4). Peak normalized knee extension power was not significantly different between the limbs of patients 6-months after TKA (60 deg/s SL 2.3 ± 1.0 vs NSL 2.3 ± 0.9; 90 deg/s SL 3.0 ± 1.5 vs NSL 2.9 ± 1.3; 120 deg/s SL 3.4 ± 1.1 vs NSL 3.4 ± 1.6 W/kg). Peak knee extension power was strongly associated with performance measures (Table 1).

**CONCLUSION:** Understanding the functional relevance of dynamic knee extension strength may have implications on the treatment of patients after TKA and serve as a useful assessment tool for evaluating post-surgical interventions.

Table 1. Correlation coefficients between power and performance measures. \*P<0.05; \*\*P<0.01

|           | Timed Up-and-Go | Stair Climbing Test | 6-Minute Walk |
|-----------|-----------------|---------------------|---------------|
| 60 deg/s  | -0.926          | -.944               | 0.998**       |
| 90 deg/s  | -0.924          | -0.928              | 0.999**       |
| 120 deg/s | 0.969*          | -0.881              | 0.904         |

2660 Board #335 MAY 31 2:00 PM - 3:30 PM

**Insulated Athletic Pants Do Not Prevent Muscle Temperature Decline Following Warm Up Nor Benefit Performance**

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(No relationships reported)

Elevations in muscle temperature (T<sub>m</sub>) have been shown to be important for enhancing maximal muscle power output during short duration, sprint based activities, hence the completion of a warm up prior to many exercise types. However, in many sporting activities and competition it is not uncommon for there to be delays between warm up completion and performance execution, during which time activity levels may be insufficient to maintain elevations in T<sub>m</sub>. Excessive decline in T<sub>m</sub> may lead to sub-optimal contractile conditions and impaired exercise performance.

**PURPOSE:** To determine whether a delay between warm up and competition may influence T<sub>m</sub> and performance and whether this may be attenuated using an insulated athletic pant.

**METHODS:** On two separate occasions, 11 male cyclists (24±5 yrs; 182.4±7.6cm; 77.4±10.0 Kg) completed a standardized 15 min intermittent sprint-based warm up on a cycle ergometer, followed by a 30 min passive recovery period before completing a 30 sec maximal sprint test. T<sub>m</sub> of the vastus lateralis was measured at depths of 1, 2 and 3 cm prior to and following the warm up and immediately before the sprint test. Measures of absolute and relative peak power output and blood lactate were taken. During the recovery period subjects wore a tracksuit top and either i) a standard tracksuit ensemble (CONT) or ii) a pair of insulated athletic pants (INS).

**RESULTS:** The warm up increased T<sub>m</sub> at all depths by ~2.5°C, with no differences between conditions. During the recovery period INS T<sub>m</sub> declined to similar values to CONT at 1cm (36.5±0.6°C vs. 36.3±0.4°C, INS vs. CONT), 2cm (36.7 ±0.4 vs. 36.6±0.3°C) and 3cm (37.0 ±0.3°C vs. 36.9±0.2°C). There were no differences for INS vs. CONT in absolute (1545.1 ± 338.0W vs. 1468.2 ± 260.2 W), relative (20.3 ± 2.3 ± 19.2 ± 1.7 W/kg) and mean power output (707.8 ± 127.9 Vs. 711.4 ± 153.1W) nor in Δblood lactate concentration following the sprint test (4.8 ± 2.3 vs. 4.1 ± 1.9mmol/L).

**CONCLUSION:** The use of an insulated athletic trouser has little benefit at reducing the decline in T<sub>m</sub> that is associated with forced periods of inactivity between warm up completion and competition.



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**2661** Board #336 **MAY 31** **2:00 PM - 3:30 PM**  
**Acute Exercise And Starvation-induced Insulin Resistance**

Per Berthelson. *GIH - the Swedish school of sport and health sciences, Stockholm, Sweden.*  
(No relationships reported)

It is well known that starvation causes insulin resistance. The mechanism is unclear but may relate disturbances in lipid metabolism i.e. incomplete mitochondrial FA oxidation and/or accumulation of lipid intermediates. Exercise results in increased substrate oxidation and may thus remove interfering lipid metabolites and reverse starvation-induced insulin resistance. However, the effect of acute exercise and starvation on insulin sensitivity is not known.

**PURPOSE:** The aim of this study was to investigate the effect of exercise on starvation-induced insulin resistance and to elucidate potential mechanisms.

**METHODS:** Nine healthy lean subjects underwent 84h starvation on two occasions separated by at least 2 weeks. The starvation period was followed by either exercise (EX; 5x10 min intervals with 2-4 min rest, starting at 70 %VO<sub>2</sub> max) or an equal period of rest (NE). Before and after the starvation period (3h after exercise/rest) subjects were investigated with muscle biopsies, blood samples and an intravenous glucose tolerance test. Muscle samples were used for measurements of mitochondrial respiration in permeabilized muscle fibers (Oroboros oxygraph), glycogen content and activation of signaling proteins.

**RESULTS:** Insulin sensitivity was significantly higher in the EX group compared to the NE group (p<0.05). After starvation mitochondrial respiration was lower in both groups with complex I substrates whereas respiration with complex I+II substrates was higher in EX (p<0.05 vs. basal and NE). Muscle glycogen was decreased to 73% (NE) and 31% (EX) of the basal values. The EX group had a significant increased activation of AS160. Plasma FA was increased 3-4 fold after starvation to 1.39±0.32 (NE) and 1.80±0.49 (EX) (mmol/l) and plasma beta-hydroxybutyrate increased about 50-fold to 6.43±2.01 (NE) and 7.12±1.59 (EX)(mmol/l).

**CONCLUSION:** Acute exercise reverses starvation-induced insulin resistance. Plasma FA and BOH were increased to similar extent after NE and EX and cannot explain the changes in insulin sensitivity. However, an increased substrate oxidation together with the observed increased capacity for mitochondrial FA oxidation after EX may be involved in the activation of AS160 and the reversal of starvation-induced insulin resistance.

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**2662** Board #337 **MAY 31** **2:00 PM - 3:30 PM**  
**Effect Of Calf Raise Exercise On Electromechanical Delay Of Ankle Plantar Flexion In Older Adults**

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(No relationships reported)

Ankle plantar flexion is important in phase of mid stance and terminal stance in the walk. But those functions are thought to decrease with aging.

**PURPOSE:** The purpose of this study is, by intervening calf raise exercise for the older adults, to investigate the effect that the calf raise exercise has on older adult's electromechanical delay (EMD) and muscle strength of ankle plantar flexion and walking functions.

**METHODS:** A group of 25 healthy older women (mean age: 75.2±5.6years) subject gave informed consent for participating in this experiment. Intervention of calf raise exercise is performed for eight weeks (10 × three sets per day until the three weeks, four-six weeks is 10 × four sets, seventh weeks after the 10 × five sets, and each of the intervention three times a week). The measurements of EMD and muscle strength in ankle plantar flexion are performed by using a dynamometer (KinCom 500H). Moreover, they are performed under the condition of eccentric muscle actions. The start of reaction in measurement of EMD is performed the proprio-ceptor response of plantar part. The walk function performed two-dimensional photography from the side.

**RESULTS:** The main results are as follows: In the EMD, total reaction time, and peak torque value, there was significantly improved than the pre (EMD: pre 69.9±10.5msec, post 63.1±7.1msec; total reaction time: pre 300.1±56.7msec, post 264.8±38.2msec; peak torque value: pre 50.0±18.9 Nm, post 62.9±12.2 Nm). However, Stride, pitch, maximum walking velocity, and normal walking velocity parameters, no significant changes observed in between the pre and post.

**CONCLUSION:** These results suggest that the following. Calf raise exercise, the functional recovery of the triceps surae was revealed to be effective. But, it was ineffective to the walk functions can consider a possibility of having been controlled by the function of the knee or hip joint.

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**2663** Board #338 **MAY 31** **2:00 PM - 3:30 PM**  
**No Differences in Wrist Flexion Strength for Isometric, Eccentric, and Concentric Contractions With and Without Venous Occlusion**

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(No relationships reported)

Several recent studies have reported greater strength gains with handgrip training in an occluded versus a non-occluded arm. However, few if any prior studies have compared muscular strength for different contractions with and without occlusion.

**PURPOSE:** The purpose of this study was to determine muscle strength in an occluded and non-occluded arm with exercise using concentric (CON), eccentric (ECC), and isometric (ISO) muscle contractions.

**METHODS:** Nine subjects (Men=4 Women=5, mean age ± 1 SD = 19 ± 8.5 years) completed 6 trials each using a randomized design. Each subject did one trial each of concentric (at a speed of 90° per second), eccentric (at a speed of 90° per second) and isometric (held contraction for 5 seconds) wrist flexion both occluded (OCC) and non-occluded (NO-OCC). All testing was done on a Cybex isokinetic dynamometer using the subject's right arm. For the occluded condition, the cuff was placed on the upper arm and inflated to 80 mmHg for the duration of the exercise. The subject performed 15 repetitions of the assigned condition. The cuff was released as soon as the subject finished the exercise. Initial peak torque for the first muscle contraction and the total work done for the 15 repetitions of the exercise was recorded.

**RESULTS:** Peak torques were not significantly different (P>0.05) between contraction type with or without occlusion (CON-NO-OCC= 14.1 + 7 n-m, CON-OCC = 14.3+ 6.8 n-m; ISO- NO-OCC = 18.3 + 4.5 n, ISO-OCC = 17.2 + 4.3 n ; ECC-NO-OCC = 18.8+ 8.6 n-m, ECC-OCC = 19.1 +7.6 n-m ). There were no differences in total work done between CON or ECC with or without occlusion (CON-NO-OCC= 178 + 87 n-m, CON-OCC = 158.1+ 80.3 n-m ; ECC-NO-OCC = 192.4+ 99.6 n-m, ECC-OCC = 228.0+106.6).

**CONCLUSION:** These data suggest that moderate occlusion does not result in differences in wrist flexion strength for concentric, eccentric or isometric contractions. It is possible that the lack of differences is due to the small muscle mass involved with this type of exercise.

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**2664** Board #339 **MAY 31** **2:00 PM - 3:30 PM**  
**The Acute Effects of Stretching on Pennation Angle, and Force Production**

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(No relationships reported)

Stretching has been found to acutely reduce maximal voluntary contraction force (MVC). While there are several potential mechanisms which may influence MVC following stretching their roles are unclear. Pennation angle (PA) should have a mathematical relationship to MVC, as the PA of muscles describe what portion of the muscle fibers' force production is being applied to its deep aponeurosis. If stretching results in a change in PA, then this may aid in explaining the reduction in MVC commonly observed.

**PURPOSE:** To examine changes in pennation angle as a result of stretching, and its relationship with reduced in force production.

**METHODS:** Using a randomized crossover design, 24 subjects (10 male, 14 female, ages 19-30) were treated with either stretching (S) or mock stretching (MS) during each of four trials (2 S, 2 MS). The S treatment consisted of four 30 second passive calf stretches with 15 seconds of rest in-between, while the MS treatment served as a control. PA was assessed on the medial gastrocnemius using ultrasonography before, during, and after each treatment. A single repetition maximal isotonic plantar flexion protocol was employed to measure MVC before and after each treatment. Changes in PA and MVC were analyzed using paired T-tests, while the relationship between change in PA and MVC was analyzed using a one-way ANOVA.

**RESULTS:** Significant reductions in MVC were noted following the S treatment ( $-5.30 \pm 2.40$  kg,  $p < 0.01$ ), but not for the MS treatment ( $+0.52 \pm 0.26$  kg,  $p = 0.06$ ). No significant changes in PA were observed for either the S ( $+0.31 \pm 1.33^\circ$ ,  $p = 0.27$ ) or MS ( $+0.41 \pm 1.12^\circ$ ,  $p = 0.09$ ) treatments. The relationship between PA and MVC was found to be insignificant ( $p = 0.948$ ).

**CONCLUSION:** PA change was not a mechanism which contributed to the reduction in MVC due to stretching.

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**2665** Board #340 MAY 31 2:00 PM - 3:30 PM

**Relationship Between Oxidative Capacity And Work Capacity With 3-week Upper Limb Immobilization**

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(No relationships reported)

It is well known that muscle disuse causes decreased muscle mass, muscle strength, and muscle oxidative capacity. On the other hand, the change in work capacity following muscle disuse and its mechanism remain to be conclusive. We have chosen a 3-week upper limb immobilization that created only muscle functional decline without muscle mass reduction (Homma et al., 2009).

**PURPOSE:** To investigate whether the 3-week immobilization reduces muscle functions and to clarify the relationship between oxidative capacity and work capacity with the 3-week upper limb immobilization.

**METHODS:** Eight healthy men ( $19.5 \pm 0.9$  years, mean  $\pm$  SD) were participated in this study. For all subjects non-dominant arm was immobilized for 3 weeks with a cast (IMM) and the dominant arm was measured as control (CON). We measured the following parameters for participant pre- and post-immobilization: maximal voluntary contraction (MVC) of the grip, forearm cross-sectional area (CSA), work capacity per CSA (dynamic handgrip exercise at 30% of MVC of the day, 1 Hz until exhaustion). The oxidative capacity was evaluated by the time constant for the recovery of phosphocreatine (PCrTC) using  $^{31}$ P-phosphorus-magnetic resonance spectroscopy ( $^{31}$ P-MRS).

**RESULTS:** There is no significant change in CSA (pre:  $3604 \pm 662$  mm<sup>2</sup>, post:  $3568 \pm 607$  mm<sup>2</sup>) pre- and post-immobilization. MVC (pre:  $415.5 \pm 72.4$  N, post:  $305.9 \pm 80.5$  N), PCrTC ( $39.6 \pm 10.6$  s,  $58.4 \pm 14.4$  s), and work capacity ( $0.55 \pm 0.18$  N $\cdot$ m / mm<sup>2</sup>,  $0.42 \pm 0.16$  N $\cdot$ m / mm<sup>2</sup>) were significantly decreased post-immobilization. A negative correlation was found between work capacity and PCrTC ( $r = -0.62$ ,  $p < 0.01$ ) pre-immobilization, but no correlation was observed between the change (post - pre) in PCrTC and work capacity pre- and post-immobilization. For all the measurements there was no significant difference observed between pre- and post- intervention in the CON.

**CONCLUSIONS:** The work capacity and the oxidative capacity were decreased, but the decrease in the work capacity showed no relationship with the decrease in oxidative capacity post-immobilization.

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**2666** Board #341 MAY 31 2:00 PM - 3:30 PM

**The Effect of Low-Pressure Functional Elastic-Property Tights on Reoxygenation Recovery Following Exhaustive Knee Extension Exercise**

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(No relationships reported)

In recent years, various types of functional tights such as graduated compression tights have been used to aim at enhancing athletic performance. However, there is limited information about the effect of low-pressure functional elastic-property tights (Tights<sub>LP</sub>) on physical performance and muscle metabolism.

**PURPOSE:** To clarify the effects of Tights<sub>LP</sub> on muscle oxygenation in the rectus femoris (RF) and vastus lateralis (VL) muscles during exhaustive knee extension exercise.

**METHODS:** Six subjects performed knee extension exercise on the dominant leg using isokinetic ergometer (Biodes). The maximal load torque (W<sub>max</sub>) for each subject was determined using the ramp exercise test (20 Nm increment per a stage from 20 Nm until exhaustion). The subjects performed three sets of exhaustive exercise at W<sub>max</sub>, with one contraction every 2.5 s, followed by the active recovery (30% W<sub>max</sub> each for 5 min). The subjects performed the knee extension exercise with or without Tights<sub>LP</sub> (Elacion PRO, soft type, Asahi Kasei Fibers Corporation). Muscle deoxygenation using near infrared spectroscopy and electromyography (EMG) activity in the RF and VL were simultaneously measured during both the W<sub>max</sub> and the active recovery. The muscle fatigue index was defined as the ratio between the root mean square (RMS) of the last 36 s (RMS<sub>E</sub>) and the RMS of the initial 36 s (RMS<sub>I</sub>) during 30% W<sub>max</sub>. Leg blood flow was measured using ultrasonic Doppler in the femoral artery during the active recovery.

**RESULTS:** The recovery half time of muscle reoxygenation was significantly shortened with the Tights<sub>LP</sub> for the second set in the RF ( $P < 0.05$ ) and the VL ( $P < 0.05$ ) and, although it did not reach statistical significance, for the third set in the VL ( $P = 0.06$ ). The muscle fatigue index showed a decrease tendency for the third set in the RF ( $P = 0.08$ ). Blood flow during 30% W<sub>max</sub> showed a increase tendency with the Tights<sub>LP</sub>.

**CONCLUSIONS:** We found that Tights<sub>LP</sub> was effective for the faster recovery from muscle deoxygenation and gradual decline in muscle fatigue index during 30% W<sub>max</sub>, suggesting an enhancement of blood flow (venous return) in the lower limb during low-intensity active recovery.

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**2667** Board #342 MAY 31 2:00 PM - 3:30 PM

**Regulators of Muscle Hypertrophy are Unaffected by Free Leucine Supplementation in Older Individuals**

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(No relationships reported)

**PURPOSE:** To examine the effects of ingesting free leucine on serum insulin-like growth factor 1 (IGF-1), free testosterone and hepatocyte growth factor (HGF) levels and muscle tissue phosphorylated mesenchymal-epithelial transition factor (c-Met) concentrations compared to isoenergetic placebo during a 12 week resistance training program in older males.

**METHODS:** Twenty three non-resistance trained males ( $61.22 \pm 7.13$  yrs,  $176.93 \pm 5.99$  cm,  $92.59 \pm 14.59$  kg) were randomized in a double blind manner. Participants ingested either leucine (LEU) [3.6g/d LEU + 5g carbohydrate (CHO)] or maltodextrine (CHO) (5g/d CHO) while participating in a supervised high intensity resistance training program (3 sets  $\times$  10 repetitions at 75% of 1RM), 3 days per week for 12 weeks. Testing sessions were completed prior to (0 weeks), 4 weeks, 8 weeks and 12 weeks post resistance training and supplementation. Each testing session included blood collection and vastus lateralis muscle biopsy. The blood serum was analyzed for IGF-1, free testosterone and HGF and the muscle tissue for phosphorylated c-Met. Data was analyzed using repeated measures ANOVA.

**RESULTS:** No significant time effects were observed for serum free testosterone (0 weeks:  $18.79 \pm 11.2$  pg/ml vs. 12 weeks:  $18.19 \pm 12.9$  pg/ml,  $p = 0.862$ ), IGF-1 (0 weeks:  $0.686 \pm 0.503$  pg/ml vs. 12 weeks:  $0.685 \pm 0.585$  pg/ml,  $p = 0.809$ ), HGF (0 weeks:  $267.28 \pm 289.14$  pg/ml vs. 12 weeks:  $173.32 \pm 177.04$  pg/ml,  $p = 0.192$ ), or phosphorylated c-Met (0 weeks:  $0.105 \pm 0.185$  ng/mg vs. 12 weeks:  $0.230 \pm 0.239$  ng/mg,  $p = 0.09$ ). Furthermore, no significant group or group by time interactions were observed.

**CONCLUSIONS:** The ingestion of free leucine with carbohydrate, as compared to carbohydrate alone, when combined with 12-weeks of high intensity resistance training was unable to enhance serum IGF-1 and testosterone levels and/or indirect markers of satellite cell activation in older males.

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**2668** Board #343 MAY 31 2:00 PM - 3:30 PM

**Effect Of Regular Exercise On Different Tissues Oxygenation In Retired Female Athletes**

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(No relationships reported)

Regular exercise has been shown to improve the ability of the tissue oxygenation. However, no study has been done on different tissues oxygenation on elder athletes, who were not participating in regular exercise after retirement.

**PURPOSE:** This study was aimed to examine the effect of regular exercise on different tissues oxygenation in retired female basketball players.

**METHODS:** In this study, retired domestic A-class female basketball players were recruited. All subjects were categorized into two groups as non-exercise (n=6, aged 56.7±2.14) and regular exercise (n=6, aged 57.2±1.6) groups. Each subject's oxygenation for different tissues including left and right side of forehead, upper triceps and lower gastrocnemius muscle. Oxygenation include total hemoglobin, oxyhemoglobin, de-oxyhemoglobin and oxygen saturation were determined by using near infrared spectroscopy (NIRS) at sitting position in a quite environment.

**RESULTS:** We found muscle total hemoglobin, oxyhemoglobin, deoxyhemoglobin and oxygen saturation was not significantly different for brain, triceps and gastrocnemius muscle. We speculate that retired athletes who participated in regular exercise may have better oxygenation. However our data didn't show this trend.

**CONCLUSIONS:** The reason behind no changes in oxygenation levels between non-exercise and exercise elder athletes might be the measurement of oxygenation at sitting position. Hence, we recommend further studies to measure the oxygenation levels during dynamic process.

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**2669** Board #344 MAY 31 2:00 PM - 3:30 PM

**Comparison Of Post-tetanic To Postactivation Potentiation In Human Tibialis Anterior**

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(No relationships reported)

**INTRODUCTION:** Potentiation may be induced following a conditioning contraction which can either be evoked (post-tetanus (PT)) or voluntary (postactivation (PA)). However, these conditioning contractions activate the muscle fibers using dissimilar combinations of motor unit discharge rate and recruitment pattern. Additionally, evoked contractions exclude the central nervous system, which is active during a voluntary contraction.

**PURPOSE:** To explore whether PT potentiation of contractile properties differs from PA potentiation, in the human tibialis anterior.

**METHODS:** In 8 recreationally active male subjects (age ~26.0 y), we assessed potentiation of isometric contractile properties by comparing baseline contractions to PT and PA contractions. In the following order, baseline measurements were: maximal twitch torque and peak rate of twitch torque development, maximal evoked 50Hz torque, and maximal voluntary (ballistic) peak rate of torque development. In random order, potentiation was induced by either a 10s 50Hz evoked contraction, or a torque-matched 10s voluntary contraction (~76% MVC torque). Immediately following the conditioning contraction, two twitches were evoked followed by two maximal voluntary ballistic contractions. Prior to all conditioning contractions, subjects rested for a minimum of 6 min, and twitch torque had returned to baseline.

**RESULTS:** Baseline twitch torque was 5.7±1.9 Nm, which was potentiated equally (P<0.05) for PT (9.5±2.4 Nm), and PA (9.3±3.4 Nm) contractions. Peak rate of twitch torque development at baseline was 182.1±44.9 Nm/s, and was increased equally (P<0.05) for PT (305.8±65.2 Nm/s), and PA (290.9±89.1 Nm/s) contractions. Ballistic rate of torque development was not different between baseline, PT, or PA (P = 0.07).

**CONCLUSIONS:** For this experimental paradigm, PT and PA have similar potentiating effects on twitch contractile properties, and neither significantly potentiates voluntary rate of torque development immediately following either tetanus or voluntary activation.

Supported by NSERC

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**2670** Board #345 MAY 31 2:00 PM - 3:30 PM

**Skeletal Muscle Metabolism and Glucose Tolerance after Spinal Cord Injury: Influence of Intramuscular Fat and Injury Duration**

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(No relationships reported)

Spinal cord injury (SCI) represents one of the most extreme health conditions resulting in physical inactivity, especially in the paralyzed musculature. This lack of muscle activity results in muscle atrophy, increases in intramuscular fat, and reduced mitochondrial function.

**PURPOSE:** To examine the relationships between injury duration and intramuscular fat (IMF), mitochondrial function, and glucose tolerance in individuals with complete (AIS-A) SCI.

**METHODS:** Eleven individuals (2 female) with chronic (1.7-22.1 years post-injury) SCI gave informed consent prior to testing. All subjects completed a standard 75-gram oral glucose tolerance test at the Shepherd Hospital (Atlanta, GA). Blood samples were taken and analyzed for glucose and insulin. Magnetic resonance testing was performed in a 3 Tesla magnet. Axial T1-weighted magnetic resonance images of the thighs were collected to assess muscle volume and IMF. Muscle metabolism of the m. vastus lateralis was measured as the rate of phosphocreatine recovery after electrical stimulation using 31P MRS. Statistical significance was tested using a one-tailed t-test.

**RESULTS:** The results showed relationships between the duration of injury and mitochondrial impairment (r=0.58, p=0.03), IMF and mitochondrial impairment (r=0.58, p=0.03), and IMF and glucose tolerance (r=0.59, p=0.028). In this study we found no relationship between mitochondrial function and glucose tolerance.

**CONCLUSIONS:** The duration of spinal cord injury appears to be related to the degree of mitochondrial dysfunction and level of intramuscular fat. Intramuscular fat may be a predictor of glucose tolerance; while the role of mitochondrial function in glucose tolerance is still being investigated. Future studies will help guide the development of effective interventions to improve the health of individuals with spinal cord injury.

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**2671** Board #346 MAY 31 2:00 PM - 3:30 PM

**Skeletal Muscle Mitochondrial and Lipid Droplet Volume Density: Validity of Electron Microscopy Point-counting Measurements**

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(No relationships reported)

Mitochondrial (M) and lipid droplet (L) volume density (vd) are often used in exercise research. Vd is the volume of muscle occupied by M and L. The means of calculating these percents are accomplished by applying a grid to a 2D image taken with transmission electron microscopy; however, it is not known which grid best predicts these values.

**PURPOSE:** To determine the grid with the least variability of Mvd and Lvd in human skeletal muscle.

**METHODS:** Muscle biopsies were taken from *vastus lateralis* of 10 healthy adults, trained (N=6) and untrained (N=4). Samples of 5-10mg were fixed in 2.5% glutaraldehyde and embedded in EPON. Longitudinal sections of 60 nm were cut and 20 images were taken at random at 33,000x magnification. Vd was calculated as the number of times M or L touched two intersecting grid lines (called a point) divided by the total number of points using 3 different sizes of grids with squares of 1000x1000nm sides (corresponding to 1µm<sup>2</sup>), 500x500nm (0.25µm<sup>2</sup>) and 250x250nm (0.0625µm<sup>2</sup>). Statistics included coefficient of variation (CV), 1 way-BS ANOVA and spearman correlations.

**RESULTS:** Mean age was 67 ± 4 yo, mean VO<sub>2peak</sub> 2.29 ± 0.70 L/min and mean BMI 25.1 ± 3.7 kg/m<sup>2</sup>. Mean Mvd was 6.39% ± 0.71 for the 1000nm squares, 6.01% ± 0.70 for the 500nm and 6.37% ± 0.80 for the 250nm. Lvd was 1.28% ± 0.03 for the 1000nm, 1.41% ± 0.02 for the 500nm and 1.38% ± 0.02 for the 250nm. The mean CV of the three grids was 6.65% ± 1.15 for Mvd with no significant differences between grids (P>0.05). Mean CV for Lvd was 13.83% ± 3.51, with a significant difference between the 1000nm squares and the two other grids (P<0.05). The 500nm squares grid showed the least variability between subjects. Mvd showed a positive correlation with VO<sub>2peak</sub> (r = 0.89, p < 0.05) but not with weight, height, or age. No correlations were found with Lvd.

**CONCLUSION:** Different size grids have different variability in assessing skeletal muscle Mvd and Lvd. The grid size of 500x500nm (240 points) was more reliable than 1000x1000nm (56 points). 250x250nm (1023 points) did not show better reliability compared with the 500x500nm, but was more time consuming. Thus, choosing a grid with square size of 500x500nm seems the best option. This is particularly relevant as most grids used in the literature are either 100 points or 400 points without clear information on their square size.

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### Determination of Architecture in Healthy and Dystrophic Muscles Using Three-dimensional Optical Coherence Tomography

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(No relationships reported)

A variety of *in vivo* imaging techniques are being developed to assess changes in whole muscle structure and/or function. The ability to view individual myofibers is possible with many histological techniques, but not yet with standard *in vivo* imaging, such as MRI. Optical coherence tomography (OCT) is an emerging medical imaging technology that can generate high resolution 1-10  $\mu\text{m}$  cross-sectional imaging (1-2 mm in depth) of tissue microstructure *in vivo* and in real time.

**PURPOSE:** OCT has recently been used in dystrophic skeletal muscle to identify necrosis and changes after exercise. We used *in vivo* OCT to determine architectural differences of whole muscles of healthy (wild-type, or WT) and dystrophic (mdx) muscle.

**METHODS:** We examined the tibialis anterior muscles (TA) of WT mice (n=3) and mdx mice (n=3). Before OCT, high resolution T1 and T2-weighted structural MRI (100 $\mu\text{m}$  x 100 $\mu\text{m}$  x 750  $\mu\text{m}$ ) including diffusion tensor imaging (DTI, 150 $\mu\text{m}$  x 150 $\mu\text{m}$  x 750  $\mu\text{m}$  x 12 directions) were acquired on a 7T MRI system. The OCT system utilized a wavelength-swept laser source. It generates a broadband spectrum of ~100 nm FWHM centered at 1310 nm, which provides an axial resolution of 10  $\mu\text{m}$  in the tissue. Laser sweep rate was 16 kHz. A Michelson interferometer composed of one circulator, and a fiber-optic 50/50 splitter is used to generate the Fourier-domain OCT interference signal. Immediately after OCT, muscles were harvested, snap frozen in pentane-cooled liquid nitrogen, and sectioned (longitudinally) for H&E staining.

**RESULTS:** DTI was used for 3D reconstruction of fiber tracks (fascicles) and showed an increase in isotropy of mdx compared to WT TAs. OCT indicated a shorter intramuscular tendon (WT/mdx ratio of 1.5) and a 10 % higher degree of pennation in mdx. H&E staining confirmed these architectural changes.

**CONCLUSIONS:** The increase in isotropy suggested differences in pennation angles and OCT was used to confirm this supposition by imaging of individual myofibers. Because physiological cross-sectional area (PCSA) is proportional to the cosine of the pennation angle and muscle mass, the increase in pennation alone in mdx TAs would result in a corresponding reduction in stress (force/PCSA) of 10%, assuming similar fiber lengths. This reduction would be even more dramatic given the apparent increase in muscle size.

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### In Vivo Imaging Of Intramyocyte Sodium Following Eccentric Contractions In Rat Skeletal Muscle

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(No relationships reported)

Intramyocyte ionic balance controls various muscle functions. The primary cause of muscle fatigue and damage are believed to be induced, in part, by failure to maintain intramyocyte ionic homeostasis. Eccentric contractions (ECC) facilitate intramyocyte influx of ions such as Na<sup>+</sup> and Ca<sup>2+</sup> by operation of stretch-activated channels (SAC). We have recently shown that ECC induce prolonged elevation of myocyte Ca<sup>2+</sup> using an *in vivo* imaging model. However, little is known regarding intramyocyte Na<sup>+</sup> regulation after ECC under *in vivo* conditions

**PURPOSE:** We tested the hypothesis that ECC-induced damage and fatigue would be associated with intramyocyte Na<sup>+</sup> accumulation.

**METHODS:** For *in vivo* microscopic observation, adult male Wistar rats (n = 8) were anesthetized and the spinotrapezius muscle exteriorized maintaining principal blood vessels and neural pathways intact. Tetanic eccentric contractions (100 Hz, 700 ms duration, 20 contractions per minute for a total of 10 sets of 50 contractions) were elicited by electrical stimulation during synchronized muscle stretch of 10% resting muscle length. The fluorescence ratio (F340/F380 nm) was determined from images captured following each set of contractions, and SBFI-AM was used to estimate intracellular Na<sup>+</sup> and changes thereof.

**RESULTS:** Isometrically-evoked active force was decreased significantly with each set of ECC (-76.8  $\pm$  0.9 % at end of 10th set vs. initial force). Morphological features of muscle damage such as extreme sarcomeric disruption and hypercontracted fibers were clearly evident. However, there was no significant change of intracellular Na<sup>+</sup> level over the 10 sets of ECC (pre-contraction : 1.68  $\pm$  0.03, 1 set : 1.66  $\pm$  0.03, 5 set : 1.66  $\pm$  0.03, 10 set : 1.62  $\pm$  0.03, 340/380 ratio value, p >0.05).

**CONCLUSIONS:** These results demonstrate that intracellular Na<sup>+</sup> homeostasis is maintained following ECC. Therefore muscle damage and fatigue after ECC are not associated with lack of Na<sup>+</sup> homeostasis *per se*.

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### Muscle Adaptations Following Short-Duration Bed Rest with Integrated Resistance, Interval, and Aerobic Exercise

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(No relationships reported)

Exercise countermeasures have been frequently tested during bed rest (BR) and limb suspension; however, high-intensity, short-duration exercise prescriptions have not been explored.

**PURPOSE:** To determine if a high intensity resistance, interval, and aerobic exercise program could protect against muscle atrophy and dysfunction when performed during short duration BR.

**METHODS:** Nine subjects (1F,8M) performed a combination of supine exercises during 2 weeks of BR. Resistance exercise (3 d  $\cdot$  wk<sup>-1</sup>) consisted of squat, leg press, hamstring curl, and heel raise (3 sets, 12 repetitions). Aerobic (6 d  $\cdot$  wk<sup>-1</sup>) sessions alternated continuous (75% VO<sub>2</sub> peak) and interval exercise (30s, 2 & 4min) and were completed on a supine cycle ergometer and vertical treadmill. Muscle volumes were calculated pre, mid, and post-BR using magnetic resonance imaging. Maximal isometric force (MIF), rate of force development (RFD), and peak power were measured twice before BR (averaged to represent pre) and once post BR. ANOVA with repeated measures and *a priori* planned contrasts tested differences.

**RESULTS:** There were no changes to quadriceps, hamstring, and adductor muscle volumes at mid and post BR compared to pre BR (Table 1). Peak power increased significantly from 1614  $\pm$  372 W to 1739  $\pm$  359 W post BR (+7.7%, p = 0.035). Neither MIF (pre: 1676  $\pm$  320 N vs. post: 1711  $\pm$  250 N, +2.1%, p = 0.333) nor RFD (pre: 7534  $\pm$  1265 N $\cdot$ ms<sup>-1</sup> vs. post: 6951  $\pm$  1241 N $\cdot$ ms<sup>-1</sup>, -7.7%, p = 0.136) were significantly impaired post BR.

Table 1.

| Muscle Group    | Pre           | Mid           | Post          | % change <sup>^</sup> | p-value <sup>†</sup> |
|-----------------|---------------|---------------|---------------|-----------------------|----------------------|
| Quadriceps (mL) | 974 $\pm$ 104 | 989 $\pm$ 104 | 992 $\pm$ 109 | +1.84%                | 0.083                |
| Hamstrings (mL) | 466 $\pm$ 76  | 468 $\pm$ 82  | 471 $\pm$ 83  | +1.07%                | 0.662                |
| Adductors (mL)  | 386 $\pm$ 57  | 382 $\pm$ 67  | 377 $\pm$ 63  | -1.03%                | 0.321                |

Mean  $\pm$  SD; <sup>^</sup>Pre to Post; <sup>†</sup>ANOVA time effect

**CONCLUSION:** A combination of high intensity, short duration exercise countermeasures performed during 2 weeks of BR increased concentric power and protected muscle from unloading induced atrophy and dysfunction.

**2675** Board #350 **MAY 31 2:00 PM - 3:30 PM**  
**Pgc-1 $\alpha$  Enhances Skeletal Muscle Recovery From Disuse Atrophy**

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(No relationships reported)

Prolonged inactivity results in skeletal muscle atrophy including increased reactive oxygen species generation, inflammation, protein degradation, and weight loss. Over-expression of peroxisome proliferator-activated receptor- $\gamma$  coactivator-1 $\alpha$  (PGC-1 $\alpha$ ) has been shown to increase mitochondria biogenesis and reduce oxidative stress. **PURPOSE:** Thus, we hypothesize that PGC-1 $\alpha$  over-expression may ameliorate skeletal muscle atrophy caused by immobilization in rats.

**METHODS:** FVB/N mice (Age 8 mo, N=20) were randomly divided into four groups; (1) control and injected with empty vehicle (GFP) transfection (Con-GFP); (2) control and injected with Flag-PGC-1 (Con-PGC-1); (3) five days remobilization after 2 weeks of immobilization with hindlimb banding and injected with GFP (RM-GFP); and (4) RM and injected with PGC-1 (RM-PGC-1). GFP or PGC-1 was injected to tibialis anterior (TA) muscle of one of the hindlimbs with a skeletal muscle gene electroporation.

**RESULTS:** There was a decrease in Cytochrome C (Cyt C) expression after 2 weeks immobilization, whereas Cyt C was significantly increased by ~3.9-fold in both Con and RM groups with PGC-1 in vivo transfection. RM mediated ~20% decrease in Tfam expression (p<0.05), however, its level was restored by PGC-1 overexpression in RM group (p<0.01). mtDNA:nDNA ratio was decreased by 72% in RM groups (p<0.01), whereas PGC-1 increased the mtDNA significantly (p<0.05). PGC-1 increased cytochrome c oxidase (COX) activity by 55% in CON (p<0.05) and by 29% in RM and mitochondrial ATP production rate (MAPR) was increased by 18% in RM-PGC-1 (p<0.05).

**CONCLUSIONS:** PGC-1 enhanced mitochondrial biogenesis and oxidative capacity in the recovery of skeletal muscle from disuse atrophy.

**2676** Board #351 **MAY 31 2:00 PM - 3:30 PM**  
**Sex-Related Difference in Muscle Oxygenation Kinetics during Isometrics Contraction in Older Adults**

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(No relationships reported)

**PURPOSE:** The aim of this study was to investigate the effect of sex-related on local muscle oxygenation kinetics and oxygen desaturation through relative intensity exercise.

**METHODS:** Nine male (M) (aged 65  $\pm$  2.2 yr) and seven female (F) (aged 60  $\pm$  5.7yr) were recruited. All subjects performed 20, 30, 40, 50 and 60% maximum voluntary contraction (MVC) of knee extension exercise by a custom-made isometrics strength device. Local muscle oxygenation was recorded by a frequency-domain Near-infrared spectroscopy (Imagent, ISS Inc.). Infrared light of 690 and 830 nm wavelengths were applied to estimate hemodynamic parameters of vastus lateralis obliquus muscle. Outcome measures derived from oxy-hemoglobin (Hb), deoxy-Hb, total Hb (Hbt) and oxygen saturation using a hyperbolic tangent equation to fit the oxygen saturation curves of exercise phase and recovery phase. Inflection time (time to reach 50 % of the change range) represents the efficiency of reaching steady-state level. Time constant (the changing rate of oxygen desaturation) was used to represent the characteristic of oxygenation adjustment during isometrics contraction. The minimum and maximum values of each phase will be found to estimate the change volume. The dependent variables both groups were compared by Mann-Whitney U test.

**RESULTS:** In exercise phase, phase, the inflection time in M was longer than F at 60% MVC (41.66  $\pm$  2.52s vs. 38.71  $\pm$  2.75s, p<0.05). Time constant was significantly lower in F than M at 20% MVC (4.2  $\pm$  2.21 vs. 6.92  $\pm$  2.17, p<0.05) and a larger time constant in W at 40% MVC (7.99  $\pm$  1.53 vs. 5.16  $\pm$  1.36, p<0.05). A great oxygen desaturation in man at 20% MVC (8.51  $\pm$  5.79% vs. 2.17  $\pm$  1.32%, p<0.05), 30% MVC (11.51  $\pm$  7.26% vs. 4.18  $\pm$  2.18%, p<0.05), 50% MVC (14.96  $\pm$  7.82% vs. 7.92  $\pm$  4.02%, p<0.05) and 60% MVC (15.75  $\pm$  8.23% vs. 8.64  $\pm$  2.46%, p<0.05) than Female (p< 0.05).

**CONCLUSIONS:** At the same relative exercise intensity, female reduce oxygen consumption which can support energy demand during muscle contraction. The results suggest that sex-related difference in muscle oxygenation can be observed in exercise phase. Future, it is important to find the sex-related difference in muscle oxygenation at other age levels to get a better understanding on sex-related factor.

**2677** Board #352 **MAY 31 2:00 PM - 3:30 PM**  
**Protein Expression and Activity of Antioxidant Enzymes in the Muscle of Rats Subjected to Exercise**

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(No relationships reported)

**PURPOSE:** The goal of the present study was to analyze the activity and protein expression of the antioxidant enzymes catalase (CAT), superoxide dismutase (SOD) and glutathione peroxidase (GPx) as well as a lipid peroxidation biomarker (thiobarbituric acid reactant substances; TBARs) in the skeletal muscle of rats subjected to swimming exercise.

**METHODS:** Eighteen male Wistar rats were used. With 90 days of age, the animals were divided into 2 groups: Control Group (C: n=10): rats maintained as sedentary controls; Trained Group (T: n=8): rats subjected to swimming exercise. The exercise protocol consisted of 1h/day of swimming exercise, 5x/week, during 8 weeks. The animals carried out overload equivalent to 5% of body weight. At the end of the experiment, the rats were killed by CO<sub>2</sub> inhalation and cervical dislocation; samples of gastrocnemius muscles (200mg) of all rats were collected for antioxidant enzymes activities (Cayman Chemical, Michigan, USA) as well as protein expression (western blotting; Primary and secondary antibodies Santa Cruz Biotechnology, inc.) determinations; the lipid peroxidation biomarker (Cayman Chemical, Michigan, USA) was also determined. The data were analyzed using Student t-test (p value of <0.05).

**RESULTS:** The antioxidant enzymes activities levels were significantly higher in the skeletal muscle of T group [CAT (Umol/min.mg.protein): 0.87 $\pm$ 0.04; SOD (U/ml): 6.49 $\pm$ 0.04; GPx (nmol/min.protein): 6.57 $\pm$ 0.52] if compared to C group (CAT: 0.51 $\pm$ 0.03; SOD: 4.01 $\pm$ 0.37; GPx: 2.94 $\pm$ 0.56). On the other hand, the TBARs levels (nmol/mg.protein) were significantly lower in the skeletal muscle of T group (2.34 $\pm$ 0.41) when compared to C group (8.94 $\pm$ 0.56). In addition, the protein expression of antioxidant enzymes were found increased (CAT: 25%; SOD: 33%; GPx: 23%) in the gastrocnemius muscle of rats belonging to T group if compared to C Group.

**CONCLUSIONS:** The antioxidant mechanisms were improved (increased protein expressions and activities of the antioxidant enzymes and decreased lipid peroxidation) in the skeletal muscle of rats subjected to chronic swimming exercise. Such results indicated that regular physical exercise may protect the organism against the oxidative stress caused by the sedentarism condition.

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**2678** Board #353 **MAY 31 2:00 PM - 3:30 PM**  
**Aging is Associated with Increased Skeletal Muscle Type IV Collagen Content and Decreased MMP-2 Expression in Mice**

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(No relationships reported)

Aging is associated with decreases in muscle size and force production and increased connective tissue content. However, the role of matrix metalloproteinases (MMPs) in aging related changes in muscle collagen content is not clear.

**PURPOSE:** To examine the expression of type IV collagen and its degrading enzymes MMP-2 and MMP-9 in slow and fast-twitch muscles of younger (3 month old) and older (22 month old) mice.

**METHODS:** Younger and older WT mice were run on a rodent treadmill at a 17% downhill gradient at 15meters/min for 3 bouts of 30min. Blood was taken pre, immediately post, and 1 day post-exercise. Gastrocnemius (GAST) and soleus (SOL) muscles were isolated and trunk blood collected 1 day post-exercise. Semi-quantitative PCR was performed to determine levels of MMP-2, MMP-9, and TIMP-1 mRNA. Plasma MMP-2, pro-MMP-9, total MMP-9, and TIMP-1 protein levels were determined by ELISA assay. Type IV collagen immunohistochemistry was performed on 10um-thick serial cross sections of GAST and SOL. Threshold analysis using ImageJ64 was performed to determine collagen-staining quantity.

**RESULTS:** The relative percentage of type IV collagen immunostaining was significantly greater in muscle sections from older GAST and SOL compared to younger muscle. Plasma levels of MMP-2 were significantly lower in older compared to younger mice, while neither pro- nor total plasma MMP-9 levels differed between younger and older mice. MMP-2 mRNA levels were significantly lower in both GAST and SOL of older mice compared to younger mice. Plasma TIMP-1 levels were significantly higher in older compared to younger mice, however TIMP-1 mRNA levels did not differ between the two age groups but were greater in the SOL compared to the GAST.

**CONCLUSION:** Age-related changes in systemic and/or muscle MMP-2 expression may contribute to the accumulation of type IV collagen observed in aging muscle.

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**2679** Board #354 MAY 31 2:00 PM - 3:30 PM

**Intramuscular Doxorubicin Accumulation and Skeletal Muscle Function**

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(No relationships reported)

Doxorubicin (DOX) is powerful anthracycline antibiotic used to treat a wide variety of cancers. DOX has been linked to debilitating side effects, and recent studies have reported a DOX-induced decline in skeletal muscle function. However, the connection between intramuscular DOX accumulation and muscle dysfunction has yet to be determined.

**PURPOSE:** To evaluate the effects of DOX on type I and type II muscle function and DOX accumulation.

**METHODS:** Male Sprague-Dawley rats received 15 g/kg DOX i.p. (n=27) or an equivalent volume of saline i.p. as a control (CON, n=11). Soleus (SOL) and extensor digitorum longus (EDL) function was assessed *ex vivo* 1 day (n=9), 3 days (n=10), or 5 days (n=8) post DOX injections. DOX accumulation in skeletal muscle was then assessed using high performance liquid chromatography.

**RESULTS:** No significant SOL or EDL maximal twitch force differences were observed 1 day or 3 days post DOX when compared to CON (p>0.05). However, SOL maximal twitch force 5 days post DOX was significantly lower than CON (19±5 mN vs. 39±3 mN, respectively, p<0.01), and EDL maximal twitch force 5 days post DOX was significantly lower than CON (34±4 mN vs. 76±8 mN, respectively, p<0.01). SOL DOX accumulation at 1, 3, and 5 days post injection was (in ng DOX/g of tissue) 269±35, 147±29, and 166±45, respectively. The only significant DOX accumulation difference observed between SOL and EDL was at day 1 (p<0.01). Significant reductions in intramuscular DOX levels were observed in SOL between days 1 and 5 (p<0.01) and days 3 and 5 (p<0.05), but significant reductions in intramuscular DOX levels were not observed between days 1, 3, or 5 in the EDL (p>0.05).

**CONCLUSIONS:** Although DOX treatment resulted in depressed skeletal muscle function in both the SOL and EDL, differences in intramuscular DOX accumulation and clearance were observed between the SOL and EDL. DOX levels were higher in the SOL when compared to EDL, but this elevated level also declined significantly over time in the SOL suggesting differential accumulation and clearance of DOX in type I and type II muscle.

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**2680** Board #355 MAY 31 2:00 PM - 3:30 PM

**Skeletal Muscle Quality Is Associated With Physical Function In People With COPD**

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(No relationships reported)

The loss of muscle mass and muscle strength observed in people with chronic obstructive pulmonary disease (COPD) has been associated with impaired mobility and lower physical activity levels. However, muscle atrophy alone does not fully explain the loss of function. Changes in muscle quality (e.g. fatty infiltration) may also account for impaired functional performance.

**PURPOSE:** To compare skeletal muscle quality in people with COPD to controls using magnetic resonance imaging and proton spectroscopy (MRI/1H-MRS) and to correlate it with measures of muscle function and physical activity.

**METHODS:** Seven individuals with moderate to severe COPD and seven control subjects underwent T1-weighted MRI at 1.5T to obtain maximal muscle cross-sectional area (CSA<sub>max</sub>) of the quadriceps, hamstrings, dorsi- and plantar-flexors; and 1H-MRS of the vastus lateralis and soleus muscles to obtain lipid:water ratio. Isometric and isokinetic peak torque of the same muscle groups, six-minute walk distance (6MWD) and physical activity levels using a questionnaire (PASE score) were also assessed.

**RESULTS:** People with COPD and controls were matched for age (72±6.7 vs 69±9.3 yrs), sex (3 males, 4 females) and body mass index (25±6.2 vs 25±4.6 kg/m<sup>2</sup>). Compared with controls, people with COPD had ~30% lower CSA<sub>max</sub> of their quadriceps, hamstrings and plantarflexors (p<0.05); whereas muscle strength of the same muscle groups was ~60% lower in people with COPD (p<0.05). Lipid:water ratio was ~55% higher in COPD vs controls for the vastus lateralis and soleus (p=0.003; p=0.02). 6MWD was lower in people with COPD (248 m vs 639 m; p=0.02); however, no difference was observed between groups for PASE score. CSA<sub>max</sub> of the quadriceps and plantarflexors were correlated with peak torque (r=0.87; r=0.83). Correlations were also observed between lipid:water ratio and peak torque (r=-0.93), 6MWD (r=-0.91) and PASE scores (r=-0.89). **CONCLUSION:** Muscle atrophy and greater fatty infiltration was observed across thigh and calf muscles of people with COPD and was associated with muscle strength, 6MWD and physical activity. Functional impairments in muscle strength were more profound than muscle atrophy and highly associated with poor muscle quality in people with COPD.

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**2681** Board #356 MAY 31 2:00 PM - 3:30 PM

**Prevalence of Mitochondrial Respiratory Chain Deficiency in Skeletal Muscle of Chronic Obstructive Pulmonary Disease Patients**

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(No relationships reported)

Chronic obstructive pulmonary disease (COPD) is characterized by exercise intolerance and peripheral muscle weakness and dysfunction. Alterations in skeletal muscle structure and metabolic properties are common and include fiber atrophy, type II fiber predominance and decreased mitochondrial content and oxidative capacity. Interestingly, these cellular characteristics are also common features of healthy aging muscle. Consequently, it has been suggested that COPD pathophysiology is characterized by a premature aging phenotype. A major marker of age-related cellular muscle damage is the focal loss of cytochrome c oxidase (COX, a respiratory chain enzyme encoded by mitochondrial DNA) activity, which arises secondary to mitochondrial DNA damage from oxidative stress, resulting in compromised mitochondrial respiratory capacity. However, the prevalence of this COX deficiency in COPD has not previously been investigated.

**PURPOSE:** To quantify the levels of COX deficient myofibers in patients with COPD.

**METHODS:** Histochemistry using combined COX and succinate dehydrogenase (SDH, a respiratory system enzyme encoded by nuclear DNA) stains was used to identify respiratory deficient myofibers in quadriceps of 12 COPD patients (mean age 68±5yr, FEV1=48±15% predicted). The proportions of COX normal and deficient fibers, as well as fiber cross-sectional area, were determined using Image J software by two independent investigators.

**RESULTS:** Muscle sections from 9 patients had COX deficient myofibers. On average, 0.37% of all myofibers analyzed (n=10,945) were COX deficient, a proportion exceeding over 7-fold the established standard values for that age group (-0.05%, Sleight et al. Muscle and Nerve 2011). Compared to COX normal, COX deficient fibers were not significantly different in size.

**CONCLUSION:** The higher proportion of COX-deficient myofibers in our participants support the notion that COPD is characterized by an accelerated aging phenotype. Biochemical and molecular genetic analyses are currently underway to determine if the COX deficient fibers identified in these patients contain age-related clonally-expanded mitochondrial DNA deletions and greater oxidative stress compared to COX normal fibers, which would provide a molecular basis for this age-related biochemical defect.

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2682 Board #357 MAY 31 2:00 PM - 3:30 PM

**In Vivo Measurement of Intercellular pH and Contractile Performance During Repetitive Stimulation in Rat Skeletal Muscle**

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(No relationships reported)

Homeostasis of intracellular pH (pHi) serves a crucial role for maintenance of cellular function. However, the relationship between muscle force/fatigue and pHi under physiological (circulation intact) conditions remains unclear.

**PURPOSE:** Using an in vivo bioimaging model, we tested the hypothesis that muscle fatigue would be associated closely with a reduction in pHi during tetanic muscle contractions.

**METHODS:** The intact spinotrapezius muscle of adult Wistar rats (n = 7) was exteriorized and loaded with the fluorescent probe BCECF-AM (10 μM). Tetanic isometric contractions (20 contractions/min for a total of 10 sets of 50 contractions) were elicited by electrical stimulation (100 Hz, 4-7 V). The fluorescence ratio (F500 nm/F445 nm) was determined from images captured following each set of contractions was used to estimate pHi and changes thereof.

**RESULTS:** Tetanic force at the end of set 3 was decreased significantly to  $-54.7 \pm 2.3\%$  of initial force ( $P < 0.01$ ). On the other hand, there was no significant change of pHi throughout this period. Subsequently, tetanic force declined gradually until set 10 ( $-38.3 \pm 3.2\%$  of initial force at set 1) by which time pHi was reduced substantially (set 5:  $-10.0 \pm 2.7\%$ , set 10:  $-19.9 \pm 3.9\%$  vs. pre-contractions). Below  $\sim 55\%$  initial force further reductions in force and pHi correlated tightly ( $r = 0.97$ ,  $P < 0.001$ ).

**CONCLUSIONS:** These results demonstrate two distinctly different profiles of pHi during fatiguing stimulation protocol. Although initial muscle fatigue is independent of the pHi, decline of pHi during sequential bouts of muscle contractions is associated closely with fatigue. This model offers a unique opportunity to investigate the consequences of experimental manipulations of pH on muscle fatigue under close-to-physiological conditions.

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2683 Board #358 MAY 31 2:00 PM - 3:30 PM

**Effect Of Aging On The Relationship Between Knee Angle And Triceps Surae Power Output**

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(No relationships reported)

**INTRODUCTION:** Human adult aging is associated with a loss of strength, contractile velocity and power of the plantar flexors, but the effect of knee joint angle on the force-velocity relationship and hence power is unknown. As the dominant plantar flexor (PF), the triceps surae is comprised of the bi-articular gastrocnemii and the mono-articular soleus, and in young men isometric PF torque and power are reduced in knee flexion compared with extension. In addition to mechanical differences in these muscles there are dissimilar histochemical and electrophysiological properties; but it is unknown how changes in these may alter torque and power with aging.

**PURPOSE:** To assess the effects of adult aging and knee angle on PF performance.

**METHODS:** Neuromuscular properties were recorded from 11 young ( $\sim 25$  y) and 11 old ( $\sim 78$  y) men with either the knee extended ( $170^\circ$ ) or flexed ( $90^\circ$ ). Participants performed isometric maximal voluntary contractions (MVCs), followed by maximal dynamic shortening contractions using the isotonic mode of a Biodex at loads from 15%, 20%, 30%, 45%, 60% and 75% of MVC; applied in random order.

**RESULTS:** The young were stronger ( $\sim 25\%$ ), faster ( $\sim 13\%$ ) and more powerful ( $\sim 30\%$ ) than the old in all static and dynamic contractions. In both young (170 Nm vs 203 Nm) and old (128 Nm vs 154 Nm), MVC was greater in the extended than flexed position, respectively, with no difference in voluntary activation ( $\sim 96\%$ ). There was no difference between age groups in the degree of strength decrement from the extended (young  $\sim 17\%$ , old  $\sim 15\%$ ) to the flexed position. The young men produced (7-10%) faster shortening velocities with their knee extended for the 15%, 20% and 30% of MVC contractions, but no differences for higher loads; whereas there were no differences in shortening velocity between knee positions in the old group across all relative loads. In the young, power production was  $\sim 20$ - $25\%$  greater in the extended knee across all loads, whereas the old had greater power at lower loads, but similar power in both knee positions at  $> 45\%$  of MVC.

**CONCLUSION:** Results indicate that the presumed age-related preferential loss of Type II muscle fibers may lead to impairment in gastrocnemius function, causing an age-related attenuation of differences in plantar flexion function between extended and flexed knee angles.

Supported by NSERC

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2684 Board #359 MAY 31 2:00 PM - 3:30 PM

**Median Power Frequency As A Parameter To Measure Muscle Fatigue During Intense Exercise**

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(No relationships reported)

Fatigue may be explained as a task dependent multifactorial phenomenon. Alterations in muscle performance, especially during muscle fatigue may be analyzed through the use of surface electromyography (sEMG). Changes in sEMG during muscle contraction can be observed and have been used to describe various aspects of motor unit activation.

**PURPOSE:** The purpose of the study was to quantify the level of muscle fatigue at the end of a VO<sub>2max</sub> test in comparison with an anaerobic test (AnT). To assess muscle fatigue, the median power frequency (MPF) of the sEMG signals was computed before, during and after the two tests.

**METHODS:** Six aerobically conditioned men ( $28 \pm 6.5$  yr;  $60.9 \pm 9.7$  mL/kg/min) performed two cycle ergometry tests on different days. VO<sub>2max</sub> testing began at 15% of peak watts (previously determined) and every minute an increment of 11% was added until exhaustion. AnT began at 100% of peak watts and continued until exhaustion. Six bipolar channels continuously assessed sEMG of the rectus femoris (RF), vastus medialis (VM) and vastus lateralis (VL) for both legs. Raw data segments of 20% of the total test time were further analyzed. MPF values were normalized to the maximal voluntary contraction (MVC) preceding each test. Data were analyzed using separate muscle- and leg-specific 2 (test type) by 2 (pre-, post-test) ANOVAs with repeated measurement and  $\alpha = .05$  to observe differences in the MPF during the last 20% segment of the tests.

**RESULTS:** The interaction effect was significant for the left VM (VO<sub>2max</sub>= $79.39 \pm 11.26\%$  vs anaerobic test =  $88.28 \pm 9.6\%$ ):  $F(1,6) = 8.517$ ,  $p = .027$ ; the right RF (VO<sub>2max</sub>= $92.91 \pm 8.85\%$  vs anaerobic test =  $82.82 \pm 10.51\%$ ):  $F(1,5) = 12.608$ ,  $p = .016$ ; and the right VL (VO<sub>2max</sub>=  $93.46 \pm 8.78$  vs anaerobic test =  $80.54 \pm 13.17$ ):  $F(1,5) = 7.583$   $p = .033$ .

**CONCLUSION:** For our sample, muscle fatigue at the end of a VO<sub>2max</sub> was not maximal; there was a reserve of muscle fiber recruitment mainly from the slow-twitch fiber type. EMG signals may be used to evaluate muscle fatigue during intense exercise. We found the median frequency to be the most sensitive signal.

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**Mechanomyographic Frequency Domain Responses During Fatiguing Concentric Isokinetic Leg Extensions**

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(No relationships reported)

The mechanomyographic (MMG) represents a summation of the mechanical activity from individual motor units. During voluntary contractions, it has been suggested that the frequency domain parameters may reflect the firing rate. Furthermore, during fatiguing concentric isokinetic muscle actions it is believed that the median frequency may reflect the decrease in recruitment of fast-twitch muscle fibers.

**PURPOSE:** The purpose of the present study was to examine the MMG median frequency (MDF) responses of the vastus lateralis (VL) and rectus femoris (RF) during concentric isokinetic leg extension endurance tests.

**METHODS:** Twenty-four healthy men (mean  $\pm$  SD, age =  $23 \pm 4$  yrs, body mass  $82 \pm 12$  kg) volunteered for this investigation. The MMG sensor (EGAS-FS-10/V05; Measurement Specialties, Inc., Hampton, VA) was placed over the VL and RF of the muscle at 50% of the distance between the greater trochanter and lateral condyle of the femur. Each participant completed the leg extension endurance test on the Biodex System 3 isokinetic dynamometer. Three to five submaximal trials preceded 50 consecutive maximal concentric isokinetic leg

extension muscle actions performed at  $180^{\circ}\text{s}^{-1}$  with the right leg. Not all subjects were able to complete all 50 repetitions; however, all subjects did complete at least 48 repetitions. Therefore, the first 48 repetitions were analyzed. Percent decline calculations were used to measure the changes in  $\text{MMG}_{\text{MDF}}$  during the endurance tests (percent decline = initial  $\text{MMG}_{\text{MDF}}$  - final  $\text{MMG}_{\text{MDF}} \div$  initial  $\text{MMG}_{\text{MDF}} \times 100$ ). The initial  $\text{MMG}_{\text{MDF}}$  was calculated as the average of the 3 highest values, whereas the final  $\text{MMG}_{\text{MDF}}$  represented the average of the 3 lowest values during the endurance test. A paired-samples *t* test was used to examine if there was a difference between the VL and RF on percent decline of  $\text{MMG}_{\text{MDF}}$ .

**RESULTS:** There was a greater ( $P < 0.001$ ) percent decline in  $\text{MMG}_{\text{MDF}}$  for the RF ( $59.52 \pm 4.85\%$ ) than the VL ( $50.95 \pm 7.38\%$ ) during the fatiguing leg extension tests.

**CONCLUSION:** The results of the present study indicated that the  $\text{MMG}_{\text{MDF}}$  responses during the fatiguing concentric isokinetic leg extensions reflected the differences between fiber type compositions of RF and VL muscles.  $\text{MMG}_{\text{MDF}}$  may have reflected a fatigue-induced "dropout from recruitment" of fast-twitch fibers, which are more abundant in RF than the VL.

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**2686** Board #361 MAY 31 2:00 PM - 3:30 PM

**Creatine Kinase Inhibition with Iodoacetamide Does Not Alter Microvascular PO<sub>2</sub> On-kinetics and Twitch Tension in the Rat EDL**

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(No relationships reported)

Creatine kinase (CK) catalyzes the reversible reaction in which high-energy phosphates are shuttled between phosphocreatine and ADP. Thus, CK is a pivotal regulator of energy flux in skeletal muscle at the onset of contractions when the metabolic demand increases. The microvascular PO<sub>2</sub> (PO<sub>2mv</sub>) reflects the dynamic relationship between oxygen delivery (QO<sub>2</sub>) and oxygen consumption (VO<sub>2</sub>). Inhibition of CK with iodoacetamide (IA) has recently been shown to slow VO<sub>2</sub> on-kinetics and to impair force production in vasodilated canine muscle.

**PURPOSE:** The purpose of this study was to determine the impact of CK inhibition on PO<sub>2mv</sub> on-kinetics and muscle twitch tension in the auto-perfused rat extensor digitorum longus muscle (EDL).

**METHODS:** The predominantly fast-twitch, EDL of female Sprague Dawley rats (n=20) was isolated and the distal tendon was attached to load cell interfaced with a Muscle Tension Analyzer. PO<sub>2m</sub> was measured with the phosphorescence quenching method using Oxyphor G2. All animals first completed a 3 min electrical stimulation (1 Hz, 6V) during which PO<sub>2m</sub> and twitch tension were measured continuously. After recovery the rats were randomly assigned to either a IA treatment group (46 mg/kg) or a saline vehicle control (C). The stimulation bout was repeated 10 min later to assess the effect of CK inhibition.

**RESULTS:** Baseline PO<sub>2m</sub>, PO<sub>2m</sub> on-kinetics, and EDL twitch tension for IA and C groups were not different during the initial contraction bout. During the second contraction bout (after IA), there was no difference in pre-stimulation PO<sub>2m</sub> in IA and C rats ( $25 \pm 1$  and  $23 \pm 1$  mmHg) or on-kinetics as reflected in similar time delay (IA  $4 \pm 1$ ; C,  $3 \pm 1$  s) and time constant (IA,  $15 \pm 2$  s; C,  $15 \pm 2$  s). Twitch tension was not different between IA and C revealing only minimal fatigue (IA,  $-5 \pm 2$ ; C,  $-8 \pm 2\%$ ) over the 3 min bout.

**CONCLUSIONS:** Contrary to expectations, IA did not alter PO<sub>2m</sub> on-kinetics or muscle contractile function. The reason for the lack of effect of IA in the present study is unclear, however, they may reflect differences in the experimental preparation (i.e., twitch contractions in an auto-perfused, predominantly fast-twitch muscle in rats) or that the dose of iodoacetamide was insufficient. (Supported by Graduate Program Committee, KCOM-ATSU.)

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**2687** Board #362 MAY 31 2:00 PM - 3:30 PM

**Resveratrol Improves Muscle Function, Increases Utrophin Expression, And Decreases Inflammation In The Mdx Mouse**

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(No relationships reported)

Duchenne Muscular Dystrophy (DMD) is fatal X-linked genetic muscle disease characterized by reduced muscle function, increased oxidative stress, and inflammation for which there is no good treatment. Resveratrol is a compound found in various foods that has anti-inflammatory and antioxidant effects.

**PURPOSE:** Examine the effect of resveratrol in the mdx mouse model of DMD on muscle function and pathology.

**METHODS:** Mice were given resveratrol (100 mg/kg) via oral gavage everyday for 10 days or every other day for 8 weeks. Rotarod performance and in-situ muscle function were examined before and after 8 weeks of treatment. Inflammation was quantified from H&E stained gastrocnemius muscle samples after 10 days of treatment. PGC-1 $\alpha$  and utrophin mRNA expression, and total utrophin protein were analyzed by qRT-PCR and western blot respectively after 10 days of treatment.

**RESULTS:** Resveratrol treatment increased Rotarod performance  $53 \pm 15\%$  ( $p < 0.05$ ). In-situ peak tension of the triceps surae muscle complex increased  $9.5 \pm 2\%$  with resveratrol treatment ( $p < 0.05$ ). Time to fatigue during a tetanic contraction of the triceps surae muscle complex increased  $44 \pm 18\%$  with resveratrol treatment ( $p < 0.05$ ). Overall inflammation was reduced  $20.7 \pm 6\%$  after 10 days of resveratrol treatment ( $p < 0.05$ ). PGC-1 $\alpha$  and utrophin mRNA expression increased  $1.4 \pm 0.2$  fold and  $1.7 \pm 0.2$  fold respectively after 10 days of resveratrol treatment ( $p < 0.05$ ).

**DISCUSSION:** We conclude that resveratrol improves muscle function and decreases muscle pathology in the mdx mouse. The improvement is likely due to increases in oxidative capacity, improved membrane integrity (utrophin), and decreased inflammation.

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**2688** Board #363 MAY 31 2:00 PM - 3:30 PM

**Morphological Characteristics of Deep Aponeurosis of Pennate Muscle in Men and Women**

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(No relationships reported)

Aponeurosis is a broad tendinous sheet that attaches to pennate muscle and is known to be an important component that affects muscle function. Sex differences in muscle contractile properties and fatigue resistance have previously been reported. However, it is unknown if a morphological difference in the aponeurosis exists between men and women.

**PURPOSE:** To compare the morphological characteristics of deep aponeurosis in young recreationally active men and women.

**METHODS:** Eight young men (mean age, 19 [SD 1] yr; height, 1.73 [SD 0.06] m; weight, 60.2 [SD 7.5] kg) and 8 young women (mean age, 19 [SD 1] yr; height, 1.60 [SD 0.04] m; weight, 50.1 [SD 4.8] kg) volunteered. Continuous cross-sectional images of the thigh were obtained using magnetic resonance imaging (MRI). In each slice, anatomical muscle cross-sectional area (CSA) was measured, and muscle length, muscle volume and mean muscle CSA (muscle volume divided by muscle length) of quadriceps muscle (QF) were calculated. For aponeurosis of vastus lateralis muscle (VL), width of the aponeurosis (aponeurosis width) was measured in each slice, and aponeurosis length and aponeurosis area were determined.

**RESULTS:** Muscle length (men, 39.4 [SD 1.6] cm; women, 35.1 [SD 1.4] cm), muscle volume (men, 1792 [SD 382] cm<sup>3</sup>; women, 978 [SD 84] cm<sup>3</sup>), and mean muscle CSA (men, 45.2 [SD 8.0] cm<sup>2</sup>; women, 27.8 [SD 1.9] cm<sup>2</sup>) of the QF were greater ( $p < 0.01$ ) in men than in women (12%, 83%, and 63%, respectively). Maximal aponeurosis width (men, 9.7 [SD 0.9] cm; women, 7.8 [SD 1.2] cm), aponeurosis length (men, 22.8 [SD 3.0] cm; women, 18.8 [SD 1.7] cm), and aponeurosis area (men, 150 [SD 15] cm<sup>2</sup>; women, 111 [SD 20] cm<sup>2</sup>) of the VL were also greater ( $p < 0.01$ ) in men than in women (25%, 21%, and 35%, respectively). However, the ratio of aponeurosis maximal width to length of the VL was quite similar between men (0.43 [SD 0.08]) and women (0.42 [SD 0.07]). There was a significant correlation between VL aponeurosis area and QF mean muscle CSA in women ( $r = 0.87$ ,  $p < 0.01$ ), but not in men ( $r = 0.52$ ). QF muscle length was correlated to VL aponeurosis length in men ( $r = 0.84$ ,  $p < 0.01$ ), but not in women ( $r = 0.14$ ). VL maximal aponeurosis width did not associate with QF muscle length in either sex.

**CONCLUSIONS:** Our results suggest that there are morphological differences in the deep aponeurosis of the VL muscle between young men and women.

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**2689** Board #364 MAY 31 2:00 PM - 3:30 PM

**Fatty Acid Intake and Exercise Improve Body Composition and Functionality in High Fat Diet-Fed Mice**

Jeong-Su Kim, Sang-Rok Lee, Samuel C. Grant, Edward Jo, Andy V. Khamoui, Bong-Sup Park, Michael C. Zourdos, Shirin Hooshmand, Michael J. Ormsbee,

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(No relationships reported)

Conjugated Linoleic Acid (CLA) and Omega-3 polyunsaturated fatty acids (n-3) have received attention due to their health benefits; however, their potential synergistic effects with resistance training (RT) during a high fat diet are not well established.



**PURPOSE:** To determine the effects of combined CLA and n-3 administration independently or with RT on body composition, strength, and sensorimotor function in middle aged male mice during 20 wks of a high fat diet.

**METHODS:** Nine-month old C57BL/6 male mice were randomly assigned to five groups (n=10/group): 1) normal diet (CON), 2) High fat diet (HFD), 3) HFD+RT (HFD/RT), 4) HFD+CLA/n-3 (HFD/CN), and 5) HFD+RT+CLA/n-3 (HFD/RT/CN). Progressive RT (4 sets of 3 repetitions with 1-min inter-set rest) was conducted using a ladder climbing device 3x/wk for 20 wks. The combined supplement was comprised of 1% CLA (0.5% of c9, t11 and 0.5% of t10, c12) and 1% n-3. Lean (LM) and fat mass (FM) were determined using dual energy x-ray absorptiometry while grip strength and sensorimotor function were evaluated with a strain gauge and the incline-plane test, respectively. All measures were obtained pre- and post-intervention. Data were analyzed with a group x time repeated measures ANOVA, and significance was set at  $p < 0.05$ .

**RESULTS:** There were significant group x time interactions for LM, FM, grip strength, and sensorimotor function. FM increased in HFD (+30%) and HFD/RT (+34%), while LM decreased in HFD (-32%) and HFD/RT (-55%). No significant changes in LM or FM were observed for CON, HFD/CN, and HFD/RT/CN. Strength significantly declined in HFD (-15%) and HFD/CN (-17%) but was maintained in both CON and HFD/RT. Sensorimotor function declined significantly in HFD (-11%) with no change in CON, HFD/CN and HFD/RT. Interestingly, CLA/n-3 administration appeared to facilitate greater RT-mediated improvements in strength (+22%) and sensorimotor coordination (+17%).

**CONCLUSION:** Body composition and functionality were negatively altered following 20 wks of high fat diet. Daily CLA/n-3 intake appears to attenuate these negative alterations while even facilitating RT-induced improvements in body composition and functionality.

Study partly supported by Sekwang Inc., Vital Pharmaceuticals, and Ocean Nutrition

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2690 Board #365 MAY 31 2:00 PM - 3:30 PM

### Muscle Regeneration: Impact of Mast Cells on Inflammatory Cell Recruitment and Muscle Cell Proliferation

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(No relationships reported)

Inflammatory cells are traditionally associated with pain, heat, redness and swelling. However, accumulating studies have shown that some of these cells can also contribute to tissue repair. Indeed, neutrophils and macrophages can contribute to the resolution of inflammation and to skeletal muscle regeneration via the release of cytokines and growth factors. We recently showed that tryptase, the most abundant mediator in mast cell granules, could potentially support muscle regeneration by increasing skeletal muscle cell proliferation.

**PURPOSE:** To evaluate if mast cells can stimulate skeletal muscle cell proliferation.

**METHODS:** In vitro: mast cells were isolated from peritoneal cavity of female Wistar rats. L6 muscle cells were cultured with either mast cells activated with compound 48/80 or mast cell-derived conditioned media. L6 cell number was determined with CellTiter assay 24h post-seeding. In vivo: muscle injury was induced through a bupivacain injection into the right EDL muscle. Rats received a daily intra-peritoneal injection of 5 bromo-2' deoxyuridine (BrdU) and were treated or not with the mast cell stabilizer cromolyn from 24h before injury. Rats were sacrificed 48 h post injury and immunohistochemistry analyzes were performed.

**RESULTS:** In vitro proliferation of L6 cells cultured with either activated mast cells or mast cell-conditioned media was significantly increased above control (1.30±0.08 fold and 1.24±0.04 fold), respectively. The proliferative effect of conditioned media was lost when APC-366, a tryptase inhibitor, was added. In vivo results shown that, compared to control, mast cell stabilization increased the density of proliferating cells (109,033±8,186 vs 79,678±10,833 cells/mm<sup>3</sup>), neutrophils (34,116±6,167 vs 15,636±4,201 cells/mm<sup>3</sup>), macrophages ED1 (35,426±7,517 vs 13,075±4,108 cells/mm<sup>3</sup>) and macrophages ED2 (21,671±1,676 vs 16,922±715 cells/mm<sup>3</sup>), respectively.  $P < 0.05$ .

**CONCLUSION:** Activated mast cells can stimulate skeletal muscle cell proliferation via tryptase release in vitro. However, in vivo this effect was masked by the influence of mast cells on the recruitment of other mitogenic cells such as neutrophils and macrophages.

Supported by grants from NSERC.

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2691 Board #366 MAY 31 2:00 PM - 3:30 PM

### Signaling Responses In Unloaded Rat Soleus Muscle To Combination Of Heat Stress And Intermittent Reloading

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<sup>3</sup>Juntendo University, *Inzai, Japan.*

(No relationships reported)

Heat stress and intermittent reloading are known as the effective countermeasure for skeletal muscle atrophy. However, it remains unclear whether the combination of heat stress and intermittent reloading are effective to attenuate muscle atrophy.

**PURPOSE:** To examine the effect of the combination of heat stress and intermittent reloading on signaling responses in unloaded rat soleus muscle induced by hindlimb unloading.

**METHODS:** Forty male Wistar rats (10wk of age, 261.7±1.17 g) were randomly divided into four groups: control (CON, n=10), hindlimb unloading (HU, n=10), hindlimb unloading with intermittent reloading (IR, n=10), hindlimb unloading with intermittent reloading and heat stress (IR+H, n=10). The HU, IR and IR+H group were unloaded for seven days. IR and IR+H group were released from unweighting for 1h every second days. During this time, IR+H group was exposed to environmental heat stress (41.5-42°C for 30 min) in a heat chamber without anesthesia. After seven days unloading, the soleus muscle were removed and analyzed by western blotting.

**RESULTS:** Seven-days unloading resulted in a 31% reduction in the soleus muscle mass, but only IR+H significantly prevented the reduction (CON; 168.2±6.7, HU; 116.3±3.7, IR; 121.0±3.7, IR+H; 131.1±2.4 mg). In soluble fraction, although 80-kDa form of calpain 1 was significantly increased in IR+H group compared to CON and HU group (HU; 102, IR; 132 and IR+H; 147% of CON), the autolyzed form of IR+H group was lower than CON group. Moreover, autolyzed form of calpain 2 (HU; 267, IR; 236 and IR+H; 105% of CON) and ubiquitinated protein (HU; 164, IR; 140 and IR+H; 112% of CON) in particulate fraction was significantly increased in HU group, but IR+H group prevented the increase. There were no significant changes in the phosphorylation of Akt, mTOR, S6K1 and eIF-4E.

**CONCLUSION:** The combination of heat stress and intermittent reloading attenuates soleus muscle atrophy through the prevention of calpain autolysis and protein ubiquitination, but independent of Akt/mTOR pathway.

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2692 Board #367 MAY 31 2:00 PM - 3:30 PM

### Developmental Change in Domain Size of Endplate Nucleus in the Rat Diaphragm

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(No relationships reported)

**PURPOSE:** Nuclei around the neuromuscular junction play an important role for the maintenance of motor endplate morphology and function in skeletal muscle. In this study, we examined the number of endplate nuclei, 3-dimensional morphological properties of the motor endplate, and the expression level of muscle-specific kinase (MuSK) in rat muscles during the postnatal development.

**METHODS:** Segments of the mid-costal diaphragm (DIA) and sternocleidomastoideus (STM) muscles were removed at 1, 2, 3, 4, 11 and 25 weeks after birth (n=7 in each age group). Motor endplates were labeled with a-bungarotoxin conjugated tetramethylrhodamine. Then, several single muscle fibers with labeled endplate were isolated from the segments under fluorescent microscopy, and myonuclei, including endplate nuclei, were stained with DAPI (4', 6-diamino-2-phenylindole) to examine the space distribution of these nuclei. Thirty to fifty single fibers from each muscle segment were imaged using a laser-scanning confocal system, and the domain sizes of endplate nuclei were calculated from endplate volume and number of endplate nuclei. Furthermore, total RNA was extracted from the remains of muscle segments and the level of Pax7 mRNA expression was determined using real time RT-PCR analysis system.

**RESULTS:** In DIA collected during the developmental period (1 to 25 weeks after birth), the mean values of muscle fiber diameter and endplate volume were significantly increased from 24±6µm to 60±15µm and from 451 ± 304µm<sup>3</sup> to 1045 ± 781µm<sup>3</sup>, respectively. The mean values of the number of endplate nuclei were increased from 3.9±1.2 at 1 week to 10.2±7.8 at 25 weeks; therefore, domain sizes of endplate nuclei were identical during the developmental period (115±77µm<sup>3</sup> at 1 week and 102.5±75µm<sup>3</sup> at 25 weeks). The level of MuSK mRNA expression was dramatically decreased by 60% during this period. There were no obvious differences in the above data between DIA and STM muscles.

**CONCLUSIONS:** The domain sizes of endplate nuclei were speculated to be constant during postnatal development and between muscles, indicating that a regulation mechanism of the domain size exists in the neuromuscular junction. It was also speculated that the domain size was not directly regulated by the expression of MuSK.

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2693 Board #368 MAY 31 2:00 PM - 3:30 PM

**Exercise Performance And Muscle Metabolic Response In Endurance Trained, Strength Trained And Untrained Elderly Men**

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(No relationships reported)

Ageing is accompanied by gradual deterioration of exercise performance and skeletal muscle oxidative capacity. However, information on effects of different life-long training regimes is sparse.

**PURPOSE:** To study performance, muscle metabolic capacity and response to exhaustive sub-maximal cycle exercise in lifetime endurance trained, strength trained and untrained +70 yrs old men.

**METHODS:** Life-time endurance trained (ET, n=8), strength training (ST, n=7) and untrained (UT, n=7) elderly men cycled at 75% VO<sub>2</sub>max until exhaustion. M. Vastus Lateralis biopsies were collected prior to and after exercise and antecubital vein blood samples were frequently drawn.

**RESULTS:** Exercise time was 87±8 min for ET which was 42 and 56% longer than for ST and UT, respectively. Power output was 34 and 32% higher (p<0.05) in ET than in ST and UT. Glycogen utilization per work unit was 41% lower (p<0.05) in ET than ST. Muscle lactate at exhaustion was lower (p<0.05) for ET than ST (14.1 vs 28.9 mmol kg<sup>-1</sup> d.w.) and blood lactate was lower (p<0.05) for ET than UT from 15 min of exercise with an intermediary response for ST (15 min: 2.2, 3.8 and 3.0 mM, respectively). VO<sub>2</sub>max, CS activity and capillaries per fibre, respectively, were higher (p<0.05) for ET than for ST (39, 24 and 19%) and UT (46, 53 and 35%). The MCT1 content in ET was 49% higher (p<0.05) than in UT, but not different from ST (22%, NS). No differences were evident in exercise performance, oxidative capacity or muscle metabolic response between ST and UT, except that ST had a 23% higher (p<0.05) CS activity. Exhaustion time correlated with the fraction of ST fibres (r=0.41, p<0.05) and negatively with blood lactate at exhaustion (r=-0.51, p<0.05). Muscle lactate at exhaustion correlated negatively with muscle HAD activity (r=-0.62) and positively with glycogen utilization (r=0.51) and type IIX fibres (r=0.54).

**CONCLUSIONS:** Life-long endurance trained elderly had a markedly higher endurance performance and muscle aerobic capacity compared to untrained and strength trained master athletes resulting in attenuated muscle lactate production and glycogen utilization during continuous exhaustive cycle exercise. Exercise performance and muscle metabolite exercise response did not differ between strength trained and untrained elderly men. The Danish Ministry of Culture funded the study.

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2694 Board #369 MAY 31 2:00 PM - 3:30 PM

**Plasma Matrix Metalloproteinase-9 (MMP-9) is Increased Following Downhill Running in Sedentary Individuals**

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(No relationships reported)

Our lab has investigated the utility of plasma MMP-9 as a potential systemic indicator of muscle damage in humans. We have previously reported that the systemic response is variable and unchanged in the week following an eccentric arm task in sedentary subjects, and a downhill run in concentrically-trained subjects. Although concentrically-dominated training has been associated with increased susceptibility to muscle damage, subjects may not have experienced the degree of damage that might ensue in a sedentary population. Sedentary subjects did not have a systemic MMP-9 response after completing an eccentric arm task, but the volume of muscle damaged may have been too small to detect a response. Thus, it is still not clear whether plasma MMP-9 or its inhibitor, tissue inhibitor of metalloproteinase-1 (TIMP-1), change following a downhill run in sedentary subjects.

**PURPOSE:** To quantify systemic changes in MMP-9, TIMP-1, and other muscle damage indices following a downhill run in sedentary subjects.

**METHODS:** 8 sedentary males (n=3) and females (n=5) ran downhill (-10°) for 30 minutes. Plasma creatine kinase (CK) activity, MMP-9 and TIMP-1 concentrations, soreness ratings, and leg strength were collected pre-exercise (pre-ex), immediately post-, 1-, 2-, 4-, and 7-days post-exercise (post-ex). Trends were analyzed with a linear mixed model approach. Means ±SE are presented with p<0.05 considered significant.

**RESULTS:** Soreness significantly increased (p=0.013) from 4.1 ±2.3 mm pre-ex to a peak of 44.0 ±7.5 mm at 1-day post-ex (p=0.003). Values returned to baseline by 4-days post-ex. Plasma CK activity was significantly increased (p=0.005) from 74.5 ±29.4 U/L pre-ex to a peak of 102.7 ±25.2 U/L at 1-day post-ex. Plasma MMP-9 was significantly increased (p=0.009) from 25.4 ±2.4 ng/ml pre-ex to 35.8 ±4.1 ng/ml at 4-days post-ex. Plasma TIMP-1 levels were unchanged throughout the time course.

**CONCLUSIONS:** Plasma MMP-9 levels are increased at 4-days post-downhill running in sedentary individuals. These results, along with our previous results, suggest that the plasma MMP-9 response to exercise may be related to either physical training history or the severity of an exercise task. We plan to follow-up on this by examining the tissue response to either concentric or eccentric exercise in sedentary human muscle biopsies.

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2695 Board #370 MAY 31 2:00 PM - 3:30 PM

**Comparison of Skeletal Muscle Tissue Oxygen Saturation Responses between Genders**

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(No relationships reported)

Special attention should be given to subcutaneous thigh fat accrual and its impact on the amount of skeletal muscle blood flow and accumulation when using different initial restrictive pressure (IRP) during blood flow restriction (BFR) training. Due to different patterns of fat distribution and deposition in males and females, it is important to test the effects of subcutaneous fat on tissue oxygenation and lactate production during exercises with BFR.

**PURPOSE:** The present study investigated the importance of thigh subcutaneous fat as a variable that may be associated with affecting the magnitude of initial pressure (tightness of cuffs before inflation with air) on skeletal muscle tissue oxygen saturation and lactate between males and females.

**METHODS:** Twenty healthy volunteers, 10 males (25 ± 4.83 yr) and 10 females (20.7 ± 1.06 yr), performed exercises with an IRP of 40mmHg. The following procedures were performed in order: a) subcutaneous fat thickness, b) pre-maximal isometric force (MVC), c) 4 sets (1 × 30 reps and 3 × 15 reps) of dynamic knee extension exercises performed at 20% MVC, d) post-MVC. Skeletal muscle tissue oxygen saturation was continuously monitored before, during, and after exercises with near-infrared spectroscopy placed to a mark that was made at 50% on the line from the anterior superior iliac spine to the superior part of the patella. Plasma lactate levels were assessed prior to, in between the first and second set, immediately after post MVC, 5min-post, 10 min-post, and 20 min-post.

**RESULTS:** Thigh subcutaneous fat thickness was significantly greater in females than males (p<0.01). Tissue oxygenation significantly decreased (p<0.03) throughout exercise in both genders with an observed significant time × gender interaction (p<0.01). Both male and females responded to the BFR similarly with a significant decrease (p<0.01) in peak force production from pre to post exercise, while plasma lactate levels significantly differed (p<0.01) throughout the exercise with no time × gender interaction (p<0.3).

**CONCLUSIONS:** The observed gender difference in tissue oxygenation in response to BFR with an IRP of 40mmHg underline the necessity for future studies to consider subcutaneous fat as a variable to influence the magnitude of physiological adaptations between genders and adjust the IRP accordingly.

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2696 Board #371 MAY 31 2:00 PM - 3:30 PM

**A Computational Model of Neuromuscular Function That Predicts Age-Related Fatigue Resistance**

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(No relationships reported)

Numerous studies indicate that the muscles of older individuals fatigue relatively less than younger individuals during isometric contractions. Due to the many differences in neuromuscular function between young and old, it is difficult to ascertain with precision the physiological mechanisms of age-related fatigue resistance. While computational models have been developed that predict muscle fatigue, and others have been designed to predict altered neuromuscular function with old age, no integrative model has been presented that examines age-related changes of the neuromuscular system in the context of fatigue.

**PURPOSE:** To develop a comprehensive computational model that evaluates the effects of old age on neuromuscular function during fatiguing voluntary contractions.

**METHODS:** We combined de novo experimental data and literature values to derive functions that describe multiple components of neuromuscular function (motor unit recruitment, excitation-contraction coupling, force generation, bioenergetics, and ankle dorsiflexion torque) during voluntary activation. These functions were parameterized in two versions; one to represent the neuromuscular function of younger men (YM) and the other to characterize older men (OM). Separate forward dynamics simulations were run using each model to predict isometric torque-generating capacity during repeated, maximal voluntary activations. We tested the validity of this model to predict fatigue, defined as a relative decline in maximal torque, by comparing model estimates of torque to values from the literature.

**RESULTS:** The model simulated contractions of similar duration and duty cycle to an example from the literature, and less fatigue was predicted by OM (84.4% initial) than YM (79.1%). These values are highly consistent with those reported in vivo for younger and older men (Root mean square difference [RMSD] = 6.6% and 0.11% respectively).

**CONCLUSIONS:** By simulating contraction protocols from the literature, we have demonstrated sensitivity of the present model to age-related differences in neuromuscular function and fatigue. These findings validate the present model as a unique and powerful tool for testing hypotheses related to the phenomenon of age-related fatigue resistance.

Support: NIH K02A6023582

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2697 Board #372 MAY 31 2:00 PM - 3:30 PM

**Estrogen Receptor (ER) Mediated Recovery Of Atrophic Muscle Following Hind Limb Unweighting (HLU)**

Andries J. Ferreira, Madoka Spence, Andrew J. Dunn, James R. Langworthy, Marybeth Brown. *University of Missouri, Columbia, MO.*

(No relationships reported)

Estrogen (E2) is necessary for normal muscle function.

Genomic E2 effects are mediated through two ER, alpha and beta but whether they are important for the recovery of atrophic muscle has not been identified.

**PURPOSE:** to determine if the recovery of atrophic muscle (mass and contractile function) is ER mediated.

**METHODS:** Mature 4 mos old female C57/BL6 mice (n=70) were divided into sham ovariectomy (OVX) and OVX groups. All but 10 sham controls were HLU for 4 wks. One third of the HLU mice were studied immediately after unweighting, one third were studied after 3 days of recovery following HLU and the final third were studied after 3 days of recovery and 3 days of injections with ICI 182780, an E2 antagonist that blocks both ER alpha and beta. Contractile tension was determined in soleus, plantaris, gastrocnemius and tibialis anterior. Muscle mass and fiber cross-sectional area (CSA) were also determined for each muscle. **RESULTS:** HLU significantly reduced muscle mass and contractile force in all 4 muscles studied. In Sham OVX, recovery resulted in a significant (p<0.05) return toward baseline for muscle mass; recovery in mass was barely apparent in OVX mice. ICI attenuated recovery in Sham OVX and blocked recovery in OVX females. Evidence of recovery in muscle force (Po) was evident in Sham OVX but not in OVX with the exception of the soleus (e.g., sham Con 9.0 + 3.1, OVX HLU 5.0 + 2.7, OVX HLU + recovery 5.6 + 1.0 and OVX HLU + recovery + ICI 6.7 + 1.5). Values for CSA mirrored those of mass.

**CONCLUSIONS:** Without ER, recovery is attenuated suggesting an alternative but slower route mediating E2 effects. Without E2 or ER, recovery of atrophic muscle is compromised but effects are muscle specific. Supported by NIH HD 058834 and the MO Spinal Injuries Research Board.

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2698 Board #373 MAY 31 2:00 PM - 3:30 PM

**Effect of Exercise Order on Testosterone Availability in Post-exercise Recovery**

Daniel W.D. West, Lisa M. Cotie, Cameron J. Mitchell, Tyler A. Churchward-Venne, Maureen J. MacDonald, Stuart M. Phillips, FACSM. *McMaster University, Hamilton, ON, Canada.*

(No relationships reported)

It has been suggested that performing arm prior to lower-body resistance exercise could reduce testosterone-rich blood delivery to the arm in recovery, thereby hampering potential hypertrophy over time.

**PURPOSE:** To determine the availability of testosterone to the arm, after arm exercise performed before or after intense lower-body resistance exercise.

**METHODS:** In a randomized cross-over design, four men (28 ± 5 y, BMI = 25.8 ± 2.0 kg m<sup>-2</sup>; means ± SD) performed 4 sets of isotonic arm exercise on a Biodex before (A-L) or after (L-A) intense bilateral leg resistance exercise. Blood samples for hormone analysis as well as brachial artery blood flow measures (Doppler ultrasound) were obtained immediately after arm and leg exercise and at intervals for 75 min of post-exercise recovery. Testosterone and growth hormone (GH) 'delivery' were calculated as the product of blood flow and hormone concentration.

**RESULTS:** There was a 3-fold increase in brachial artery blood flow after exercise by either legs or arm alone, followed by a further 1.5-fold increase after subsequent leg or arm exercise; consequently, there were no overall differences between exercise order for brachial artery blood flow. Testosterone and GH increased similarly with both A-L and L-A, each peaking 15 min after leg exercise. After A-L and L-A (respectively), testosterone delivery (AUC, arbitrary units) was 159 ± 26 and 141 ± 58 and GH delivery was 454 ± 111 and 462 ± 128. Total work output across 4 sets of arm exercise was higher in A-L (162 ± 35 kJ) than L-A (131 ± 50 kJ; P = 0.03).

**CONCLUSIONS:** Exercising the legs after arm exercise enhances rather than impairs blood flow to the exercised arm. Total testosterone and GH availability to the arm is not different depending on whether arm exercise is performed before or after intense leg exercise and so would not impair hypertrophy. Supported by CIHR and NSERC.

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2699 Board #374 MAY 31 2:00 PM - 3:30 PM

**A Description of the Relationship between Straight Leg Raise (SLR) Test and Muscle Hardness**

Susumu Iwasaki<sup>1</sup>, Akitoshi Sogabe<sup>2</sup>, Andrew C. Fry<sup>1</sup>, Philip M. Gallagher<sup>1</sup>, Erik Christensen<sup>3</sup>. <sup>1</sup>The University of Kansas, Lawrence, KS. <sup>2</sup>Konan University, Kobe, Japan. <sup>3</sup>The Ohio State University, Columbus, OH.

(No relationships reported)

**PURPOSE:** The two purposes of this study are to: 1) describe the participants' results of SLR and muscle hardness statistically, and 2) identify any significant linear regression relationship between the SLR results and the muscle hardness as the preliminary study for upcoming analysis with the EMG data from the identical participants.

**METHODS:** Participants, the SRL of 23 males (age, 23.22±10.78 yrs; height, 174.67±12.83 cm; weight, 82.98±23.29 kg) were measured for both legs, and the muscle hardness for five different conditions: relaxed, voluntarily SLR, passively SLR, forcedly SRL, and maximal voluntary contraction with four different muscles: vastus medialis, vastus lateralis, rectus femoris, and biceps femoris. As the statistical data analysis, the descriptive statistics such as means and SDs for each variable were calculated. Also, linear regression and correlation analyses were conducted in order to identify any significant relationship. In order to judge collinearity, tolerance and VIF coefficients were calculated for each predictor.

**RESULTS:** The linear regression analysis revealed a set of significant regression coefficients that the SLR for left leg is predicted by all the muscle hardness scores (5 conditions \* 4 muscles = 20 predictors), (F=35.01; p<.028; df=20).

**CONCLUSION:** Even though there is only one statistically significant regression relationship, it may be possible to identify other significant pathways by such as collecting a larger sample. However, the description of dispersion with the participants' SLR and muscle hardness scores is beneficial for the future study.

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2700 Board #375 MAY 31 2:00 PM - 3:30 PM

**Gender Differences in Leg Length, Q-Angle, Navicular Drop, and Tibial Torsion of College Age Subjects**

Mark Walker<sup>1</sup>, Ali Boolani<sup>2</sup>, A. Warren<sup>3</sup>, C. Kline<sup>3</sup>, J. Guerrero<sup>4</sup>. <sup>1</sup>Tennessee State University, Nashville, TN. <sup>2</sup>Oklahoma City University, Oklahoma, OK. <sup>3</sup>Oklahoma State University, Stillwater, OK. <sup>4</sup>Texas A&M University, College Station, TX.

(No relationships reported)

**PURPOSE:** The objective of this study was determine whether gender differences exist in skeletal structures. **Methodology:** A convenience sample of 24 males (age=22.46yrs ±2.41; height (HT)= 68.06in ±3.50; weight (WT)=186.75lbs±49.84) and 34 females (age=21.50yrs ±1.73; HT=66.05in ±2.61; WT=138.98lbs ±20.98) was chosen from a large Midwestern university in the United States. Leg length (LL), Q-Angle, Navicular Drop (ND) and Tibial Torsion (TT) were measured for each subject. Data was analyzed using a one-way ANOVA.

**RESULTS:** Analysis yielded significant differences between TT ( $p<.001$ ), LL ( $p=.001$ ) and Q-Angle ( $p=.005$ ), however no significant difference was found in ND ( $p=.189$ ) and LL/HT ratio ( $p=.601$ ). Males had significantly longer LL ( $94.68\text{cm} \pm 6.37$ ) and TT ( $19.79$ [[Unsupported Character - &#7506;]]  $\pm 5.74$ ) compared to females (LL= $89.72\text{cm} \pm 4.56$ ; TT=  $13.29$ [[Unsupported Character - &#7506;]]  $\pm 4.29$ ), however women had significantly large Q-angles ( $9.03$ [[Unsupported Character - &#7506;]] than males ( $7.50$ [[Unsupported Character - &#7506;]]).

**CONCLUSION:** This study validated studies that have stated that females have larger Q-angles than males. While lateral rotation of the tibia occurs at sexual maturation, males tend to have a great rotation of the tibia than females. Leg length was also significantly greater in males than females ( $p=0.001$ ), however this may be attributed to the males in this study being taller than females since LL/HT ratio was not significantly different ( $p=.601$ ). Inter-tester reliability may also be in question, as inter-tester reliability at 99% confidence indicated high correlation ( $R>0.85$ ) between TT and LL measurements, however lower correlations ( $R=0.65-0.85$ ) for Q-Angle and ND. Further investigation is required to determine why males have greater lateral rotation than females.

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**2701** Board #376 MAY 31 2:00 PM - 3:30 PM

**Aging-related Changes In Isokinetic Torque Generation Capacities Of Knee Extensor**

kyung jae yoon<sup>1</sup>, Ho Jun Lee<sup>2</sup>, Min-Kyun Oh<sup>3</sup>, Dong Yeon Cha<sup>2</sup>, Yong-Taek Lee<sup>1</sup>. <sup>1</sup>Kangbuk Samsung Hospital, Sungkyunkwan University, School of Medicine, Seoul, Korea, Republic of. <sup>2</sup>Dongguk University, College of medicine, Goyang, Korea, Republic of. <sup>3</sup>Gyeongsang National University Hospital, Jin-ju, Korea, Republic of. (No relationships reported)

The purpose of this study was to investigate the effect of aging on the concentric and eccentric peak torque (PT) generation capacities of knee extensors in three different angular velocities (30, 60, and 180°/s). Concentric and eccentric PTs were measured in 130 healthy men (27-76 years). PT was compared between three age groups (young: 20 - 39 years, intermediate: 40 - 59 years, and old: 60 years and older). Concentric quadriceps PT at all angular velocities in intermediate and old group was significantly lower than that in young group ( $p<0.01$ ). Further regression analysis showed that the decrement of the PT explained by aging was larger in higher angular velocities than the lower (concentric PTs of old group were 82.8%, 80.4%, and 72.2% of the young group at angular velocity of 30°/s, 60°/s, and 180°/s, respectively). However, the eccentric PT did not demonstrate any significant differences among the three age groups ( $p>0.05$ ). These findings suggest that the neuromuscular aging not only diminishes the concentric peak torque generation but also impedes the rate of torque generation capacities of knee extensors. In eccentric contraction, the torque generation capacities might be influenced more by non-contractile, passive properties of muscles than in the concentric contraction.

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**2702** Board #377 MAY 31 2:00 PM - 3:30 PM

**Asymmetry joint loading of Temporomandibular Joint During Clenching in Patients with Temporomandibular Joint Disorders**

Han-Yi Cheng<sup>1</sup>, Shin-Tsu Chang<sup>2</sup>, Pei-Wen Pon<sup>3</sup>, Wei-Chun Hsu<sup>4</sup>, Yuan-hsiang Lin<sup>4</sup>, Keng-Liang Ou<sup>5</sup>, Wan-Ju Hsu<sup>4</sup>, Shih-Chi Lee<sup>4</sup>, Yu-An Hu<sup>4</sup>. <sup>1</sup>National Taiwan University, Taipei, Taiwan. <sup>2</sup>Tri-Service General Hospital, Taipei, Taiwan. <sup>3</sup>College of Oral Medicine, Taipei, Taiwan. <sup>4</sup>National Taiwan University of Science and Technology, Taipei, Taiwan. <sup>5</sup>Taipei Medical University, Taipei, Taiwan. (No relationships reported)

To examine the causal relationship between pain and joint loading at temporomandibular joint (TMJ), one must focus on the magnitude and location of the maximum stresses under physiological loading during functional oral activities such as clenching. However, the asymmetry nature of left and right sides joint loading was not fully addressed using finite element analysis (FEA).

**PURPOSE:** To quantify the stress distribution in the mandibular condyle, disc and articular eminence, and to compare the joint loading revealed by von Mises' and shear stresses on the models of normal young adults and patients with TMJ disorders.

**METHODS:** The CT images of TMJ of three healthy adult female volunteer and three patients with TMJ disorders were used to build the models for FEA. As loading condition, 290N for masseter, 140N for temporalis, and 143N for medial pterygoid were introduced bilaterally. For each subject, the highest von Mises' stresses and highest shear stresses at TMJ during clenching were calculated

**RESULTS:** For the comparison of joint loading at right and left sides, all the normal young adults manifest symmetry joint loading in terms of their highest von Mises' stresses (Y: 2.321-2.855 MPa at the mandibular condyle, 0.634-0.957 MPa at articular disc, and 1.743-1.976 MPa at articular eminence; TMJ: 2.652-3.717 MPa at the mandibular condyle, 0.620-1.789 MPa at articular disc, and 1.632-2.010 MPa at articular eminence) and of highest shear stresses (Y: 3.023-3.725 MPa at the mandibular condyle, 0.815-1.291 MPa at articular disc, and 2.289-2.518 MPa at articular eminence; TMJ: 0.840-2.317 MPa at articular disc, and 2.196 -2.650 MPa at articular eminence).

**CONCLUSION:** All the patients with TMJ disorders manifest asymmetry joint loading revealed by von Mises' stresses at the mandibular condyle, by von Mises' stresses at the articular disc, by shear stresses at the mandibular condyle, and by shear stresses at the articular disc; while these asymmetry findings were not shown neither by the von Mises' stresses nor by the shear stresses at the articular eminence. Both the von Mises and shear stress during clenching was higher in patient with TMJ disorder than that in healthy subjects. Trends of the asymmetry loading have been observed in the patients with TMJ but not in the normal young adults.

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**D-33** Free Communication/Poster - Sleep

MAY 31, 2012 1:00 PM - 6:00 PM

ROOM: Exhibit Hall

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**2703** Board #378 MAY 31 3:30 PM - 5:00 PM

**Do Sleep Problems Mediate Development of Mental Health Symptoms After Deployment?**

Caroline A. Macera, FACSM, Hilary J. Aralis, Mitchell J. Rauh, FACSM, Andrew J. MacGregor. Naval Health Research Center, San Diego, CA. (No relationships reported)

**PURPOSE:** Many military members who are exposed to combat-related blasts and screen for traumatic brain injury (TBI) subsequently develop mental health symptoms suggesting posttraumatic stress disorder (PTSD) or depression. One common symptom reported after deployment is difficulty falling or staying asleep. The role of sleep in the development of mental health symptoms is unclear.

**METHODS:** We prospectively followed 29,640 U.S. Navy and Marine Corps men who completed health assessments immediately upon return from deployment in Kuwait, Iraq, or Afghanistan during 2008 and 2009. Among those who did not screen positive for PTSD ( $n = 29,019$ ), self-reported sleep problems and TBI screening results were obtained and related to PTSD screening results from a separate health assessment administered several months later. After establishing a significant association between TBI and sleep problems, the association of TBI and PTSD was independently tested and retested while controlling for sleep problems. Similar methods were used for the alternative outcome of a positive depression screen ( $n = 27,702$ ).

**RESULTS:** After controlling for sleep problems, the odds of receiving a positive PTSD screen decreased from 1.61 (confidence interval [CI]: 1.21-2.14) to 1.32 (CI: 0.99-1.77) for a subject screening positive for TBI relative to a subject screening negative. Sleep problems mediated 26% of TBI's effect on development of PTSD. After controlling for sleep problems, the odds of receiving a positive depression screen for a subject screening positive for TBI relative to a subject screening negative decreased from 1.41 (CI: 1.11-1.80) to 1.15 (CI: 0.90-1.47), and the ratio became nonsignificant. Sleep problems mediated 41% of the effect of TBI on development of depression.

**CONCLUSIONS:** We found the effect of a positive TBI screen on the development of PTSD or depression is mediated by sleep problems. The results of our study suggest that sleep problems may be an early indicator of risk for PTSD or depression, and immediate treatment of self-reported sleep problems could mitigate the risk for development of mental health disorders, although future (intervention) studies are needed. This work was supported by the U.S. Navy Bureau of Medicine and Surgery under Work Unit No. 60818.

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2704 Board #379 MAY 31 3:30 PM - 5:00 PM

**Objectively Measured Sleep is Predictive of Adiposity in Young Adult Women**

Bruce W. Bailey, Matthew Allen, Marshall Hill, James D. LeCheminant, FACSM. *Brigham Young University, Provo, UT.*

(No relationships reported)

**PURPOSE:** Over the past several decades, the prevalence of obesity has risen at an alarming rate. One of the critical times for developing excess body weight is during the college years. The reason for this weight gain is not completely clear, but one factor that has not been well examined is the role of sleep. The purpose of this study is to examine the relationship between sleep and adiposity in 199 college women.

**METHODS:** The study was cross-sectional. Participants were recruited from October 2009 to August 2011 from a Mountain West University. Participants wore an accelerometer for seven consecutive nights to assess sleep duration and quality. Participants also kept a sleep log to verify sleep time. Height and weight were assessed following a three-hour fast and in a standard one-piece swimsuit. Body composition was assessed using the BOD POD.

**RESULTS:** The women in the study slept an average of  $7.41 \pm 0.82$  hours per night. There was a negative relationship between total minutes in bed and BMI; this correlation was strengthened when controlling for average number of awakenings per night ( $P \leq 0.05$ ). It was also found that percent body fat was trending in the same direction as BMI, but was not significant ( $P = 0.07$ ). There was a 72% reduction in the odds of being overweight for those who slept more than 6.5 hours per night ( $P \leq 0.05$ ).

**CONCLUSIONS:** Total sleep time is related to BMI in college women; this relationship was strengthened when controlling for number of awakening per night. More than 6.5 hours of sleep per night seems to be a reasonable recommendation for sleep time in college women and is related with the lowest BMIs.

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2705 Board #380 MAY 31 3:30 PM - 5:00 PM

**Associations Between Objectively-Measured Physical Activity and Sleep**

Liana L. Suhadolnik<sup>1</sup>, Kelly R. Laurson<sup>1</sup>, Miguel A. Calabro<sup>2</sup>, Greg J. Welk, FACSM<sup>2</sup>. <sup>1</sup>Illinois State University, Normal, IL. <sup>2</sup>Iowa State University, Ames, IA.

(No relationships reported)

Adequate sleep is vital to achieve proper health and well-being; however, millions of U.S. adults are not getting enough sleep, nor are they getting quality sleep. Physical activity may be an important tool in combating sleep inadequacy, although prior research is unclear on any potential associations between these two behaviors.

**PURPOSE:** To compare various measures of physical activity with sleep duration and sleep quality.

**METHODS:** Subjects ( $n=58$ , mean age = 54 years) wore the SenseWear Armband for approximately 12 consecutive days. Duration and intensity of physical activity, steps per day, minutes of sleep, and sleep quality were recorded and averaged over the monitoring period. Pearson correlations were used to examine the association between measures of physical activity and sleep duration and quality. Sleep duration was categorized into tertiles ("high" >409.7 minutes, "moderate" 355.9 - 409.7 minutes, and "low" <355.9 minutes) and physical activity was compared between the three groups using an ANOVA.

**RESULTS:** There was a consistent trend for measures of physical activity (steps per day, and minutes of moderate and vigorous physical activity) to be negatively correlated with sleep duration and quality, however all correlations were non-significant. The results of the ANOVA indicated that the low sleep group took significantly more steps per day (12,952 steps/day) than the high sleep group (9,207 steps/day;  $p < 0.05$ ). Also, there were significant differences in sleep quality between the high and low sleep groups and the moderate and low sleep groups (both  $p < 0.05$ ). Those that slept for shorter durations generally had a lower sleep quality. Minutes of moderate and vigorous activity were not statistically different between tertiles of sleep duration.

**CONCLUSION:** The findings indicate that aggregate measures of sleep duration and quality are related to physical activity. Overall, subjects that slept a greater duration were less physically active and had a higher quality of sleep.

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2706 Board #381 MAY 31 3:30 PM - 5:00 PM

**Association Of Poor Food Choices With Sleep And Performance Among Qatar STARS League Football Players**

Abdulaziz Farooq, Rita Mansour, Christopher P. Herrera, Rodney Whiteley, Bruce Hamilton. *ASPETAR, Qatar Orthopaedic and Sports Medicine Hospital, Doha, Qatar.*

(No relationships reported)

Healthy eating and sleeping habits are associated with better athletic performance. Additionally, sleeping habits can be altered by dietary intake. These modifiable factors have not been documented in Arab footballers.

**PURPOSE:** To determine the dietary habits of professional football players and study their association with sleep and physical performance.

**METHODS:** A cross-sectional study of 111 athletes (age  $23.6 \pm 4.7$  y) were randomly recruited from eight different clubs from the STARS league. Each completed a culture-specific, structured questionnaire to quantify both frequency and preferences of food intake. All participants underwent body composition analysis by DXA, haematological investigations for lipid profile and vitamin D concentration. Sleep was assessed using the Arabic version of the Pittsburgh Sleep Quality Index (PSQI) and Insomnia Severity Index (ISI). Physical performance was evaluated based on isokinetic dynamometer (Biodex 3.0).

**RESULTS:** A large proportion of the athletes did not consume fruits (74.3%), vegetables (59.8%) or milk (67.6%) as a part of their regular diet. Players consumed fried chips (33.6%), chocolate bars (40.4%) and sweets (44.2%) at least twice daily and 79.6% do not hydrate adequately. Participants that consumed chocolate 2-3 times a day were younger ( $-4.6 \pm 1.6$  y,  $P=0.009$ ) and had high triglyceride ( $+0.3 \pm 0.1$  mmol/L,  $P=0.026$ ) compared to those who did not. Frequent chocolate snacks were also associated with poor sleep quality ( $P=0.029$ ) and insomnia severity ( $P=0.013$ ). After adjusting for age and lean mass of the limb, subjects who never consumed sweet snacks showed better eccentric hamstring performance on left ( $+24.5 \pm 9.3$  Nm,  $P=0.010$ ) and right ( $+16.7 \pm 8.8$  Nm,  $P=0.063$ ) legs.

**CONCLUSIONS:** This study documents dietary inadequacies in Arab footballers, and their association with poor sleep quality, and reductions in a measure of performance. Further research is needed using controlled trials to establish better relationship of diet on sleep and performance in this population.

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**D-63 Basic Science Poster Reception - Basic Science Poster Reception**

May 31, 2012 5:45 PM - 7:00 PM

ROOM:

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2707 **Chair:**  
Frank Booth, FACSM. Univ. of Missouri, Columbia, MO.

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2708 Board #1 May 31 5:45 PM - 7:00 PM

**Variability in Simulated Hemorrhagic Challenge Tolerance is not Explained By Differences in Body Temperature**

Matt S. Ganio<sup>1</sup>, Kimberly Ganio<sup>2</sup>, James Pearson<sup>2</sup>, Rebekah Lucas<sup>3</sup>, Robert Matthews Brother<sup>4</sup>, Craig G. Crandall, FACSM<sup>3</sup>. <sup>1</sup>University of Georgia, Athens, GA. <sup>2</sup>Texas Health Presbyterian Hospital, Dallas, TX. <sup>3</sup>Texas Health Presbyterian Hospital, Dallas, TX. <sup>4</sup>University of Texas Austin, Austin, TX.

(No relationships reported)

**PURPOSE:** To examine if body temperature variations in normothermic and heat stressed conditions explain the variability in tolerance to simulated hemorrhage within each thermal condition.

**METHODS:** Data were retrospectively examined in individuals who underwent a simulated hemorrhagic challenge to pre-syncope (onset of syncopal symptoms) via lower body negative pressure (LBNP). The correlation between mean body temperature (T<sub>body</sub>, calculated from core and skin temperatures) and LBNP tolerance time while normothermic (n=45) and passively heat stressed (n=90) was examined. Second, LBNP time while normothermic and heat stressed in the 15 lowest T<sub>body</sub> was compared to the 15 highest T<sub>body</sub> within each thermal condition. Third, for subjects tested in both thermal conditions (n=33), the correlation between the increase in T<sub>body</sub> and the decrease in LBNP time was examined, as was LBNP times of the 10 smallest T<sub>body</sub> increases relative to the 10 largest T<sub>body</sub> increases.

**RESULTS:** LBNP time while normothermic (1237 ± 240 sec) and heat stressed (635 ± 275 sec) was not correlated to T<sub>body</sub> within each condition (normothermic range = 36.21-37.24°C, r = -0.15, p=0.33; heat stress range = 37.69-39.46°C, r=-0.12, p=0.28). Normothermic LBNP times of those with the lowest (36.35 ± 0.07°C) and highest (36.87 ± 0.15°C) T<sub>body</sub> were not different (1241 ± 256 and 1233 ± 294 sec, respectively; p=0.94). Similarly, heat stressed LBNP times of those with the lowest (37.86 ± 0.09°C) and highest (38.82 ± 0.20°C) T<sub>body</sub> were not different (690 ± 266 and 559 ± 282 sec; p=0.20). For subjects tested in both thermal conditions, decreases in heat stressed LBNP time (606 ± 218 sec) were not correlated to the magnitude of T<sub>body</sub> elevation (1.64 ± 0.23°C; r=0.04; p=0.83); moreover LBNP time of those with the smallest T<sub>body</sub> increase (664 ± 231 sec, 1.38 ± 0.14°C) was not different than those with the largest T<sub>body</sub> increase (611 ± 212 sec, 1.91 ± 0.07°C; p=0.60).

**CONCLUSIONS:** Between subject variations in T<sub>body</sub> while normothermic and heat stressed do not explain the within-condition variability in tolerance to a simulated hemorrhagic challenge. Although heat stress compromises blood pressure control, differences (1.1-2.0°C) in the magnitude of body temperature increase during a heat stress do not explain the variability in tolerance.

Support NIH GM068865

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**2709** Board #2 May 31 5:45 PM - 7:00 PM  
**mTORC2 Is Activated In Muscle During Exercise And Regulates Contraction Induced Glucose Uptake**

Maximilian Kleinert, Lykke Sylow, Erik Richter. *University of Copenhagen, Copenhagen, Denmark.*

(No relationships reported)

**PURPOSE:** Two distinct mTOR complexes (mTORCs) have been defined. While mTORC1 serves as a regulator of protein synthesis, mTORC2 has been found to be downstream of PI3K and to phosphorylate Akt on Ser 473. However, little is known about the physiological importance of mTORC2 in skeletal muscle during muscle contractions. Here we test the hypothesis that mTORC2 is activated during exercise and might be involved in contraction-induced glucose uptake in skeletal muscle.

**METHODS:** mTORC2 activity was judged by phosphorylation of its downstream target N-myc downregulated gene 1 (NDRG1) on the Thr346 residue. Mice ran for 30 min on a treadmill at 70% of their individual maximal running capacity, or EDL and soleus muscles were incubated in vitro and stimulated with insulin or contracted in the presence or absence of pharmaceutical inhibitors. Radioactive tracers were used to estimate glucose uptake.

**RESULTS:** In vivo running increased NDRG1 Thr346 phosphorylation by 60% (p < 0.05) compared to resting controls in gastrocnemius muscle. To test whether the running induced increase in mTORC2 activity was dependent upon AMPK activity, NDRG1 Thr346 phosphorylation was measured in mice that overexpress a kinase-dead alpha 2 subunit of the AMPK protein in skeletal muscle (AMPK-KD). In these mice NDRG1 Thr346 phosphorylation increased significantly to the same extent as in WT mice. Treatment of mouse soleus muscles with the total mTOR inhibitor, AZD8055, blocked basal and insulin stimulated NDRG1 Thr346 phosphorylation (p < 0.001) and inhibited Akt phosphorylation and glucose uptake, while rapamycin (a mTORC1 specific blocker) treatment had no effect. In EDL muscle AZD8055 had no effect on insulin stimulated glucose uptake despite ablation of Akt and NDRG1 phosphorylation. During in vitro contractions AZD8055 reduced contraction induced glucose uptake by 23% (p < 0.05) in EDL. In soleus the inhibitor had no effect on contraction induced glucose uptake. While AZD8055 reduced NDRG1 Thr346 phosphorylation to almost undetectable levels, AMPK Thr172 phosphorylation was unaffected by the blocker and increased about 2-fold with contractions in both EDL and soleus (p < 0.05).

**CONCLUSIONS:** It is concluded that mTORC2 is activated in muscle during exercise and has muscle specific effects on insulin and contraction induced glucose uptake.

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**2710** Board #3 May 31 5:45 PM - 7:00 PM  
 **$\alpha$ -adrenergic Vasoconstriction Contributes To The Age-related Increase In Conduit Artery Retrograde And Oscillatory Shear**

Darren P. Casey<sup>1</sup>, Jaume Padilla<sup>2</sup>, Branton G. Walker<sup>1</sup>, Essa A. Mohamed<sup>1</sup>, Michael Joyner, FACSM<sup>1</sup>. <sup>1</sup>Mayo Clinic, Rochester, MN. <sup>2</sup>University of Missouri, Columbia, MO.

(No relationships reported)

Aging is associated with greater presence of retrograde and oscillatory shear in peripheral conduit arteries of humans. We previously demonstrated that reduced nitric oxide bioavailability in the resistance vessels contributes, in part, to the age-related alterations in shear rate patterns.

**PURPOSE:** To further elucidate the potential mechanisms for age-related discrepancies in shear patterns, we examined the contribution of  $\alpha$ -adrenergic vasoconstriction in resistance vessels on shear rate patterns in upstream conduit arteries of younger (n=8; 5M/3F, age 27 ± 2 years) and older (n=11; 6M/5F, age 68 ± 2 years) healthy adults.

**METHODS:** Brachial artery diameter and velocities were measured via Doppler ultrasound during 1) rest (control), 2) sympathetic activation via lower body negative pressure (LBNP; -20 mmHg), and 3) intra-arterial administration of phentolamine (non-specific  $\alpha$ -adrenergic antagonist).

**RESULTS:** At rest older adults exhibited greater brachial artery retrograde and oscillatory shear (-9.9 ± 2.7 s<sup>-1</sup> and 0.11 ± 0.03 arbitrary units, respectively) compared with younger adults (-3.1 ± 1.0 s<sup>-1</sup> and 0.05 ± 0.02 arbitrary units, respectively; P < 0.05 for both). LBNP increased brachial artery retrograde and oscillatory shear in young (-6.7 ± 2.1 s<sup>-1</sup> and 0.10 ± 0.02 arbitrary units, respectively, respectively; P < 0.05 vs. control) but not older adults (-9.1 ± 2.4 s<sup>-1</sup> and 0.12 ± 0.02 arbitrary units, respectively; P = 0.85-0.97 vs. control). With phentolamine retrograde and oscillatory shear were abolished in young adults (-0.2 ± 0.2 s<sup>-1</sup> and 0.00 ± 0.00 arbitrary units, respectively; P < 0.05 vs. control) and markedly reduced, however still persistent, in older adults (-3.8 ± 0.9 s<sup>-1</sup> and 0.02 ± 0.01 arbitrary units, respectively; P < 0.001 vs. control).

**CONCLUSIONS:** Our data indicate that  $\alpha$ -adrenergic vasoconstriction substantially contributes to age-related discrepancies in conduit artery shear rate patterns at rest.

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**2711** Board #4 May 31 5:45 PM - 7:00 PM  
**High Fat Diet Enhances Tumorigenesis And Pro-tumoral Factors in the C3(1)SV40Tag Breast Cancer Mouse Model**

Jennifer Steiner<sup>1</sup>, J. Mark Davis, FACSM<sup>1</sup>, Jamie McClellan<sup>1</sup>, Jeffrey Green<sup>2</sup>, E. Angela Murphy<sup>1</sup>. <sup>1</sup>University of South Carolina, Columbia, SD. <sup>2</sup>National Cancer Institute, Bethesda, MD.

(No relationships reported)

High fat diet (HFD) induced obesity increases the risk for breast cancer (BrCa); obese women have a greater risk of developing breast cancer and of dying from the disease than healthy women. However, few well supported mechanistic explanations in regards to the relationship between HFD induced obesity and BrCa exist.

**PURPOSE:** The purpose of this study was to determine the effects of HFD feedings on tumorigenesis in the C3(1)SV40Tag mouse model of BrCa and further to relate this to pro-tumoral factors expressed in the tumor microenvironment.

**METHODS:** Female C3(1)SV40Tag mice were assigned to a dietary treatment group (n=14-15), beginning at 4 wks of age: control (CON) diet (AIN76A), or high fat diet (HFD). The CON diet contained 11.5% kcal fat while the HFD diet had 41% kcal fat. All diets were identical in vitamin and mineral content. Body weight (BW) was measured weekly, and mice were examined bi-weekly for palpable tumors, from which tumor number and volume was recorded. At 18wks of age mice were sacrificed and all visible tumors were counted, measured, and excised. Tumor tissue was analyzed for pro-tumoral factors including mRNA gene expression of CD206 (a marker for pro-tumor M2 macrophage phenotype), VEGF (a mediator of angiogenesis) and TNF- $\alpha$  & IL-6 (pro-inflammatory cytokines) using RT-PCR. Tumor number and volume as well as BW were analyzed using a one-way repeated measures ANOVA and pro-tumoral factors were analyzed using Student's T-Tests. Significance was set at P<0.05.

**RESULTS:** HFD feedings significantly increased BW (wks 8-18), and body fat percentage (~70%) (P<0.05). Tumorigenesis was greatly enhanced by HFD; tumor volume in HFD was ~50% greater than CON at 18wks (P<0.05). HFD consumption increased tumor expression of CD206 (1.4 fold), VEGF (1.5 fold), IL-6 (~3 fold), and TNF- $\alpha$  (1.2 fold) compared to CON.

**CONCLUSIONS:** These data confirm the negative influence of HFD consumption on breast cancer in a transgenic mouse model and further provide evidence of a relationship between HFD and pro-tumoral factors related to tumor associated macrophages, angiogenesis and inflammation within the tumor microenvironment.

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2712 Board #5 May 31 5:45 PM - 7:00 PM

**Vascular Dysfunction with Age: Evidence from Upright and Supine Passive Limb Movement**

Jon Groot<sup>1</sup>, Joel D. Trinity<sup>2</sup>, Gwenael Layec<sup>2</sup>, Matthew J. Rossman<sup>1</sup>, Stephen J. Ives<sup>2</sup>, Russell S. Richardson<sup>2</sup>. <sup>1</sup>University of Utah, Salt Lake City, UT. <sup>2</sup>Salt Lake City VAMC, Salt Lake City, UT.  
(No relationships reported)

Aging attenuates the hyperemic response to supine passive limb movement. In the young, increased perfusion pressure evoked by an upright-seated posture augmented the hyperemic response, however, whether this increase is consistent with age is unknown.

**PURPOSE:** Utilizing a model devoid of exercise-induced increases in metabolism, this study sought to elucidate the impact of age on central and peripheral contributors to movement-induced hyperemia to better understand the mechanisms contributing to reduced blood flow with age.

**METHODS:** Passive leg movement was performed in 20 young (21±2 yrs) and 20 old (72±6 yrs) healthy participants for 3 min in both the supine and upright-seated position. Second-by-second measurements of central and peripheral hemodynamic responses were noninvasively performed (Finometer and Doppler Ultrasound), while femoral perfusion pressure (FPP) was directly measured via catheter in a subset of 10 participants.

**RESULTS:** The young exhibited a 25% increase in movement-induced peak leg blood flow in the upright-seated position (supine: 942±67; upright: 1189±89 mL/min), while in the old, leg blood flow failed to increase (supine: 737±65; upright: 649±50 mL/min), despite a similar increase in FPP (5±1 mmHg). Changes to central hemodynamic responses in the supine and upright-seated position were unremarkable between groups.

**CONCLUSIONS:** In light of similar central hemodynamic changes with posture, this study reveals attenuated movement-induced hyperemia in the elderly. This observation appears to be independent of both metabolism and perfusion pressure, implying that local vascular phenomena, such as endothelial function and vascular stiffness, likely play a major role in vascular dysfunction with age.

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2713 Board #6 May 31 5:45 PM - 7:00 PM

**Peripheral MCP-1 Induces Fatigue and Modulates Central Fatigue-Associated Neural Factors in the Brainstem and Cerebellum**

Seung H. Jung, E Angela Murphy, Raja Fayad, Maria Pena, Benjamin T. Gordon, Martin Carmichael, J Mark Davis, FACSM. University of South Carolina, Columbia, SC.  
(No relationships reported)

An increased concentration of peripheral monocyte chemoattractant protein-1 (pMCP-1) has been reported in people with diseases, such as cancers and Alzheimer's disease, with which central fatigue often occurs and has a negative impact on these people, but no study has been done to evaluate a role of pMCP-1 in fatigue.

**PURPOSE:** To investigate pMCP-1 effects on occurrence of fatigue and central fatigue-associated neural factors in the brain.

**METHODS:** Voluntary wheel running activities of male C57/BL6 mice during 19:00 - 07:00 were collected to investigate the effects of daily, intraperitoneal injections (ip) of MCP-1 for 3 continuous days on the occurrence of fatigue. Another set of male C57/BL6 mice were used to investigate the effects of the pMCP-1 on the central fatigue-associated neural factors in the brainstem and cerebellum.

**RESULTS:** Compared with the mean baseline, the MCP-1 treatments induced a significant reduction in relative running distance (% change from the mean baseline) on days after 2nd injection (2nd mid), 3rd injection (1st post day) and 4th post day; a significant reduction in relative total running time (%) on 2nd mid and 1st, 4th, 6th and 7th post days; and a significant reduction in relative average running speed on the 4th post day. When compared with the placebo group, mRNA expression of cytokine IL-1β was 28% and 24% increases in the brainstem and cerebellum (p < 0.05) in MCP-1 group 12 hours after the 3rd injection. Our data showed 25% and 24% increases in mRNA expression of 5-HT1B receptors in the brainstem and a 19% increase in mRNA expression of 5-HT1A receptor in the cerebellum. No effect was found on the dopamine D2 receptor.

**CONCLUSIONS:** These data suggest for the first time that pMCP-1 induces fatigue that is associated with changes in CNS fatigue-associated neural factors, including IL-1β, 5-HT1A, and 5-HT1B receptor subtypes in the brainstem and/or cerebellum. The results are important to elucidate the central mechanisms of fatigue, which occurs with a certain diseases or disorders, such as cancer and infection where elevated levels of pMCP-1 are common.

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2714 Board #7 May 31 5:45 PM - 7:00 PM

**Short-Term Unloading and Exercise Effects on Mechanical Stress-Sensitive Structural and Sensor Proteins in Human Soleus**

Clay E. Pandorf, Fadia Haddad, Joshua Cotter, Kenneth Baldwin, FACSM, Vincent J. Caiozzo, FACSM, Gegory R. Adams. University of California, Irvine, Irvine, CA.  
(No relationships reported)

Loading forces are critical to maintaining homeostasis in the muscle cell. Perturbations, such as unloading/disuse, upset the normal gene expression of structural and signaling proteins. Exercise countermeasures can offset these alterations.

**PURPOSE:** To examine gene expression of several large sarcomeric proteins that provide structural support to the myofibril (titin, nebulin and α-actin) and converge at the Z-disc. Since evidence suggests that loading forces in the muscle may be transmitted by structural support proteins that integrate mechanical stress at the Z-disc, we also examined several signaling proteins that reside in this region (STARS, atrogin-1, and calcineurin via its modulator MCIP1) and can in-turn regulate the expression of sarcomeric genes.

**METHODS:** Two groups of healthy inactive human subjects participated in unilateral lower limb suspension (ULLS; male N=5; female N=4) for 10 days alone or with a combination of aerobic and resistance exercise training (ULLS+T; male N=5; female N=5). Soleus biopsies were obtained before and after ULLS; ULLS+T biopsies were obtained ~24 hrs after the last training session. RT-PCR was used to quantify pre-mRNA and mRNA levels of select genes (arbitrary units/mg).

**RESULTS:** Nebulin, titin and α-actin RNA levels changed pre to post by -11%, +26% and +7% with ULLS, and by +25%\*, +56%\* and +16% with ULLS+T, respectively (\*p<0.05 pre to post). STARS, atrogin1 and MCIP1 mRNA levels changed pre to post by -75%\*, +77%\* and -40%\* with ULLS, and by -63%\*, +30%\* and -26%\* with ULLS+T, respectively (\*p<0.05 pre to post).

**CONCLUSIONS:** While changes in transcription of the Z-disc associated structural proteins nebulin and titin following 10d unloading was not statistically significant, there was significant upregulation with unloading + training stimuli. The unfavorable unloading-induced signaling response was ameliorated when combined with training as suggested by differential mRNA levels of mechano-sensitive Z-disc factors that can promote atrophy (atrogin) and fiber-type shifts (calcineurin/MCIP1). These data suggest that exercise countermeasures to short-term unloading of the loading-sensitive slow soleus muscle can promote favorable transcriptional responses of proteins associated with the stress-sensitive Z-disc. (Supported by NSBRI-NASA NCC 9-58)

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2715 Board #8 May 31 5:45 PM - 7:00 PM

**Role of Dietary Leucine on Amino Acid Transporter mRNA Expression Following Resistance Exercise**

Tyler A. Churchward-Venne<sup>1</sup>, Andrew Philp<sup>2</sup>, George R. Marcotte<sup>1</sup>, Cameron J. Mitchell<sup>1</sup>, Daniel W.d West<sup>1</sup>, Leigh Breen<sup>1</sup>, Steven K. Baker<sup>1</sup>, Keith Baar, FACSM<sup>2</sup>, Stuart M. Phillips, FACSM<sup>1</sup>. <sup>1</sup>McMaster University, Hamilton, ON, Canada. <sup>2</sup>University of California, Davis, CA.  
(No relationships reported)

Skeletal muscle amino acid transporters (AAT) may play a key role in the regulation of muscle protein metabolism via their ability to transport amino acids (AA) across the sarcolemma and relay signals to downstream protein targets. The mRNA expression of some AAT is increased after essential amino acid (EAA) intake and resistance exercise (RE); however, the combined effect of AA and RE on AAT mRNA expression and whether greater leucine intake alters the response is unknown.

**PURPOSE:** To examine the effect of AA/whey protein intake (with high and low leucine content) after RE on the mRNA expression of select AAT in human skeletal muscle.

**METHODS:** 24 adult men (22±1 y) completed unilateral knee-extensor RE before consuming one of the following: WHEY (25 g whey protein); LEU (6.25 g whey protein supplemented with leucine to be iso-leucine with WHEY); and EAA-LEU (6.25 g whey protein supplemented with EAA except leucine to be iso-EAA with WHEY for each EAA except for leucine). Muscle

biopsies were obtained before RE and 1, 3, and 5h after from both rested-fed (FED) and exercise-fed legs (EX-FED). qRT-PCR was used to determine changes in mRNA expression of LAT-1, CD-98, and PAT-1 AAT and members of the general AA control pathway GCN-2 and ATF-4.

**RESULTS:** mRNA expression of CD-98 and LAT-1 (fold-change from basal) increased in FED and EX-FED, however the response at 5h was greater in EX-FED (CD-98 FED = 2.17 vs. EX-FED = 3.52 (P=0.003); LAT-1 FED = 3.58 vs. EX-FED = 5.18 (P=0.025)). PAT-1 increased in FED and EX-FED, however EX-FED was greater in WHEY vs. EAA-LEU (WHEY = 3.26 vs. EAA-LEU = 1.89 (P=0.031)). ATF-4 showed time dependent changes in all treatments while the FED response of GCN-2 was greater in LEU vs. WHEY and EAA-LEU at 5h (LEU = 2.07 vs. WHEY = 1.44 vs. EAA-LEU = 1.02 (P=0.004)).

**CONCLUSIONS:** RE prior to whey protein/AA intake increases the mRNA expression of select AAT above feeding alone at 5h post RE. WHEY induced greater changes in PAT-1 vs. EAA-LEU suggesting unique benefits of whey protein that extend beyond total leucine content. EAA-LEU resulted in robust increases in select AAT comparable to LEU despite containing ~75% less leucine, suggesting that a high leucine content is not critical in increasing AAT expression after AA intake. The functional physiological significance of these changes remains to be elucidated. Supported by NSERC.

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**2716 Board #9 May 31 5:45 PM - 7:00 PM**  
**Electron Conductance in Rat and Sparrow Skeletal Muscle Mitochondrial Electron Transport Chain**

Sarah Kuzmiak, Wayne T. Willis. *Arizona State University, Tempe, AZ*  
(No relationships reported)

Flying birds utilize fat for fuel during flight, a moderate-high intensity exercise, while mammalian reliance on carbohydrate increases with increasing exercise intensity. Previous investigations in our lab have shown this pattern of fuel selection persists even when saturating fuels are provided to the inner membrane transporters of intact respiring mitochondria, suggesting a fuel selection mechanism at the level of the matrix.

**PURPOSE:** To compare the maximal rates of complete substrate oxidation to the oxidation of electrons as well as electron conductance in rat and sparrow mitochondria to elucidate differences between the species in the ability to produce electrons (via dehydrogenase enzymes,  $\beta$ -oxidation, and the citric acid cycle) and the capacity for these electrons to be consumed (via travel down the electron transport chain (ETC)).

**METHODS:** Intact mitochondria were isolated, provided saturating fuels (pyruvate, glutamate, and malate), and the maximal rate of oxygen consumption ( $J_o$ ) was determined. Mitochondria were then sonicated and maximum NADH oxidation was measured following the rate of oxygen reduction to water. The slope of the oxidation:reduction (redox) potential difference ( $\Delta E_h$ ): $J_o$  relationship, a measure of the conductance of electron flow down the ETC, was also determined.

**RESULTS:** Intact maximal  $J_o$  were  $636 \pm 87$  and  $641 \pm 83$  nmol-mg<sup>-1</sup>-min<sup>-1</sup> in rat and sparrow, respectively, while the ETC  $V_{max}$  were  $731 \pm 76$  and  $1020 \pm 108$  nmol-mg<sup>-1</sup>-min<sup>-1</sup>. Combined, these data indicate greater relative ETC activity in the sparrow; the (intact oxidase pathway)/(ETC only) ratio was  $.86 \pm .04$  in the rat and  $.65 \pm .07$  in the sparrow. Additionally, the slope of the  $\Delta E_h$ :  $J_o$  relationship was 1.7x greater in sparrow than the rat mitochondria,  $12306 \pm 1538$  and  $7196 \pm 924$ , respectively.

**CONCLUSIONS:** These data indicate avian mitochondria have greater ETC "excess capacity" as well as greater conductance down the ETC compared to mammalian mitochondria. As a high reduction level of the mitochondrial matrix has been associated with an inhibition of  $\beta$ -oxidation, we posit rat fatty acid oxidation is inhibited by high reduction in the mitochondrial matrix while birds, via a high ETC conductance, are able to maintain lower matrix reduction, allowing fatty acid oxidation to proceed.

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**2717 Board #10 May 31 5:45 PM - 7:00 PM**  
**Fat Tissue Inflammation, Sedentary Time, and Light Daily Activity among Postpartum Latinas**

Paska Permana<sup>1</sup>, Barbara Ainsworth, FACSM<sup>2</sup>, Michael Belyea<sup>2</sup>, Kathie Records<sup>2</sup>, Sonia Vega-López<sup>2</sup>, Allison Nagle-Williams<sup>2</sup>, Dean V. Coonrod<sup>3</sup>, Colleen Keller<sup>2</sup>.  
<sup>1</sup>Phoenix Veterans Affairs Health Care System, Phoenix, AZ. <sup>2</sup>Arizona State University, Phoenix, AZ. <sup>3</sup>Maricopa Integrated Health System, Phoenix, AZ.  
(No relationships reported)

Postpartum Latinas have high rates of obesity and are at risk for obesity-related metabolic disorders, yet their physical activity (PA) rates are often quite low. Chronic sub-clinical inflammation associated with obesity may exacerbate risk for metabolic disorders and pro-inflammatory cytokines released by fat tissue contribute to systemic inflammation.

**PURPOSE:** To determine if fat tissue inflammation correlates with daily PA in postpartum Latinas.

**METHODS:** Madres para la Salud is a prospective, randomized trial exploring the effectiveness of a culturally specific social support intervention using moderate-intensity PA to reduce body fat, systemic and fat tissue inflammation, and depression symptoms in postpartum Latinas. PA was assessed at baseline with the ActiGraph GT3X accelerometer, worn for 7 days. PA intensities were determined from sedentary to vigorous using Freedson's and Matthews' cut-points. A subcutaneous abdominal fat biopsy and a blood draw were performed on a subset (n=15) of participants. We determined mRNA expression levels of inflammatory markers Interleukin-6 (IL-6), Interleukin-8 (IL-8), and Tumor Necrosis Factor  $\alpha$  (TNF- $\alpha$ ) in fat tissue using Real Time PCR. Plasma concentrations of IL-6 and IL-8 were measured using Enzyme Linked Immunosorbent Assay. Data are presented as Mean $\pm$ SD.

**RESULTS:** Daily proportion of light PA (39 $\pm$ 9%) correlated negatively ( $r=-0.98$ ,  $p<0.001$ ) with sedentary time (58 $\pm$ 10%). Fat tissue mRNA expression levels, but not plasma concentrations, of IL-6 (3.8 $\pm$ 6.8 Relative Units), IL-8 (1.7 $\pm$ 1.6), and TNF- $\alpha$  (0.9 $\pm$ 0.2) correlated with sedentary time ( $r=0.47$ ,  $p=0.08$ ;  $r=0.7$ ,  $p=0.004$ ;  $r=0.55$ ,  $p=0.04$ , respectively) and inversely with light PA ( $r=-0.51$ ,  $p=0.05$ ;  $r=-0.75$ ,  $p<0.001$ ;  $r=-0.59$ ,  $p=0.02$ , respectively).

**CONCLUSIONS:** The correlation between the mRNA expression levels of inflammatory markers in fat tissue with sedentary time and, inversely, with light PA is strengthened by the inverse correlation between the two types of activity. These results indicate that even light PA incorporated in daily routine, independent of more intense PA, may already reduce inflammation in fat tissue in postpartum Latinas. Moderate-intensity intervention will likely further reduce fat tissue and systemic inflammation, thus minimize risk for obesity-related diseases.

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**D-64 Clinical Poster/Reception - Clinical Poster Reception**

May 31, 2012 5:45 PM - 7:00 PM  
ROOM:

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**2718 Chair:**  
Elizabeth A. Joy, FACSM. University of Utah, Salt Lake City, UT.

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**2719 Board #1 May 31 5:45 PM - 7:00 PM**  
**Associations Between Abnormal Ultrasound Color Doppler Measures and Pain Symptoms In Badminton Players During a Season: A Prospective Cohort Study**

Anders P. Boesen<sup>1</sup>, Morten Ilum Boesen<sup>2</sup>, Soren Torp-Pedersen<sup>2</sup>, Robin Christensen<sup>2</sup>, Karen Ellegaard<sup>2</sup>, Henning Bliddal<sup>2</sup>, Lars Boesen<sup>2</sup>, Hölmich Per<sup>3</sup>, Michael Bachmann Nielsen<sup>4</sup>, Andreas Hartkopp<sup>5</sup>, Henning Langberg<sup>1</sup>. <sup>1</sup>Institute of Sportsmedicine, Bispebjerg Hospital, Copenhagen, Denmark. <sup>2</sup>Parker Institute, Frederiksberg Hospital, Copenhagen, Denmark. <sup>3</sup>Amager Hospital, Copenhagen, Denmark. <sup>4</sup>Department of Radiology, Rigshospital, Copenhagen, Denmark. <sup>5</sup>A2, Hillerød Hospital, Copenhagen, Denmark.  
(No relationships reported)

Color Doppler ultrasound is widely used to examine intra-tendinous flow in individuals with overused tendon problems but the association between color Doppler and pain is still unclear.

**PURPOSE:** To find out if intra-tendinous flow is present and associated with complaints in badminton players and if intra-tendinous flow and pain increase during a badminton season.



**METHODS:** Ninety-five semi-professional badminton players were included in the study at a tournament at the start of the badminton season. All players were interviewed regarding pain. Each tendon was scored using a quantitative grading system (grade 0 to 5) and a qualitative scoring system (color fraction) using color Doppler ultrasound. Eight months later, 86 of the players (91%) were re-tested by the same investigators during an equivalent badminton tournament (incl. 1032 tendon regions - 86 players with 4 tendons each with 3 regions), forming the study group.

**RESULTS:** At start of the season 24 players (28%) experienced pain in 37 tendons (11%) and at the end of the season 31 players (36%) experienced pain in 51 tendons (15%), which was a statistically significant increase ( $P = 0.0002$ ). Abnormal flow was found in 230 tendon regions in 71 players (83%) at start season compared to 78 tendon regions in 41 players (48%) at the follow-up. The decrease in abnormal flow was statistically significant ( $P < 0.0001$ ). Of the 37 painful tendons at the start of the season 25 had abnormal flow (68%). In contrast 131 tendons (85%) with abnormal flow start season were pain-free. At the end of the season 18 of the 51 painful tendons (35%) had abnormal flow. Ninety-six of the 131 pain-free tendons (73%) with abnormal flow at start season were normalized (no pain and normal flow) at end season.

**CONCLUSIONS:** It was not possible to verify any association between intra-tendinous flow and pain at start season or at the follow-up (end season). Intra-tendinous flow at the start of the season could not predict symptomatic outcome at the end of the season. The decrease in Doppler flow during season might suggest that intra-tendinous flow could be part of a physiological adaptive response to loading and that intra-tendinous flow as previously believed is not always a sign of pathology.

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**2720** Board #2 May 31 5:45 PM - 7:00 PM  
**Investigating the Participation in Level I/II Activities by Potential Copers and Non-Copers 12 Months after Anterior Cruciate Ligament Reconstruction**

Victoria Allen, Andrew Lynch, Stephanie DiStasi, Lynn Snyder-Mackler. *University of Delaware, Newark, DE.*  
(No relationships reported)

Ability to return to sport (RTS) activity is a common success measure for athletes who sustain an anterior cruciate ligament (ACL) injury. The University of Delaware uses a functional test battery to determine a minimum state of readiness for RTS. Patients complete questionnaires about their perceived knee function, current activity, and what limits their ability to return to their previous level of athletic activity. Recent work showed 78% of non-copers passed Delaware's RTS criteria 12 months after surgery, but the rate of athletes who return to their previous activity level is still unknown.

**PURPOSE:** Athletes were examined 12 months after ACL reconstruction (ACLR). The purpose was to (1) evaluate the rate of athletes returning to activity; (2) evaluate activity level based on the Marx Activity Rating Scale (MARS); (3) investigate reasons for not returning to the same level of activity, despite meeting clinical RTS criteria.

**METHODS:** Data were collected from a total of 88 non-copers ( $n=52$ ) and potential copers ( $n=36$ ); subjects were high-level athletes involved in Level I/II activities. The MARS specifically evaluates the frequency that athletes are running, cutting, jumping and pivoting. Two supplemental questions were used, asking athletes to list reasons why they have not returned to all pre-injury sports and why they have not returned to the same level of competition within the sport.

**RESULTS:** The total pass rate for RTS criteria of 87.5%. However, overall return to activity rate was 65.9%, with 77.3% of potential copers and 45.3% of non-copers returning to pre-injury levels. MARS scores frequently indicated higher activity level than the patient-reported, creating an inconsistency. "Fear of re-injury", "too little time to participate" and "not yet cleared from doctor", were listed as predominant reasons for not returning to the same level of activity, despite clinical clearance for RTS.

**CONCLUSIONS:** Although athletes pass RTS criteria, they may not return to same level of activity. Non-copers demonstrate the need for additional evaluation and education to increase their likelihood of participating in higher-level activities. The outcomes reveal the need to intervene with athletes' activity level after injury to increase the percentage of individuals who engage in at least fifty hours of level I/II sports/year.

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**2721** Board #3 May 31 5:45 PM - 7:00 PM  
**Dogs and Docs - Getting Patients More Active**

Jacqueline N. Epping. *CDC, Atlanta, GA. (Sponsor: Robert E. Sallis, FACSM)*  
(No relationships reported)

**PURPOSE:** To examine and describe the role that dogs and dog walking may play in initiating, increasing and maintaining physical activity and improving health in patients.

**METHODS:** The relationship of dog ownership to a variety of health outcomes was examined. Dog walking as a mechanism to increase physical activity, in particular was examined. A rationale was provided for the potential effectiveness of dog walking as a population-based intervention strategy that could be utilized by health care providers.

**RESULTS:** A growing body of literature was reviewed which demonstrates the relationship of dogs, dog ownership, and dog walking to a wide variety of health outcomes, including increased physical activity and the likelihood of meeting physical activity guidelines and recommendations. For example, a recent review of the literature found that, among dog owners, those owners who walked their dogs were 2.7 times as likely to meet U.S. guidelines for physical activity as owners who do not walk their dogs.

**CONCLUSIONS:** Recommending dog walking to patients can be a strategy that health care professionals can use to encourage and motivate patients to initiate, increase, and sustain health-enhancing levels of physical activity.

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**2722** Board #4 May 31 5:45 PM - 7:00 PM  
**Primary Prevention of the Female Athlete Triad in College Athletics**

Jill W. Lassiter<sup>1</sup>, Don Sabo<sup>2</sup>, Celia A. Watt<sup>3</sup>. <sup>1</sup>Bridgewater College, Bridgewater, VA. <sup>2</sup>D'Youville College, Buffalo, NY. <sup>3</sup>The College at Brockport, Brockport, NY.  
(No relationships reported)

Primary prevention of the female athlete triad is recommended by numerous athletic organizations as a primary means to address health risks among female athletes. Collegiate athletic departments can play a role in prevention.

**PURPOSE:** To describe current triad-related preventative practices of college sports medicine departments, and identify characteristics associated with prevention.

**METHODS:** Surveyed all NCAA member institutions with on-line questionnaire that measured the extent of screening and educational practices for each component of the triad. The sampling procedure generated a 37% response rate ( $N = 327$ ), representing all NCAA athletic divisions (32.5% DI, 8.0% DIAA, 5.5% DIIAA, 26.0% DII, 41.5% DIII). ANOVA and independent-t tests were used to compare differences across institutional characteristics.

**RESULTS:** At least half of the institutions did not screen for the components of the triad (disordered eating 52.9%, menstrual dysfunction 49.5%, osteoporosis 61.2%). Screening most often occurred reactively, when athletes presented with signs and symptoms. Almost half of the institutions (48.6%) provided no education to athletes regarding the triad, and 55.4% provided no education to coaches. Division IA institutions were significantly more likely to implement preventative screenings ( $F=5.601$ ,  $p<0.001$ ) and to educate athletes and coaches ( $F=6.921$ ,  $p<0.001$ ,  $F=2.916$ ,  $p<0.05$ , respectively) than lower division institutions. Other institutional correlates of preventative practices included participation in the NCAA CHAMPS program, regular presence of a team physician, and larger athletic training staffs ( $\geq 3$  ATC's).

**CONCLUSIONS:** Primary preventative practices related to the female athlete triad are not common within college athletics. Comprehensive prevention is minimal, however, Division IA institutions with larger healthcare staffs are significantly more likely to engage in preventative practices. Further steps are needed to encourage implementation of triad related preventative practices within collegiate athletic departments.

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2723 Board #5 May 31 5:45 PM - 7:00 PM

**Diclofenac Sodium 1% Gel for Relief of Osteoarthritis Pain in the Finger Joints**

Roy D. Altman<sup>1</sup>, John H. Peniston<sup>2</sup>, Morris S. Gold<sup>3</sup>, Matthew S. Wieman<sup>4</sup>. <sup>1</sup>David Geffen School of Medicine, Los Angeles, CA. <sup>2</sup>Feasterville Family Health Care Center, Feasterville, PA. <sup>3</sup>Novartis Consumer Health, Inc., Parsippany, NJ. <sup>4</sup>Endo Pharmaceuticals Inc, Chadds Ford, PA.

(R.D. Altman: Consulting Fee; Endo, Novartis, Abbott, Ferring, AstraZeneca, and Rottapharm. Contracted Research - Including Principle Investigator; Novartis and Ferring.)

**PURPOSE:** To compare the relative efficacy of diclofenac sodium 1% gel (DSG) to treat osteoarthritis (OA) pain in the first carpometacarpal (CMC1) and intraphalangeal (IP) joints of the hand. OA of the IP and CMC1 joints may occur in participants of sports that require exceptional grip strength (eg, climbing) or have a high risk for thumb and finger injuries (eg, basketball, boxing). Patients with OA limited to a few finger joints may prefer topical treatments to minimize systemic nonsteroidal anti-inflammatory drug (NSAID) exposure.

**METHODS:** Patients (aged  $\geq 40$  y) with hand OA applied DSG or vehicle gel, 2 g per hand, 4 times daily for 8 weeks. Assessments at 6 weeks included pain intensity (100-mm Visual Analog Scale [VAS]) and Australian/Canadian Osteoarthritis Hand Index (AUSCAN) subscales for pain, stiffness, and function. Efficacy was compared in patients with OA in CMC1 only (n=34), CMC1 plus  $\geq 1$  IP joint (CMC1+; n=241), and IP joints only (no CMC1; n=110). Institutional review board approval and patient informed consent were obtained.

**RESULTS:** In adults with OA of the hand, DSG was superior to vehicle for relieving pain to a similar degree in all finger joints (IP and CMC1). VAS pain intensity improved by 40%-49% with DSG compared with 34%-37% for vehicle. AUSCAN pain improved by 30%-43% with DSG compared with 28%-30% for vehicle. A general trend for mild to moderate improvement in stiffness and function was observed.

**CONCLUSIONS:** DSG was superior to vehicle for reducing OA pain in hand joints, with a trend toward improvement in stiffness and function. Limiting OA treatment to the affected finger joints with topical DSG may be preferable for patients wishing to minimize systemic NSAID exposure.

This study was funded by Endo Pharmaceuticals Inc., Chadds Ford, PA.

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2724 Board #6 May 31 5:45 PM - 7:00 PM

**Barriers to Intake Assessment in Women Referred for Cardiac Rehabilitation**

Mireille Landry, Jennifer A.D. Price, Paula J. Harvey. *Women's College Hospital, Toronto, ON, Canada.*

(No relationships reported)

The benefits of exercise-based cardiac rehabilitation (CR) are well-documented in the literature. CR is underutilized, particularly in women. Once referred to CR, women are less likely to attend the first appointment or intake assessment (IA) compared to male counterparts. Previous studies have investigated barriers to attendance or completion of CR once enrolled, but little attention has been paid to barriers that affect attendance to IA.

**PURPOSE:** To describe women referred to CR but who fail to attend an IA, and their barriers to IA.

**METHODS:** Women referred to CR from 2008-2010 but did not attend an IA completed a telephone survey. Telephone interviews included a demographics questionnaire, open-ended questions regarding perceived barriers to attending IA, the Cardiac Exercise Self-Efficacy Instrument (CESEI) and Cardiac Rehabilitation Barriers Scale (CRBS). Descriptive statistics were generated on the collected variables, and compared to women who attended IA. The content of the participant responses to the open-ended questions was analyzed through categorization, coding of data, and frequency counts.

**RESULTS:** Of the 671 referrals received from 2008-2010, 169 (25%) did not attend an IA, and were eligible to participate in this study. A total of 53 (mean age= 56.6 yrs, +/-12.2 yrs) consented to participate. Depression (n=22, 42%) and arthritis (n=29, 55%) were most frequently cited comorbidities among participants. The presence of arthritis was significantly different in attendees to IA vs. nonattendees (p<0.001). Mean scores on the CRBS and CESEI were 2.37 +/- .55 and 3.35 +/- .88 respectively. Distance to CR was significantly greater for the nonattendees (p< 0.001). Distance and transportation issues were also cited by 26% (n=14) of respondents as a specific challenge to attending CR. 15 participants (28%) went on to attend CR closer to home.

**CONCLUSIONS:** Improved participation in CR by women can be effected through careful evaluation of factors that influence access to care. Addressing transportation issues at onset of referral may improve attendance to IA in women referred to CR.

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2725 Board #7 May 31 5:45 PM - 7:00 PM

**Female Former Elite Athletes Suffering From Eating Disorders During Their Career. A 15-20 Year Follow-up**

Jorunn Sundgot-Borgen<sup>1</sup>, Kjersti K. Danielsen<sup>1</sup>, Monica K. Torstveit<sup>2</sup>. <sup>1</sup>The Norwegian School of Sport Sciences, Oslo, Norway. <sup>2</sup>University of Agder, Kristiansand, Norway.

(No relationships reported)

Longitudinal follow up studies on female former elite athletes and knowledge regarding the recovery rate of eating disorders (EDs) is lacking.

**PURPOSE:** To examine whether female former elite athletes diagnosed with an eating disorder (ED) during their athletic career recover from EDs and whether long term health variables differ from former elite athletes with no history of EDs.

**METHODS:** In 1989, 18% of the total population of female elite athletes in Norway (n=522) met the criteria for a clinical ED. During the period from 2005-2010 we managed to get hold of 417 (80%) of these 522 athletes. In addition, a bureau of statistics picked a randomly selected sample of controls from the total population of female citizens in Norway aged 30-50 years and a total of 640 females volunteered to participate. In phase I, all subjects replied to a postal questionnaire including questions related to training and competitive history, health history including questions about dieting and EDs and validated questions on ED behaviour (Eating Disorders Inventory, EDI), and mental health (WHO-QOL). In phase II, all athletes and non-athlete controls with a total EDI > 40 and/or a self-reported history or present ED, as well as 20 athletes and 20 non-athletes with EDI <40 and no self-reported history of EDs (a total of 130 athletes and 110 controls) participated in a telephone interview in which the Eating Disorder Examination (EDE) was used to diagnose possible EDs.

**RESULTS:** Seventy (72%) out of those 97 athletes who met the criteria for an ED during their athletic career had recovered, and three new cases of athletes had developed an ED after they stopped competing. Out of the athletes and non-athletes who were interviewed, 30 (23%) athletes and 22 (20%) non-athletes met the DSM-IV criteria for EDs. Athletes with a history of EDs reported more present menstrual dysfunction and lower score on the WHO-QOL than former athletes with no ED history, and controls.

**CONCLUSIONS:** Most former elite athletes with a history of EDs recover, however more than one out of four are still struggling with their ED 15-20 years after they finished their sport career.

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2726 Board #8 May 31 5:45 PM - 7:00 PM

**Variability In Hallux Pressures With Cam Walker Boot And Rigid Sandal: Implications For Post-operative Mobilization**

Kenneth J. Hunt<sup>1</sup>, Rebecca Shultz<sup>2</sup>, Maria Malone<sup>2</sup>, Alex Sox-Harris<sup>1</sup>, Daniel Garza, FACS<sup>2</sup>, Gordon O. Matheson<sup>2</sup>. <sup>1</sup>Stanford, Redwood City, CA. <sup>2</sup>Stanford, Stanford, CA.

(No relationships reported)

There are numerous surgical procedures for pathologies affecting the hallux metatarsophalangeal (MTP) joint, including arthrodesis, osteotomies, bunionectomies, and soft tissue reconstructions. While early protected weight bearing (WB) has been shown to be safe for some procedures, higher failure rates have been reported for hallux MTP arthrodesis with early WB. Post-operative protocols usually include transition to WB in a short CAM walker boot device or rigid post-operative sandal. The pressures exerted at the great toe (GT) and the hallux metatarsal head (MTH) in these devices are unknown.

**PURPOSE:** To compare the contact peak pressure and impulse at the great toe and hallux MTH with three different movement tasks during ambulation in each of three foot devices.

**METHODS:** 20 healthy subjects (age 25-37) performed three movement tasks (normal walking, heel WB, 90 deg pivot turn), while wearing each of three different footwear devices: CAM walker boot, hard-sole post-operative sandal, and running shoes. Insole pressure measurements were collected using Tekscan (South Boston, MA) insoles. Contact pressures, peak pressures

and impulse (Force x time) were collected at GT and MTH during stance phase for each subject for three trials during each of the nine conditions (3 movement tasks and 3 shoe devices). Mixed-effects regression models were used to estimate mean simultaneous pairwise differences and (95%CI) between the nine conditions.

**RESULTS:** The boot resulted in lower MTH contact pressure than both other devices during all three conditions, with a significant difference occurring between the boot and the sandal during heel walking ( $p < 0.01$ ). MTH impulse was significantly lower with the boot compared to the other devices during pivot, but only versus shoe during walking, with no difference between boot and sandal during walking. The lowest peak pressure occurred during heel walking at both MTH and GT independent of the device; this was significantly lower than the other two movement tasks.

**CONCLUSIONS:** As safe, early mobilization is often the goal for patients following hallux procedures and during recovery from hallux injuries, it appears a short CAM walker boot may be superior to a rigid sandal in terms of pressures at the hallux MTH and GT.

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**2727 Board #9 May 31 5:45 PM - 7:00 PM**  
**Recurrent Syncope in an Adolescent Football Player**

Mark Riederer, Prince Kannankeril, Monroe Carell Jr. Children's Hospital at Vanderbilt, Nashville, TN.  
(No relationships reported)

**HISTORY:** A 17-year-old high school athlete adolescent male is hospitalized overnight after having a syncopal episode. He was "roughhousing" with a few of his friends when he suddenly didn't feel well and then proceeded to pass out. Two of his friends, trained in cardiopulmonary resuscitation, felt no pulse and performed chest compressions and breaths for about 1 minute until he regained consciousness.

He had two prior episodes of syncope, the first when he was 13-years-old when he collided with another boy while playing lacrosse. He had a very brief loss of consciousness after the hit, and then felt well when he awoke. The second episode occurred one year later while lifting weights he suddenly stood up and lost consciousness. Again after he awoke, he felt relatively well.

He has no other past medical history or surgical history. He plays high school football and club rugby. There is no family history of sudden death or arrhythmia. His mother has had several episodes of syncope with "stress."

**PHYSICAL EXAMINATION:** Vital signs: Heart rate 47, blood pressure 122/62. In general, he is awake, alert and well appearing. His breath sounds are symmetric, and clear to auscultation. His heart is regular in rate and rhythm, normal S1 and S2 without murmur or gallop. His abdomen is soft, nontender and nondistended. His strength is normal. There is no clubbing, edema, or cyanosis. He has a nonfocal neurologic examination.

**DIFFERENTIAL DIAGNOSIS:**

Neurocardiogenic syncope

Long QT Syndrome

Hypertrophic cardiomyopathy

Aortic stenosis

Arrhythmogenic right ventricular cardiomyopathy

Catecholaminergic polymorphic ventricular tachycardia

**TEST AND RESULTS:** He had a normal resting electrocardiogram, with a normal QT interval, and normal echocardiogram. An exercise stress test showed bidirectional ventricular tachycardia. An intracardiac electrophysiology study was normal, with no inducible arrhythmias. Resequencing of the cardiac ryanodine receptor (RYR2) gene revealed a nonsynonymous mutation in RYR2 (Arg 15 Pro), a rare variant not previously described in the literature.

**FINAL WORKING DIAGNOSIS:** Catecholaminergic polymorphic ventricular tachycardia

**TREATMENT AND OUTCOMES:** He did well on high dose beta-blocker therapy, was restricted from strenuous activity, and is doing well without any further episodes of syncope.

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**2728 Board #10 May 31 5:45 PM - 7:00 PM**  
**Infectious Disease - Swimming**

Kari Taggart<sup>1</sup>, Sherrie Ballantine-Talmdage<sup>2</sup>. <sup>1</sup>AthletiCo/Northwestern University, Evanston, IL. <sup>2</sup>Northwestern University, Evanston, IL.  
(No relationships reported)

**HISTORY** 18-year-old female Division I swimmer presented to athletic training room with sore throat, bilateral tonsillar exudates and painful swallowing. She was referred to team physician for further evaluation and treated with Penicillin. Patient improved symptomatically, but returned 13 days later with sore throat, subjective fever, body aches, headache, and muffled voice. She was treated for mono and placed on Prednisone. In four days her condition drastically changed. She called ATC with fever, difficulty breathing, and sharp, constant back/abdominal pain so was sent to ER

**PHYSICAL EXAMINATION**

VS: BP 96/55 HR 102 Temp 97.8 RR24

Gen: uncomfortable w/ breathing

HEENT: wnl

CV: S1S2 w/o murmur; tachy rate; regular rhythm

Chest: decreased and course BS at RLL; breath sounds throughout

Abd: ttp in RUQ with no guarding or rebound; (-) Murphy's sign; ttp along mid thoracic spine, in mid line, radiating around to LUQ

Ext: no clubbing, cyanosis or edema (-) Homan's B

**DIFFERENTIAL DIAGNOSIS**

1. Mononucleosis
2. Strep throat/pneumonia
3. Community-Acquired Pneumonia
4. Sepsis
5. Pulmonary Embolism
6. Endocarditis/pericarditis
7. Peritonsillar abscess

**TESTS/RESULTS**

At Hospital

CXR for B infiltrates (+)

Elevated WBC

Blood cultures: Fusobacterium necrophorum & Streptococcus dysgalactiae

Elevated LFTs

**TREATMENT/OUTCOMES**

Began Unasyn at hospital for presumed CAP with sepsis

Continued to spike fevers and had persistent RUQ pain; Ultrasound showed mildly enlarged spleen  
Thoracentesis performed and chest tubes placed bilaterally  
Patient underwent empyema treatment w/ multiple rounds of tPa  
Neck CT reviewed again and R IJ thrombus found  
Cardiothoracic surgery consulted and decortication of B lungs performed, revealing significant pus throughout RLL and under diaphragm  
Patient improved post-op (week 3), but became anemic; transfused prior to discharge  
Began light cardiovascular exercise in spring and had tonsillectomy in summer due to persistent tonsillar pain  
Progression back to swimming following tonsillectomy and return to pre-illness levels of training in the fall  
**FINAL/WORKING DIAGNOSIS** Lemierre Syndrome; Mononucleosis; Anemia

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## E-20 Free Communication/Poster - Bone Mineral Density

JUNE 1, 2012 7:30 AM - 12:30 PM  
ROOM: Exhibit Hall

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### 2729 Board #1 June 1 9:30 AM - 11:00 AM

#### Reduced Bone mineralization in Elite Male Lightweight Rowers Compared to Elite Rowers Without Weight Restriction

Anders Vinther<sup>1</sup>, Tine Alkjær<sup>2</sup>, Inge-Lis Kanstrup<sup>3</sup>, Bo Zerahn<sup>3</sup>, Charlotte Ekdahl<sup>4</sup>, Per Aagaard<sup>5</sup>. <sup>1</sup>Herlev Hospital and Lund University, Herlev and Lund, Denmark. <sup>2</sup>Panum Institute, University of Copenhagen, Copenhagen, Denmark. <sup>3</sup>Herlev Hospital, Herlev, Denmark. <sup>4</sup>Lund University, Lund, Sweden. <sup>5</sup>University of Southern Denmark, Odense, Denmark.  
(No relationships reported)

During the last decades an increased incidence of exercise-induced rib stress fractures has been observed among rowers at the international elite level. In Denmark, male lightweight rowers have demonstrated a particularly high frequency of injury. Sufficient energy intake is important to ensure optimal bone adaptation, and since lightweight rowers need to comply with strict weight limits, insufficient energy intake could potentially lead to impaired bone strength. Bone Mineral Density (BMD) is closely correlated with bone strength and rowers with previous rib stress fractures have exhibited reduced BMD compared to uninjured rowers.

**PURPOSE:** To investigate if lightweight rowers were characterized by reduced BMD compared to heavyweight rowers.

**METHODS:** Total body BMD was measured in male (ML, n=20) and female (FL, n=9) lightweight rowers, and male (MH, n=10) and female (FH, n=10) heavyweight rowers (Danish National Team) by dual energy X-ray absorptiometry (DXA-scan). To enable comparisons between the four groups of rowers BMD was expressed in % of a young adult reference population (20-40 years of age). Statistical analysis was performed using one-way ANOVA with Bonferroni corrected post hoc comparisons.

**RESULTS:** Total body BMD was reduced in ML (99.9 ± 5.0 %) (mean ± SD) compared to MH (111.0 ± 5.2 %, p<0.001), FH (111.1 ± 7.2 %, p<0.001) and FL (107.2 ± 5.4 %, p<0.05). No other group differences were observed.

**CONCLUSION:** Total body BMD was reduced in male National Team lightweight rowers compared to male heavyweight rowers, whereas no difference was observed between lightweight and heavyweight female rowers. Thus, internationally competitive male National Team lightweight rowers seem to demonstrate an attenuated adaptive skeletal response compared to that observed in National Team rowers without weight restriction, which expose male lightweight rowers to an increased risk of exercise-induced rib stress fracture injury.

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### 2730 Board #2 June 1 9:30 AM - 11:00 AM

#### The Evaluation of Forearm Muscles Strength and Bone Mineral Density of Archers

Nisa Zekiye Özberk<sup>1</sup>, Özlem Öner Coşkun<sup>1</sup>, Sabire Akın<sup>2</sup>, Hayri Ertan<sup>3</sup>, Feza Korkusuz<sup>1</sup>. <sup>1</sup>Middle East Technical University Medical Center, Ankara, Turkey. <sup>2</sup>Medicana Hospital, Ankara, Turkey. <sup>3</sup>Anadolu University, Eskişehir, Turkey.  
(No relationships reported)

**PURPOSE:** Archery can be described as a static sport requiring strength and endurance of the upper body, in particular the forearm and shoulder girdle. The discipline is described as a three-phase (the stance, the drawing and the sighting) movement. Shooting the high number arrows during both training and competition, a repeated contraction-relaxation strategy by both drawing and bow hand forearm muscles should be developed. The studies that have been done on forearm muscles proved that muscular strength imbalance cause uncoordinated shooting and may impair with wrist injuries. This study investigated the effects of long-term archery training on the forearm isokinetic muscular strength and bone mineral density (BMD).

**METHODS:** 10 male and 3 female totally 13 high level archers volunteered into the study. Concentric strength of wrist extensor and flexor in both forearms was measured by using Biodex System 3 isokinetic dynamometer. Both forearms were measured at speed of 60°/s and in the distal and total radius-ulna by dual energy x-ray absorptiometry (DEXA).

To evaluate the relationship between muscle strength and bone mineral density Wilcoxon t-test in IBM SPSS 20 was used to determine whether there exist differences between the dominant and non-dominant arm. A criterion level of p<.05 was selected.

**RESULTS:** Distal radius BMD (0.42±0.06 vs. 0.39±0.05, p=.002), both of distal radius and ulna BMD (0.40±0.06 vs. 0.37±0.06, p=.011), total ulna BMD (0.61±0.05 vs. 0.59±0.05, p=.019) and both of total radius and ulna BMD (0.60±0.05 vs. 0.58±0.04, p=.017) values of dominant arm were higher than the values of non-dominant arm. Flexion Peak torque (12.26±9.25 vs. 8.35±5.55, p=.023), extension Peak torque/body weight (28.83±10.60 vs. 23.81±10.48, p=.021) and flexion Peak torque/body weight (18.58±12.35 vs. 11.72±8.79, p=.002) values of dominant arm were higher than non-dominant arm.

**CONCLUSIONS:** Dominant forearm BMD and muscle strength values were significantly higher than non-dominant forearm values. These strength and BMD relations indicate sport specific skeletal and muscular adaptations. As a result of sports-specific movement pattern and training programs, the dominant forearm muscle strength is expectedly higher than non-dominant forearm. The results of this study can guide clinicians, coaches and archers.

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### 2731 Board #3 June 1 9:30 AM - 11:00 AM

#### Cortisol and Bone Mineral Density in Competitive Male Cyclists

Shannon L. Mathis, Richard S. Farley, Dana K. Fuller, Amy E. Jetton, Jennifer L. Caputo. Middle Tennessee State University, Murfreesboro, TN. (Sponsor: Don W. Morgan, FACSM)  
(No relationships reported)

Elevated cortisol is linked to a high prevalence of osteoporosis. The etiology of low bone mineral density (BMD) in male cyclists may be partially due to elevations in cortisol, which increases during physiological and psychological stress.

**PURPOSE:** To determine whether pre- and post-competition cortisol levels, pre-race competitive state anxiety, daily calcium intake, and training history were related to lumbar spine and hip BMD in male cyclists.

**METHODS:** Lumbar spine (L1 - L4), total hip, femoral neck, and trochanter BMD were measured with dual x-ray absorptiometry in 33 male cyclists who competed in a state championship time trial event. Calcium intake was measured using a 1 day dietary recall. On a survey, participants reported age, years of bike-specific training, number of races per season, and minutes per week riding a bike, weight training, and running. On race day, a competitive state anxiety questionnaire was used to measure pre-race nervousness. Salivary cortisol was measured within 10 minutes of racing and within 5 minutes of race finish.

**RESULTS:** Low BMD of the lumbar spine or hip was found in 50% of the cyclists. Total hip BMD of cyclists over the age of 40 years was significantly correlated with post-race cortisol ( $r = .72, p = .03$ ), but cortisol was not significantly correlated with BMD in the full sample. Cortisol level increased significantly ( $p = .004$ ) from pre- ( $9.4 \pm 4.1$  nmol/L) to post-competition ( $20.8 \pm 14.5$  nmol/L). No correlation existed between pre-race nervousness and pre- or post-race cortisol. Weight training was associated with higher BMD of the lumbar spine ( $\beta = 0.61, t = 4.03, p < .001$ ), total hip ( $\beta = 0.62, t = 4.16, p < .001$ ), femoral neck ( $\beta = 0.70, t = 5.72, p < .001$ ), and trochanter ( $\beta = 0.68, t = 4.86, p < .001$ ). Increased number of years of cycling experience was associated with lower BMD of the femoral neck ( $\beta = -0.26, t = -2.15, p = .04$ ). Higher daily calcium intake was associated with higher BMD of the lumbar spine ( $\beta = 0.40, t = 2.30, p = .03$ ) and femoral neck ( $\beta = 0.38, t = 2.19, p = .04$ ).

**CONCLUSION:** Findings support the recommendation that cyclists should participate in weight training and increase calcium intake in order to increase or maintain BMD.

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2732 Board #4 June 1 9:30 AM - 11:00 AM

**Bone Mineral Density In Female Players: Comparisons Among Sports**

Duckhyun Nam, Seungyun Shin, Mihyun Lee, Yoonho Nam. *Yong in University, Yongin, Korea, Republic of.* (Sponsor: Zhu, Weimo, FACSM)  
(No relationships reported)

**PURPOSE:** The purpose of this study was to examine the bone mineral density (BMD) of female college athletes by sports and the relationship between BMD and body composition in an attempt to provide some information on how to improve their athletic performance.

**METHOD:** The subjects of this study were 73 female college athletes who had exercised for five or more years and had ever won a prize in national competitions: 21 taekwondo, 25 judo, 6 kendo, 9 table tennis and 12 basketball. Their body composition, spinal BMD, femur BMD and total BMD were measured by using Dual Energy X-ray Absorptiometry (GE Medical System Lunar, USA).

**RESULTS:** It was found that the judo players were the highest in spinal BMD, followed by the basketball, kendo, table tennis and taekwondo. In terms of femur BMD, judo players were the highest, followed by the basketball, kendo, taekwondo and table tennis. Comparison of the total BMD among sports, the judo players were the highest, followed by the basketball, kendo, table tennis and taekwondo. Low to moderately high correlations were found among BMD and body composition, weight and lean body mass index (BMI). Spinal BMD had highest correlation with BMI ( $r=.510$ ), followed by weight ( $r=.361$ ) and lean body mass ( $r=.305$ ); femur BMD had the highest correlation with BMI ( $r=.403$ ), followed by weight ( $r=.323$ ) and lean body mass ( $r=.322$ ); finally, total BMD had the highest correlation with BMI ( $r=.547$ ), followed by weight ( $r=.492$ ) and lean body mass ( $r=.431$ ).

**CONCLUSIONS:** It seems that characteristics of the sports exerted a different influence on BMD, and the sports with weight class such as Taekwondo had the lowest BMD, which may result from excessive weight control and accumulated training. Low to moderately high correlations were found between BMD and body composition.

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2733 Board #5 June 1 9:30 AM - 11:00 AM

**Bone Mineral Density and Fracture Risk in Young Competitive Female Cyclists**

Emily F. Foxman<sup>1</sup>, Marta Van Loan<sup>2</sup>, Caitlin Campbell<sup>2</sup>, Christina Lozada<sup>3</sup>, Gretchen Casazza<sup>4</sup>. <sup>1</sup>University of California, Davis, Davis, CA. <sup>2</sup>USDA Western Human Nutrition Research Center, Davis, CA. <sup>3</sup>University of California Davis Medical Center, Sports Medicine Program, Sacramento, CA. <sup>4</sup>Sports Performance Laboratory, University of California Davis Medical Center, Sports Medicine Program, Sacramento, CA.  
(No relationships reported)

**PURPOSE:** To determine if bone mineral density (BMD) and bone strength of competitive female cyclists is lower than the average population due to the low impact nature of their training.

**METHODS:** Eight competitive female cyclists (Age =  $26 \pm 4$  yrs) completed a maximal cycle ergometer exercise test and dual X-ray absorptiometry (DXA) and peripheral quantitative computed tomography (pQCT) scans to assess body composition, bone mineral density, bone strength and fracture risk. Serum samples for bone-specific alkaline phosphatase (BAP), carboxyterminal cross-linked telopeptide of type I collagen (CTX), parathyroid hormone (PTH), serum 25-hydroxy-vitamin D levels and estrogen were also collected. Summary of Results. Characteristics of the group included a  $VO_{2max}$  of  $53.7 \pm 5.5$  ml·kg<sup>-1</sup>·min<sup>-1</sup>, body fat of  $20.2 \pm 3.8\%$  and a total volume of training of  $10.5 \pm 3.3$  hrs per week. Total BMD was  $1.2 \pm 0.09$ , AP Spine was  $0.93 \pm 0.12$  and Femur was  $0.89 \pm 0.08$  g/cm<sup>2</sup>. Average z scores for total BMD was  $0.1 \pm 1.1$ , AP Spine was  $-1.1 \pm 1.1$  and Femur was  $-0.19 \pm 0.06$ .

**CONCLUSION:** Our results demonstrate that despite normal total body BMD, competitive cyclists had AP spine Z scores in the osteopenic range. This is especially significant in that athletes usually have higher than average BMD. Recommendations to add weight bearing cross training into the training regimens of cyclists may be warranted.

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2734 Board #6 June 1 9:30 AM - 11:00 AM

**Muscular Strength, Bone Mineral Content And Bone Metabolism In Female Adolescents**

Romulo M. Fonseca<sup>1</sup>, Ricardo J. Oliveira<sup>1</sup>, Nanci M. França<sup>2</sup>, Rinaldo W. Pereira<sup>2</sup>. <sup>1</sup>Universidade de Brasilia, Brasilia, Brazil. <sup>2</sup>Universidade Católica de Brasilia, Brasilia, Brazil.  
(No relationships reported)

Throughout life, bones adapt their strength parameters (size, shape and mass) through process of bone modeling and remodeling, in response to mechanical loading, which arises mainly from muscle contractions. However bone turnover markers and muscular strength have been poorly studied in the non-athletes growing skeleton.

**PURPOSE:** To investigate relationships among muscular strength and bone mineral content and metabolism in non-athletes female adolescents

**METHODS:** 148 post-pubertal (Tanner 4-5) healthy female adolescents were evaluated in this study (age:  $15.9 \pm 1.9$  years; body weight:  $52.7 \pm 8.2$  Kg; height:  $160.4 \pm 6.03$  cm). Muscular strength was evaluated by handgrip dynamometer. The average of the best scores of each hand was used. Arm bone mineral content was derived from total body exam in dual-energy x-ray absorptiometry. Blood serum osteocalcin (OC) and C-terminal telopeptide of type I collagen (CTX) were assessed by Elisa (Biosource hOST-EASIA kit and Serum CrossLaps® ELISA - ids, respectively). Pearson's correlation coefficient was used ( $p \leq 0.05$ ).

**RESULTS:** Muscular strength was associated to arm bone mineral content ( $r=0.55, p<0.01$ ), and it was negative associated to OC ( $r=-0.18, p<0.05$ ).

**CONCLUSIONS:** Arm muscular strength can influence local mineral content, however this influence seems to be too weak to modify bone turnover in healthy non-athletes female adolescents.

Supported by CAPES and CNPq (process id: MCT/CNPq - 02/2006 - Universal - 475438/2006-0)

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2735 Board #7 June 1 9:30 AM - 11:00 AM

**Muscle Strength of Hip and Trunk and Bone Mineral Density in Postmenopausal Women**

Zhixiong Zhou, Lu Zheng, Fang Gu, Xun Li. *Capital University of Physical Education and Sports, Beijing, China.*  
(No relationships reported)

Few studies currently demonstrated the relationship between muscle strength (MS) of hip, trunk and adjacent bone mineral density (BMD) sites.

**PURPOSE:** To investigate the relationship between muscle strength and BMD in postmenopausal women with different age groups.

**METHODS:** 293 healthy postmenopausal women aged 44-64 ys ( $54.1 \pm 4.08$ ) were classified into five subgroups: 44-50ys(G1), 51-53ys(G2), 54-56ys(G3), 57-59ys(G4), 60-64ys(G5). BMD of lumbar (L2-4BMD), femur neck(FNBMD) and total body(TBMD) were measured by dual-energy X-ray absorptiometry (DXA). Muscle strength of hip and trunk were measured using an isokinetic dynamometer. Multiple linear regression was performed using all variables.

**RESULTS:** Regional and TBMD gradually decreased with age in postmenopausal women. MS of hip and trunk did not show a decreasing trend with age. The relation between MS at different degree and BMD associated with the different age groups, there was higher correlation coefficients between TBMD and MS ( $r=0.40-0.56, P<0.05$ ) at lower speed (hip at 120°/s, trunk at 30°/s) than between TBMD and MS ( $r=0.29-0.44, P<0.05$ ) at high speed (hip at 180°/s, trunk at 60°/s and 120°/s) in G1, G3, G4. Significant relationships were drastically reduced after adjusting for lean mass in G1-G4, but significant relationships between MS and BMD were found. After controlling for lean mass the relation between MS and BMD had no significance in G5. Significant correlation coefficients were observed between MS of hip flexor at 120°/s and L2-4BMD ( $r=0.285-0.606, P<0.05-0.01$ ), and MS of trunk extensor at 30°/s and FNBMD ( $r=0.296-0.406, P<0.05-$

0.01) in five subgroups. MS of hip extensor at 90° accounted for 18.8% of the variance of TBMD in G1 and 29.10% in G2, and accounted for 27.4% of the variance of L2-4 BMD in G3. MS of trunk flexor at 120°/s accounted for 23.4% of the variance of FNBMD in G5. Body weight was an independent predictor of TBMD accounting for 53.7% of the variance, and lean mass accounted for 33.2% of the variance of L2-4BMD in G5.

**CONCLUSION:** In postmenopausal women, muscle strength of hip and trunk did not show a decreasing trend with age and significant correlation were observed between BMD and MS of hip, trunk. Lean mass is an important determinant of BMD.

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**2736** Board #8 June 1 9:30 AM - 11:00 AM

**Body Composition and Bone Mineral Density Responses to Different Intensity Resistance Training in Postmenopausal Women**

Linda Lin<sup>1</sup>, Michael Lo<sup>2</sup>, Min- Huei Hsieh<sup>1</sup>, Wei-Jen Yao<sup>1</sup>, Yi-Ju Chen<sup>1</sup>. <sup>1</sup>National Cheng Kung University, Tainan, Taiwan. <sup>2</sup>Kun Shan University, Tainan, Taiwan.  
(No relationships reported)

**PURPOSE:** The purpose of this study was to compare the effects of 24 weeks high- and medium-intensity resistance training (RT) on bone mineral density (BMD), body composition(BC), and muscular isokinetic strength in postmenopausal women.

**METHODS:** Thirty -two volunteers (50–67 years) matched for strength and randomly assigned to either the high-intensity (80% 1RM, 8 reps; HI, N = 11), medium-intensity (50% 1RM, 13reps; MI, N = 11) and control group (CG, N = 10). The exercise program consisted of using 9 resistance machines under supervised progressive resistance training two sessions per week for 24 weeks. Dual-energy X-ray absorptiometry (DXA) was used to measure subjects' body composition and total bone mineral density. Isokinetic knee and elbow extension/flexion (180°/s) performances were measured by the Biodex System 4 PRO. Total bone mineral density, body fat, lean body mass, and peak torque were measured at baseline and after 24 weeks training. The statistical comparisons for the different variables among the three groups were performed by applying one-way ANCOVA.

**RESULTS:** At baseline, the three groups had similar BMD, BC, and strength characteristics. After 24 weeks training, there were no differences between the three groups in the total bone mineral density and total body fat. HI increased significantly(3.5%) more than CG(-11%) in lean mass of arm( $p < .05$ ). The peak torque in biceps(27-29%) and quadriceps(15-22%) of both groups were also significantly higher than the control group (-2-4%)( $p < .05$ ), but there was no significant differences between three groups in triceps' peak torque.

**CONCLUSIONS:** These findings suggest that high- and medium-intensity resistance training effectively increase muscular strength and have equally beneficial effects in postmenopausal women. However, RT with higher intensity might have greater response at the upper body lean mass.

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**2737** Board #9 June 1 9:30 AM - 11:00 AM

**The Relationship Between Protein Consumption And Bone Mineral Density In Postmenopausal Breast Cancer Survivors**

Emily Page, Emily Simonavice, Michael J. Ormsbee, Pei-Yang Liu, Jasminka Z. Ilich-Ernst, Jeong-Su Kim, Bahram H. Arjmandi, Lynn B. Pantan, FACSM. Florida State University, Tallahassee, FL.  
(No relationships reported)

Breast cancer survivors (BCS) encounter many side effects from cancer treatments that negatively affect body composition. Specifically, postmenopausal BCS have increased rates of bone turnover, leading to loss of bone mineral density (BMD). There is evidence to suggest a higher level of protein in the diet may be beneficial for bones in older adults. It has not been investigated whether higher protein consumption in BCS can lead to improved BMD.

**PURPOSE:** To evaluate the relationship between protein intake and BMD of various skeletal sites in postmenopausal BCS.

**METHODS:** Twenty seven BCS (age: 64±7yrs; BMI:27.7±5.5kg/m<sup>2</sup>) completed a 24-hour dietary recall to assess nutritional intake. Total body and regional (lumbar spine, femur, and forearm) BMD were measured via dual energy X-ray absorptiometry. One way analysis of variance was used to determine if BCS consuming greater than 20% protein (>20%) in diet differed in total and regional BMD compared to those consuming less than 20% (<20%). Multiple regression models (controlled for total lean mass, fat mass, vitamin D intake) were developed to examine the influence of protein intake on various BMD sites.

**RESULTS:** The BCS consumed on average 1920±783 kcal/day with 49±13% from carbohydrates, 34±9% from fat, and 17±7% from protein. Average calcium and vitamin D intake (from food and supplements) were 1846±746 mg/day and 1218±1408 IU/day, respectively. Protein intake was 1.06±0.54 g/kg of body weight per day. BCS consuming >20% protein had significantly higher total BMD (>20%: 1.252±0.124 vs <20%: 1.118±0.120 g/cm<sup>2</sup>) and femur BMD (>20%: 1.020±0.128 vs <20%: 0.900±0.107 g/cm<sup>2</sup>). There were no differences between the two groups in BMD of other skeletal regions, body weight, lean mass, fat mass, energy intake, calcium or vitamin D intake. In multiple regression models, controlled for total lean mass, fat mass, vitamin D intake, protein intake was a significant determinant of total body and femoral neck BMD.

**CONCLUSIONS:** Our findings indicate that BCS with greater than 20% daily protein consumption exhibit higher total BMD regardless of calcium, vitamin D, or energy intake. Further research in larger samples is needed to elucidate potential benefits of protein or other dietary regimens on BMD and body composition in postmenopausal BCS.

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**2738** Board #10 June 1 9:30 AM - 11:00 AM

**High Impact Unilateral Exercise Increased Femoral Neck Bone Mineral Density in Older Men**

Sarah J. Allison<sup>1</sup>, Jonathan P. Folland<sup>1</sup>, Winston J. Rennie<sup>2</sup>, Greg D. Summers<sup>3</sup>, Katherine Brooke-Wavell<sup>1</sup>. <sup>1</sup>Loughborough University, Leicestershire, United Kingdom. <sup>2</sup>University Hospitals of Leicester, Leicester, United Kingdom. <sup>3</sup>Royal Derby Hospital, Derby, United Kingdom.  
(No relationships reported)

High impact exercise is effective for improving bone mineral density (BMD) in children and young adults, although the few studies in older adults have yielded mixed results. Older men are at risk of osteoporotic fractures but the feasibility of high impact exercise and its influence on BMD in this population is unknown. Age-related changes and lifestyle modification may confound exercise intervention trials in older people. The effect of these confounders can be minimised using a within-subjects unilateral design (exercise vs. control limb) that has greater statistical power.

**PURPOSE:** To investigate the influence of a 12 month high impact unilateral exercise intervention on femoral neck BMD in older men.

**METHODS:** Healthy community-dwelling older men completed a 12 month high impact unilateral exercise intervention which progressed to 50 multidirectional (vertical, anteroposterior, mediolateral, rotational) hops, 7 days a week on one randomly allocated leg. BMD of both femurs was measured using dual energy X-ray absorptiometry (DXA) at baseline and after 12 months of exercise, by an observer blind to the leg allocation. Two-way repeated measures ANOVA was used to identify leg (exercise leg [EL] vs. control leg [CL]) x time (pre vs. post) interactions.

**RESULTS:** Thirty-five men (mean ± SD, age 69.9 ± 4.0 yrs) exercised for 12 months and intervention adherence was 90.9 ± 9.1% (305 ± 30.5 sessions completed out of 336 prescribed sessions). Fourteen men did not complete the 12 month exercise intervention due to: health problems or injuries unrelated to the intervention (n=9), time commitments (n=2), or discomfort during exercise (n=3). Femoral neck BMD increased in the EL relative to the CL (mean ± SEM: EL 0.948 ± 0.018 to 0.954 ± 0.017g/cm<sup>2</sup>; CL 0.954 ± 0.018 to 0.945 ± 0.018 g/cm<sup>2</sup>; ANOVA leg x time  $P = 0.003$ ) as did femoral neck BMC (EL 5.50 ± 0.13 to 5.54 ± 0.12g; CL 5.51 ± 0.13 to 5.50 ± 0.13g; ANOVA leg x time  $P = 0.024$ ).

**CONCLUSION:** A 12 month high impact unilateral exercise intervention was feasible and effective for inducing modest increases in femoral neck BMD and BMC in older men. Carefully targeted high impact exercises may be suitable for incorporation into exercise interventions aimed at preventing fractures in healthy community-dwelling older men.

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**2739** Board #11 June 1 9:30 AM - 11:00 AM

**Risk Factors for Low Bone Mineral Density in Institutionalized Individuals with Developmental Disabilities**

Michael A. Vice, Vinayak K. Nahar, Martha Bass, Allison Ford-Wade. The University of Mississippi, university, MS. (Sponsor: Mark Loftin, FACSM)  
(No relationships reported)

Persons with developmental disabilities are exposed to several factors which have been determined as risks for osteoporosis. Many of these individuals are non-ambulatory, resulting in lack of weight bearing activity which is well established as a major contributor to bone loss. It is suspected that low bone mineral density (BMD) and related fractures are more prevalent in non-ambulatory persons and persons with developmental disabilities. It is also suspected that low BMD in this population is due to the presence of multiple risk factors.

**PURPOSE:** The purpose of this study was to investigate risk factors for low bone mineral density in persons with developmental disabilities who reside in an institutional setting. With the assessment of risk factors we hope to establish protocol for 1) identifying high risk persons and 2) prevention of low BMD.

**METHODS:** A cross-sectional study was conducted to gather data from client charts, pharmacy records, dietary records,

**RESULTS:** Data were collected on 69 participants. Thirty-nine were male and 30 were female. Ages ranged from 19 to 67 years with only 10 of the participants being over 55 years old (mean age = 45.58, SD = 11.52). Sixty-six of the participants were ambulatory. All were diagnosed with varying levels of intellectual disability, with 35 being classified with Profound Mental Retardation. Ultrasound BMD measures ranged from a t score of 2.0 to -3.0. Thirty-six participants (52.2%) were classified as healthy BMD, 22 (31.9%) as osteopenic, and 11 (15.9%) as osteoporotic. BMD measures were not significantly associated with age, gender, height, weight, or BMI for this population ( $p > .05$ ). When BMD was categorized as healthy, osteopenia, or osteoporosis the association with classification of intellectual disability approached significance ( $X^2 = 14.83, p = .063$ ). A significant association was also found with anti-seizure medication use ( $X^2 = 23.62, p = .009$ ).

**CONCLUSIONS:** Risk factors for low BMD have been identified for the healthy, normal population. Data collected in this study indicate that institutionalized individuals, with varying diagnosis of intellectual disability, do not share these risk factors. Studies investigating risk factors and determinants of low BMD in this population are warranted.

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**2740** Board #12 June 1 9:30 AM - 11:00 AM

**Effects of Exercise Training on Bone Mineral Density, Inflammatory Cytokines, and Biochemical Bone Markers**

Elisa A. Marques<sup>1</sup>, Jorge Mota<sup>1</sup>, Diana Tuna<sup>2</sup>, Tiago Guimarães<sup>3</sup>, Joana Carvalho<sup>1</sup>. <sup>1</sup>University of Porto - Faculty of Sport, CIAFEL, Porto, Portugal. <sup>2</sup>Hospital of S. João, Porto, Portugal. <sup>3</sup>University of Porto - Faculty of Medicine, Porto, Portugal.  
(No relationships reported)

Skeletal response to long-term exercise training is reduced in older adults; although most of the literature supports the notion that greater strain magnitudes and unusual strain distributions provide the most effective stimuli for bone formation, bone's response to exercise have produced inconsistent results. Moreover, experimental studies have recently implicated inflammation in the pathogenesis of osteoporosis.

**PURPOSE:** To determine the effects of 32-week exercise training on bone mineral density (BMD), biochemical markers of bone metabolism, and inflammatory cytokines concentrations.

**METHODS:** 47 healthy older adults (61-84 years) participated in a exercise training intervention that included resistance exercise training (2 days/week) plus a multicomponent weight-bearing impact exercise training (1 day/week) for 32 weeks. Outcome measures included lumbar spine (LS) and proximal femoral BMD (by dual X-ray absorptiometry), dynamic balance, serum osteocalcin (OC), C-terminal telopeptide of Type I collagen (CTX), osteoprotegerin (OPG), receptor activator of nuclear factor kappa B ligand (RANKL), high sensitive (hs)-CRP, and the inflammatory cytokines [interleukin (IL)-6, tumor necrosis factor (TNF- $\alpha$ ), and interferon (IFN)- $\gamma$ ] pre- and post-intervention. A two-way factorial ANOVA, with repeated measures on one factor (time), was performed for differences in main effects and time by group interactions for each dependent variable.

**RESULTS:** After 32 weeks, both men and women significantly increased trochanter ( $0.7 \pm 2.1\%$ ), intertrochanter ( $0.7 \pm 2.0\%$ ), total hip ( $0.6 \pm 1.7\%$ ), and LS BMD ( $1.7 \pm 2.3\%$ ), while OC, CTX, OPG and RANKL remained unchanged. In addition, IFN- $\gamma$  significantly decreased by 15.6% ( $p=0.002$ ), while there were no significant group or time effects in TNF- $\alpha$ . A significant decrease in IL-6 was observed only in men ( $9.0\%$ ,  $p=0.002$ ). The change in TNF- $\alpha$  was negatively correlated with the change in lumbar spine BMD ( $r=-0.30, p=0.047$ ).

**CONCLUSIONS:** Despite the lack of a significant change on bone turnover markers, our combined impact protocol decreased inflammation, and increased BMD in older adults. Results further support the beneficial role of long-term exercise on bone mass and low-grade inflammation.

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**2741** Board #13 June 1 9:30 AM - 11:00 AM

**College-age Dancers Have Greater Bone Mass than Runners and Controls Despite Low Energy Availability**

Hawley C. Almstedt, Zakkoyya H. Lewis-Powell. Loyola Marymount University, Los Angeles, CA.  
(No relationships reported)

The Female Athlete Triad is a syndrome comprised of three inter-related conditions: menstrual dysfunction, suboptimal bone health, and poor energy availability (EA). EA is calculated as kilocalorie intake minus energy expended through activity.

**PURPOSE:** The goal of this research was to evaluate the relationship between EA and bone mineral density (BMD) in runners, dancers, and controls.

**METHODS:** Runners ( $n=13$ ), dancers ( $n=11$ ), and controls ( $n=15$ ) between the ages of 18-22 (mean= $19.8 \pm 1.1$  years) underwent BMD testing at the hip, spine, and whole body using dual-energy x-ray absorptiometry (DXA, Hologic Explorer, Waltham, MA). Dietary intake was assessed using the Block 2005 Food Frequency Questionnaire (Nutrition Quest, Berkeley, CA). Average daily energy expenditure was measured via an accelerometer (Philips Respironics Actical, Bend, OR) worn by participants at the right hip for an average of four days.

**RESULTS:** Groups were similar in age, height, weight, lean mass, protein and calcium intake. EA did not correlate significantly with BMD at any site. Dancers showed a moderate, nonsignificant, negative relationship between EA and BMD at the femoral neck ( $r = -0.65, p > 0.05$ ). When controlling for lean mass (LM), there were no significant differences in EA between groups: dancers= $29.9 \pm 17.0$  kcal/kg LM, runners= $24.2 \pm 8.0$  kcal/kg LM, and controls= $31.9 \pm 13.7$  kcal/kg LM. An ANCOVA (controlling for BMI) revealed that dancers have significantly greater mean BMD at the anterior-posterior spine ( $1.06 \pm 0.10$  g/cm<sup>2</sup>) than runners ( $0.94 \pm 0.07$  g/cm<sup>2</sup>) and controls ( $0.97 \pm 0.09$  g/cm<sup>2</sup>). Dancers also had significantly greater mean femoral neck BMD ( $0.97 \pm 0.13$  g/cm<sup>2</sup>) than controls ( $0.85 \pm 0.10$  g/cm<sup>2</sup>,  $p < 0.01$ ) but not runners ( $0.88 \pm 0.06$  g/cm<sup>2</sup>). Groups were similar in BMD at the whole body.

**CONCLUSION:** Our research shows that despite similarly low EA, dancers exhibit greater BMD at the spine than runners and controls. This implies that perhaps the loading nature of dancing has a greater positive impact on bone than running.

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**2742** Board #14 June 1 9:30 AM - 11:00 AM

**Effects Of Resistance Training And Dried Plum Consumption On Bone Health In Breast Cancer Survivors**

Emily Simonavice<sup>1</sup>, Pei-Yang Liu<sup>2</sup>, Jasminka Z. Ilich-Ernst<sup>1</sup>, Jeong-Su Kim<sup>1</sup>, Bahram H. Arjmandi<sup>1</sup>, Lynn B. Panton, FACSM<sup>1</sup>. <sup>1</sup>Florida State University, Tallahassee, FL. <sup>2</sup>Akron University, Akron, OH.  
(No relationships reported)

In addition to normal age-related changes, breast cancer survivors (BCS) encounter many side effects from cancer treatments that negatively affect body composition. Specifically BCS have increased rates of bone turnover, and loss of bone mineral density (BMD). Studies have shown that both resistance training (RT) and/or dried plum (DP) consumption may elicit positive BMD changes.

**PURPOSE:** To evaluate the efficacy of a RT ( $n=14$ ) or RT+DP ( $n=13$ ) intervention to modulate BMD and biochemical markers of bone turnover in BCS during a six-month study.

**METHODS:** BCS ( $N=27$ , age:  $64 \pm 7$  yrs; BMI:  $27.7 \pm 5.5$  kg/m<sup>2</sup>) were evaluated for the following variables: muscular strength (chest press and leg extension) via one-repetition maximums (1-RM), total body and regional (lumbar spine, femur, and forearm) BMD via dual energy X-ray absorptiometry and biochemical markers of bone turnover [bone-specific alkaline phosphatase (BAP) and tartrate resistant acid phosphatase (TRAP-5b)]. RT consisted of two days/week of ten exercises including two sets of 8-12 repetitions at ~60-80% of 1-RM. RT+DP also consumed 90g of DP daily. All BCS were given a supplement containing 600mg Ca and 400 IU of Vitamin D to consume twice daily for the duration of the study. ANOVAs were utilized, and significance was set at  $p < 0.05$ .

**RESULTS:** No baseline differences were found between groups for any of the variables. No group x time interaction was detected for any variables. BCS significantly increased upper body (RT:  $68 \pm 20$  to  $82 \pm 21$  kg; RT+DP:  $72 \pm 24$  to  $96 \pm 22$  kg) and lower body (RT:  $72 \pm 19$  to  $88 \pm 28$  kg; RT+DP:  $77 \pm 17$  to  $99 \pm 19$  kg) strength. The RT+DP group lost BMD from baseline to 6M ( $0.476 \pm 0.059$  to  $0.464 \pm 0.054$  g/cm<sup>2</sup>). TRAP-5b was significantly decreased for the RT group ( $4.55 \pm 1.57$  to  $4.03 \pm 1.81$  U/L) while the RT+DP group significantly decreased TRAP-5b at a  $p=0.07$  ( $5.10 \pm 2.75$  to  $3.77 \pm 1.80$  U/L). All other BMD variables and BAP were maintained over the course of the study.

**CONCLUSIONS:** Our findings demonstrated that DP did not provide additional benefits to BMD or bone turnover markers compared to RT for the variables assessed. RT appears to be an effective way to improve markers of bone turnover in BCS. Further, RT maintained BMD at most sites; and may be an effective way to offset the negative changes that occur to bone as a result of cancer-related treatments and aging.

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2743 Board #15 June 1 9:30 AM - 11:00 AM

**Association between Sarcopenia Status and Bone Density Classification in Older Men and Women**

Harshvardhan Singh<sup>1</sup>, Daeyol Kim<sup>1</sup>, Michael Bembem, FACS<sup>1</sup>, Mark Anderson<sup>2</sup>, Debra Bembem, FACS<sup>1</sup>. <sup>1</sup>University of Oklahoma, Norman, OK. <sup>2</sup>University of Oklahoma Health Sciences Center, Oklahoma City, OK.  
(No relationships reported)

A simultaneous presence of muscle and bone weaknesses associated with frailty contributes to high fracture risk in the older population, however, the associations between sarcopenia, appendicular skeletal muscle mass (ASM), relative skeletal muscle mass index (RSMI), bone free lean body mass (BFLBM), muscle strength, and osteoporosis are not as well known.

**PURPOSE:** To examine the association between sarcopenia status and bone mineral density (BMD) classification and to determine relationships between ASM, RSMI, BFLBM, and BMD at total body, trochanter, femoral neck, total hip, and lumbar spine sites in older men (n=27) and women (n=33) (55-75 years).

**METHODS:** BMD at total body, dual proximal femur (trochanter, femoral neck, total hip) and lumbar spine sites, ASM, BFLBM, and RSMI were measured using DXA. Subjects were classified as sarcopenic if they had a RSMI < 7.26 kg/ht<sup>2</sup> for men and < 5.45 kg/ht<sup>2</sup> for women. Calcium intake and physical activity levels were assessed by questionnaires. **RESULTS:** The prevalence of osteopenia/osteoporosis was 52%/7% for men, and 67%/3% for women. Sarcopenia was found in 24% of women and 14% of men. Chi-square analysis showed that sarcopenia status was not significantly associated with osteoporosis status (p>0.05). RSMI, ASM, and BFLBM had significant (p<0.01) positive correlations (r=0.39-0.68) with BMD at total body, trochanter, femoral neck, total hip, and lumbar spine sites. Multiple regression analyses showed RSMI (p<0.01), BFLBM (p<0.001), and ASM (p<0.001) were significant predictors of BMD at total hip, femoral neck, and spine while ASM alone was a significant (p<0.001) predictor for trochanter BMD.

**CONCLUSION:** Sarcopenia status was not found to be associated with BMD classification in older individuals. Surrogate measures of muscle mass such as BFLBM and ASM were found to be the best predictors for BMD status at sites measured.

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2744 Board #16 June 1 9:30 AM - 11:00 AM

**Predictors of Bone Mass Density in Older Chinese Children**

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(No relationships reported)

**PURPOSE:** Predictors of bone mass density (BMD) were less examined among older Chinese children. Therefore, the purpose of this study was to investigate the association between physical activities, demographic factors and BMD in older Chinese children.

**METHODS:** Sixty three healthy Chinese children (boys = 25) aged 9 - 11 years participated in this study. Second, third and fourth middle phalanx BMD were measured by a MetriScan densitometer (Alara MetriScan, Hayward, CA) and mean values of these three phalanges were used in the analysis. Children's physical activity (PA) level was assessed by an ActiGraph GT3X+ accelerometer. Average time (minutes/day) spent on moderate to vigorous PA (MVPA) was calculated based on Freedson's age-specific cut-off counts. Body weight and height were also measured. Differences of BMD between genders were determined using independent-samples T test. Associations between physical activity, sex, age, weight, height, body mass index (BMI) and BMD were determined by Pearson correlations. Multiple regression analyses were used to further examine variables with significant associations.

**RESULTS:** BMD between boys and girls were similar (BMD: 0.220 ± 0.022 vs. 0.231 ± 0.023 g/cm<sup>2</sup>, p = 0.062). 90.5% of the children accrued at least 60 minutes of MVPA daily. No associations were found between sex, MVPA time, BMI and BMD. Age (r = 0.417, p = 0.001), weight (r = 0.486, p = 0.000), and height (r = 0.690, p = 0.000) were correlated with BMD. Further multiple regression analyses indicated that height (standardized coefficients β = 0.690, p = 0.000) was the only significant predictor of BMD and explained 47.6% of the BMD variance.

**CONCLUSIONS:** Height could be a predictor of BMD, accounting for 47.6% of the variance in BMD of older Chinese children.

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**E-21 Free Communication/Poster - Bone Physiology and Mechanics**

JUNE 1, 2012 7:30 AM - 12:30 PM

ROOM: Exhibit Hall

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2745 Board #17 June 1 11:00 AM - 12:30 PM

**The Effects of Dance Training on Children's Foot Arch**

Jai-yuan Zhang, Kuo-Wei Tseng, Yu-Hua Tseng, Hung-Wen Cheng. *Taipei physical education college, Taipei, Taiwan.*  
(No relationships reported)

Since many dancing movements enhance the tone of foot flexors and strengthen the foot arch, dancing has been used as a rehabilitation exercise to treat flat feet. However if the soft tissues are overstretched, the stability of the arch could be reduced.

**PURPOSE:** This study aimed to investigate if dance training in childhood changes normal foot arch development.

**METHODS:** 60 children were involved in the study: children in grade three who had dance training (DT3, 8.8±0.3 yrs, n=15); children in grade six who had dance training (DT6, 11.9±0.3 yrs, n=15); children in grade three who had no dance training (NT3, 9.0±0.3 yrs, n=15); and children in grade six who had no dance training (NT6, 11.9±0.3 yrs, n=15). The bilateral non-weight bearing navicular drop index (NDI) in a sitting position, and the even-weight bearing NDI in a standing position were measured for all subjects.

**RESULTS:** On the non-weight bearing test, NDI of DT6 and UT6 were lower than DT3 and UT3 (0.563±0.056 & 0.527±0.034 vs. 0.675±0.084 & 0.616±0.079, p<0.05). This result of non-weight bearing test shows that there is a natural maturation in NDI. On the weight bearing tests, NDI of UT6 were lower than UT3 (1.369±0.064 vs. 1.500±0.192, p<0.05), but there was no significant difference between DT3 and DT6. Thus, the development of the foot arch is gradual and maturation occurred with age in groups who had no dance training, but this was not the case for the groups who had dance training.

**CONCLUSION:** Dancing during childhood might not influence the natural development of foot arch. But over-stretching movements may decrease the elasticity of the soft tissue in the feet, resulting in lowered foot arch and structural dysfunction.

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2746 Board #18 June 1 11:00 AM - 12:30 PM

**Bone Blood Flow at Rest and During Exercise in Humans Measured with Positron Emission Tomography**

Kari Kalliokoski<sup>1</sup>, Kimmo Kaskinoro<sup>2</sup>, Jukka Kempainen<sup>1</sup>, Juhani Knuti<sup>1</sup>, Ilkka Heinonen<sup>1</sup>. <sup>1</sup>University of Turku, Turku, Finland. <sup>2</sup>Turku University Hospital, Turku, Finland.  
(No relationships reported)

**PURPOSE:** Due to methodological difficulties bone blood flow in physiologically demanding conditions such as during physical exercise remains poorly characterised in humans. In the present study we measured bone blood flow in healthy young women and men at rest and during exercise using positron emission tomography and radiowater.

**METHODS:** In women, bone blood flow was measured in femoral bone at rest and during one leg intermittent isometric exercise with increasing exercise intensities. In men, femoral bone blood flow was determined at rest and during dynamic one leg exercise and under two physiological perturbations: during moderate systemic hypoxia (14 % O<sub>2</sub>) at rest and during exercise and during intra-femoral infusion of high-dose adenosine at rest.

**RESULTS:** In women, isometric exercise increased femoral bone blood flow from rest (1.8 ± 0.6 ml · 100 g<sup>-1</sup> · min<sup>-1</sup>) to low intensity exercise (4.1 ± 1.5 ml · 100 g<sup>-1</sup> · min<sup>-1</sup>, p = 0.01), but it did not increase it further with increasing intensity (3.5 ± 0.8 ml · 100 g<sup>-1</sup> · min<sup>-1</sup> during moderate intensity and 3.7 ± 1.1 ml · 100 g<sup>-1</sup> · min<sup>-1</sup> during highest intensity, p = 0.86 for differences



between exercise intensities). In men, resting femoral bone blood flow was similar as in women ( $1.5 \pm 0.5 \text{ ml} \cdot 100 \text{ g}^{-1} \cdot \text{min}^{-1}$ ,  $p = 0.26$ ) and dynamic one leg moderate-intensity exercise increased it to  $4.2 \pm 1.2 \text{ ml} \cdot 100 \text{ g}^{-1} \cdot \text{min}^{-1}$ ,  $p < 0.001$ . Breathing of hypoxic air did not change femoral bone blood flow at rest ( $1.5 \pm 0.4 \text{ ml} \cdot 100 \text{ g}^{-1} \cdot \text{min}^{-1}$ ,  $p = 0.79$ ) or during exercise ( $5.0 \pm 1.4 \text{ ml} \cdot 100 \text{ g}^{-1} \cdot \text{min}^{-1}$ ,  $p = 0.14$ ). Finally, intra-arterial infusion of adenosine increased bone blood flow to  $5.7 \pm 2.4 \text{ ml} \cdot 100 \text{ g}^{-1} \cdot \text{min}^{-1}$ , to the level comparable with moderate intensity dynamic exercise ( $p = 0.09$ ).

**CONCLUSIONS:** Resting femoral bone blood flow is similar in healthy young women and men and increases by physical exercise, but appears to level off with increasing exercise intensities, at least during intermittent isometric exercise. Moreover, while moderate systemic hypoxia does not change bone blood flow at rest or during exercise, intra-arterially administered pharmacological vasodilator adenosine is capable of enhancing bone blood flow in humans.

2747 Board #19 June 1 11:00 AM - 12:30 PM

**Indices of Local Muscle Function Are Weak Predictors of Femoral Neck Bone Structure in Pediatric Females**

Jodi N. Dowthwaite<sup>1</sup>, Melissa E. Zajdel<sup>2</sup>, Carol A. Sames<sup>1</sup>, Paula F. Rosenbaum<sup>1</sup>, Tamara A. Scerpella<sup>3</sup>, <sup>1</sup>SUNY Upstate Medical University, Syracuse, NY. <sup>2</sup>Princeton University, Princeton, NJ. <sup>3</sup>University of Wisconsin- Madison, Madison, WI. (Sponsor: Jill A. Kanaley, FACSM)  
(No relationships reported)

As hip fracture risk may be established during growth, pediatric screening and intervention may benefit public health.

**PURPOSE:** Muscle and physical activity indices were tested as predictors of femoral neck (FN) structure in young girls.

**METHODS:** Pre-menarcheal girls (46 gymnasts, 30 non-gymnasts) reported Tanner breast stage (TB) and prior year non-aquatic physical activity (PAL). Height and weight were measured. Hologic DXA scans (whole body, left FN) yielded total body non-bone lean mass (FFM) and bone metrics. Dynamometers assessed non-dominant hand grip (GR) and left hip flexion/extension (Takei; Biodex). Parsimonious regression models were developed to predict FN indices.

**RESULTS:** For all but buckling ratio (BR), TB + hip flexion peak torque (HFPT) and TB + GR predicted FN indices (model  $r^2 = 0.34 - 0.55$ ;  $0.40 - 0.64$ , respectively) ( $p < 0.001$ ). However, FFM entry obliterated HFPT and GR explanatory value, also obliterating TB predictive value for all but cortical thickness. For all but BR, FN indices were well-predicted by FFM models. For all but cross-sectional moment of inertia, models included PAL, gymnast status (GYM) or PAL + GYM. For all but BR, entry of GYM supplanted PAL; TB + PAL + GYM predicted BR.

**CONCLUSIONS:** Pre-menarche, FN indices are a function of maturity and size (FFM) and/or PAL; local muscle indices are inferior predictors to GR (remote muscle function index) and FFM. PAL predictive value provides evidence that non-aquatic exercise is osteogenic during growth. GYM predictive value supports high impact loading as an osteogenic model, but may simply reflect greater gymnast mean PAL. However, prediction of BR by both PAL and GYM suggests independent benefits of greater activity doses and high impact loading modalities.

| Regression Results: Non-bone Lean Mass-Based Models for the Left Femoral Neck |                               |                     |       |                      |      |                               |       |                      |       |
|---|-------------------------------|---------------------|-------|----------------------|------|-------------------------------|-------|----------------------|-------|
| Femoral Neck Outcome  | Model Adjusted r <sup>2</sup> | Tanner Breast Stage |       | Total Body Lean Mass |      | PAL (Physical Activity Level) |       | GYM (Gymnast Status) |       |
|   |                               | St β                | PCC   | St β                 | PCC  | St β                          | PCC   | St β                 | PCC   |
| FNBM  | 0.79***                       | -                   | -     | 0.82***              | 0.86 | 0.19***                       | 0.37  | XX***                | XX*** |
| FNabMD  | 0.64***                       | -                   | -     | 0.63***              | 0.71 | 0.35***                       | 0.50  | XX***                | XX*** |
| NNbCSA  | 0.74***                       | -                   | -     | 0.84***              | 0.86 | -                             | -     | 0.20***              | 0.37  |
| NNCSMI  | 0.59***                       | -                   | -     | 0.77***              | 0.77 | -                             | -     | -                    | -     |
| NN CT   | 0.62***                       | 0.21*               | 0.24  | 0.42***              | 0.43 | 0.39***                       | 0.53  | XX**                 | XX**  |
| NN Z  | 0.65***                       | -                   | -     | 0.79***              | 0.80 | -                             | -     | 0.19**               | 0.31  |
| NN BR   | 0.41***                       | -0.25**             | -0.31 | -                    | -    | -0.37**                       | -0.33 | -0.26*               | -0.25 |

St β: standardized beta; PCC: partial correlation coefficient; FN: femoral neck; NN: narrow femoral neck; BMC: bone mineral content; abMD: areal bone mineral density; bCSA: bone tissue cross-sectional area; CSMI: cross-sectional moment of inertia; CT: cortical thickness; Z: section modulus; BR: buckling ratio.  
XX: GYM not included in the model presented, but inclusion of GYM yielded a more significant model in which PAL was no longer significant.  
\* < 0.05; \*\* < 0.01; \*\*\* < 0.001 for t significance of β.

2748 Board #20 June 1 11:00 AM - 12:30 PM

**Effect of Treadmill Versus Elliptical Exercise on Calcaneal Stiffness Index Among College Age Females**

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(No relationships reported)

Osteoporosis is a disease that affects many older individuals, resulting in a decrease in bone density. Yung, et al. (2005) concluded that involvement in impact loading sports was associated with greater stiffness index (SI) of the calcaneus when compared to nonimpact sports and abstinence from sports. However, comparisons between the effectiveness of impact and nonimpact exercise equipment on calcaneal SI is less clear.

**PURPOSE:** To examine the effect of treadmill versus elliptical exercise on calcaneal SI.

**METHODS:** Nine college-age females were recruited for this cross-sectional design study. The independent variables were the treadmill training group and the elliptical training group, and the dependent variable was the change in stiffness index (SI) of the calcaneus. Calcaneal SI was tested at the beginning and end of a 10-week training session. The Calcium Rapid Assessment Method was also used to assess dietary calcium intake among participants.

**RESULTS:** Pearson product correlation analysis did not indicate a significant relationship between dietary calcium intake and calcaneal SI and therefore calcium was eliminated as a covariate in subsequent analyses. Paired sample t-test for the entire sample indicated significant improvements in calcaneal SI over the 10-week training period ( $t = -3.01$ ,  $p = .02$ ). However, when the sample was split by exercise group, paired sample t-tests were not significant ( $p > .025$ ). An independent sample t-test comparing the treadmill to the elliptical training group and using change in calcaneal SI as the dependant variable was also not significant ( $p > .05$ ).

**CONCLUSION:** In conclusion both treadmill and elliptical training resulted in increases in calcaneal SI over a 10-week period but we were unable to detect significantly more benefit from treadmill training, which was counter to our hypothesis. According to this study, both treadmill and elliptical exercise can improve calcaneal SI among college age women.

2749 Board #21 June 1 11:00 AM - 12:30 PM

**Predicting Skeletal Side Dominance From Functional Dominance: DXA, pQCT And QUS Findings**

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(No relationships reported)

**PURPOSE:** Bone densitometry is typically performed on the “non-dominant” limb. While upper extremity functional dominance (writing hand) reliably predicts upper limb skeletal dominance, our experience suggested the same did not apply to the lower limb. In fact, the determination of lower extremity functional dominance is not straight forward. Consequently, the upper extremity dominance assumption is routinely extrapolated to the lower limb and densitometers are designed primarily for left hip scanning to accommodate the preponderance of right-handed individuals in the population. The aim of the current work was to determine the true nature of the association between functional and skeletal dominance of the lower limb. The ultimate goal is to establish a simple and reliable determinant of lower extremity skeletal dominance.

**METHODS:** 77 men (35.4±16.4 yrs) and 100 women (42.7±16.0 yrs) were recruited for bilateral femoral neck bone mineral density (FNBM; XR-800, Norland), calcaneal broadband ultrasound attenuation (BUA; QUS-2, Quidel), tibial peripheral quantitative computed tomography (XCT3000 Stratec) and limb anthropometry. Side dominance questionnaires and physical tasks were completed including the Waterloo Footedness Questionnaire, hop distance test, Pastor Day Marsden Test, handedness and footedness questions, and side preference for common postures (e.g. folding arms). Chi-square tests with crosstabs were run on all parameters using SPSS Version 19.

**RESULTS:** No significant association was observed between writing hand and any measure of lower limb skeletal dominance. Significant negative associations were found for strongest arm ( $p=0.01$ ) and kicking foot ( $p=0.04$ ) with FNBM dominance, and racquet hand with tibial cortical area at the 38% site ( $p=0.05$ ). Strongest arm was positively associated with dominant BUA ( $p=0.04$ ). A trend for lower limb skeletal dominance in the functionally non-dominant limb was observed for 85% of all bone parameters, excluding BUA.

**CONCLUSIONS:** Contrary to conventional thinking, skeletal dominance exists more commonly in the functionally non-dominant lower extremity. Findings bring into question the standard practice of densitometric scanning of the left lower extremity of right-dominant individuals when detection of minimum bone mass is desired.

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**2750** Board #22 June 1 11:00 AM - 12:30 PM

**Estrogen is Required for Mechanical Loading Induced Restoration of Bone Following Disuse**

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(No relationships reported)

Both estrogen and mechanical loading regulate bone maintenance. For example, ovariectomy (OVX) reduces bone mineral density (BMD) and estradiol (E<sub>2</sub>) replacement fully prevents this loss. Similarly, hindlimb unloading (HLU), a model of disuse, induces BMD loss and re-ambulation (REAMB) reverses this loss. In addition, HLU worsens OVX-induced bone loss; however, it remains unknown whether REAMB and/or exercise (EX) alter BMD following combined OVX+HLU.

**PURPOSE:** To determine whether E<sub>2</sub> influences the REAMB-induced and/or EX-induced restoration of BMD following HLU of OVX rats.

**METHODS:** Eighty-one 5 month old female Sprague-Dawley rats were randomized into the following groups: 1) Baseline controls, 2) OVX controls, 3) OVX+E<sub>2</sub> controls, 4) OVX+ 4 weeks HLU, 5) OVX+E<sub>2</sub>+HLU, 6) OVX+HLU+ 2 weeks REAMB, 7) OVX+E<sub>2</sub>+HLU+REAMB, 8) OVX+HLU+REAMB+ 2 weeks climbing, jumping, and balancing EX, or 9) OVX+E<sub>2</sub>+HLU+REAMB+EX. Serial DXA scans were performed to track total body bone characteristics throughout the study and peripheral quantitative computerized tomography (pQCT) was utilized to determine differences in distal femoral metaphyseal bone mineral characteristics between groups.

**RESULTS:** Total body BMD increased 4-8% in all animals receiving supplemental E<sub>2</sub>, while BMD did not change in animals without E<sub>2</sub>. OVX reduced trabecular (t)BMD at the distal femoral metaphysis by 35% ( $p \leq 0.001$ ) and OVX+HLU exacerbated this loss by an additional 52% ( $p \leq 0.001$ ), while also reducing cortical (c)BMD by 11% compared with Baseline controls ( $p \leq 0.001$ ). E<sub>2</sub> protected against the OVX+HLU induced bone loss at the femoral metaphysis. However, in the absence of E<sub>2</sub>, REAMB did not reverse the OVX+HLU induced bone loss. Surprisingly, REAMB+EX was severely detrimental to bone following OVX+HLU, resulting in tBMD and cBMD measurements that were 91% and 7% below baseline controls ( $p \leq 0.001$ ). Conversely, the addition of E<sub>2</sub> to REAMB or REAMB+EX protected against the OVX+HLU induced bone loss.

**CONCLUSION:** E<sub>2</sub> influences the mechanical loading induced restoration of BMD and in the absence of estrogen, moderate-intensity exercise is severely detrimental to the restoration of BMD following disuse.

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**2751** Board #23 June 1 11:00 AM - 12:30 PM

**Acute Bone Marker Responses to Whole-Body Vibration and Resistance Exercise in Postmenopausal Women**

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(No relationships reported)

No studies to date have investigated the acute bone turnover marker (BTM) responses to resistance exercise and whole-body vibration (WBV) in postmenopausal women.

**PURPOSE:** To investigate the acute BTM responses to high-intensity resistance exercise with and without whole-body vibration exercise in postmenopausal women.

**METHODS:** Eight women (58 ± 2 years) participated in this randomized crossover control study. DXA was used to measure bone mineral density (BMD) of the total body, lumbar spine, and left and right hip. 1-RM testing was conducted for leg press, seated row, hip extension, shoulder press, hip abduction, and hip adduction isotonic resistance exercises. Subjects performed 3 blood draw sessions in randomized order separated by 2-week washout periods: 1) WBV + resistance exercise (WBV); resistance exercise only (RES); and no exercise (CON). For WBV, subjects stood barefoot, knees slightly flexed on vibration plate for 5, 1-minute bouts at 20 Hz and 1.25 mm (amplitude) separated by 1-minute rest intervals, followed by the resistance exercise. For RES, subjects completed 3 sets of 10 repetitions 80% 1-RM. WBV and RES had blood draws before (Pre), and immediately post (IP) exercise and CON had 2 blood draws at baseline and after 60 minutes of sitting. WBV also included a blood draw between the whole-body vibration and resistance exercise (VibP). Serum samples were measured for bone-specific alkaline phosphatase (Bone ALP) and tartrate-resistant acid phosphatase 5b (TRAP5b) with enzyme immunoassay (EIA) kits.

**RESULTS:** Bone ALP showed a significant time effect ( $p < 0.05$ ), increasing from Pre to IP. TRAP5b had a trend ( $p = 0.061$ ) for condition × time interaction as it increased Pre to IP only for WBV (Pre - 2.433 ± 0.327 U/L vs. IP - 2.659 ± 0.347 U/L). Neither marker showed a significant response at VibP. There were trends for WBV ( $p = 0.062$ ) and RES ( $p = 0.074$ ) TRAP5b % increases Pre-IP to be greater than the CON condition (10.2 ± 2.8%; 6.4 ± 3.1%; -0.60 ± 2.8%, respectively). TRAP5b % change Pre to VibP was significantly related to total body BMD ( $r = 0.82$ ,  $p < 0.05$ ).

**CONCLUSIONS:** The addition of whole-body vibration did not alter bone formation marker responses to acute resistance exercise, however, it elevated bone resorption levels immediately post resistance exercise.

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**2752** Board #24 June 1 11:00 AM - 12:30 PM

**Focused Extracorporeal Shockwave Therapy For Non-Invasive Bone Stimulation In Scaphoid Non-Union**

Karsten Knobloch<sup>1</sup>, Robert Kraemer<sup>1</sup>, Frank Baetje<sup>2</sup>, Juergen Kopp<sup>3</sup>, Peter M. Vogt<sup>1</sup>. <sup>1</sup>Plastic, Hand and Reconstructive Surgery, Medical School Hannover, Hannover, Germany. <sup>2</sup>Shockwave Center, Hannover, Germany. <sup>3</sup>Plastic, Hand and Reconstructive Surgery, BG Frederikenstift, Hannover, Germany.  
(No relationships reported)

**PURPOSE:** Scaphoid non-union is a challenging problem. Bone stimulation using extracorporeal shockwave therapy (ESWT) has been traditionally applied on long bone pseudarthrosis only. We hypothesized that focused extracorporeal shockwave therapy is able to induce bony consolidation in scaphoid non-union both, after primary or secondary failed procedures.

**METHODS:** In a pilot case series a total number of 21 patients (76% males, mean age 36±15yrs, 30% active smokers) with persistent symptomatic scaphoid non-union were included in this pilot study. Distinct patterns of prior treatment were evident: a) no primary or secondary surgery (n=9), b) no primary surgery, secondary Matti Russe plasty with iliac bone grafting (n=9) or 1,2-ICSR vascularized graft (n=1), c) primary Matti Russe plasty, secondary STT arthrodesis (n=1) or others (n=2). A total number of 2.1±0.8 ESWT sessions (range 1-3) of high-energy focused ESWT were applied (Storz Duolith, 5000 impulses) 5±4 months following the last surgery. Level of evidence: IV (Case series).

**RESULTS:** In 95% a radiological consolidation of the scaphoid non-union was achieved (20 out of 21 patients) at 22±10 months of follow-up. No adverse effects of focused ESWT were noted. Patients' pain levels were considerably low with 2.0±2.2 (0=no pain, 10=severe pain) at 22±12months of follow-up. Only mild daily impairment with DASH scores at follow-up of 9±15 and a Michigan Hand Outcome Questionnaire (MHQ) with 85±18points at the affected side were noted in line with high patient satisfaction.

**CONCLUSION:** We conclude that focused ESWT is an effective non-invasive measure for scaphoid non-union both, in primary and in failed secondary cases in this pilot study.

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2753 Board #25 June 1 11:00 AM - 12:30 PM

**Effect Of Pre-exercise Feeding On The Metabolic Response Of Bone To Treadmill Running**

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(No relationships reported)

**PURPOSE:** Feeding suppresses resting bone resorption but its effect on the response to acute weight-bearing exercise is unknown. We examined the effect of a mixed meal on the bone metabolic response to subsequent treadmill running.

**METHODS:** Ten active males aged 28 ± 4 y completed two, counterbalanced, 8 d trials. After a 3 d standardised diet, participants performed 60 min of treadmill running at 65% VO<sub>2max</sub> at 1000 h on Day 4 after an overnight fast (FAST) or a standardised breakfast (FED) taken at 0815 h. Blood was collected at baseline, before exercise, during exercise, for 3 h postexercise and on four follow-up days (FU1-FU4). Plasma was analysed for C terminal telopeptide region of collagen type 1 (β-CTX), N-terminal propeptides of procollagen type 1 (PINP), osteocalcin (OC), bone alkaline phosphatase (bone ALP), parathyroid hormone (PTH), albumin-adjusted calcium (ACa), phosphate (PO<sub>4</sub>), osteoprotegerin (OPG), cortisol, leptin and ghrelin. Data (mean±1SD) were analysed using linear mixed model ANOVA, with *post hoc* analysis by Dunnett's or Student Newman-Keuls tests.

**RESULTS:** β-CTX was the only bone marker affected by feeding. The decrease in pre-exercise β-CTX was greater (P<0.001) in FED (0.52±0.23 μg·L<sup>-1</sup> to 0.27±0.12 μg·L<sup>-1</sup>; -47%) compared with FAST (0.56±0.24 μg·L<sup>-1</sup> to 0.40±0.15 μg·L<sup>-1</sup>; -26%). During exercise, βCTX concentrations increased in both groups (to 0.35±0.18 μg·L<sup>-1</sup> in FED and 0.40±0.13 μg·L<sup>-1</sup> in FAST) and, at 1 h post-exercise, were not significantly different from baseline (FED: 0.49±0.21 μg·L<sup>-1</sup>; FAST: 0.48±0.18 μg·L<sup>-1</sup>). At 3 h post-exercise, concentrations were decreased (P<0.001) from baseline in FAST (0.36±0.14 μg·L<sup>-1</sup>; -33%), and were lower (P<0.001) than in FED (0.46±0.17 μg·L<sup>-1</sup>). PINP increased (P<0.001) during and immediately following exercise, whereas OC was decreased (P<0.001) after 30 min of exercise but was not different from baseline thereafter. ACa, PO<sub>4</sub>, PTH, OPG, cortisol, leptin and ghrelin all responded to exercise but were not significantly influenced by feeding.

**CONCLUSION:** Feeding suppressed β-CTX at rest but did not attenuate the increase in bone resorption during weight-bearing exercise. Indeed, β-CTX was higher in FED than in FAST after 3 h of recovery. These findings suggest no benefit of pre-exercise feeding in modulating the bone metabolic response to exercise.

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2754 Board #26 June 1 11:00 AM - 12:30 PM

**Vitamin D Status in Female Endurance Runners and Controls Based in the United Kingdom**

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(No relationships reported)

Vitamin D is important for musculoskeletal health but insufficiency is common in the United Kingdom (UK). Vitamin D insufficiency in female runners could contribute to increased risk of stress fractures or future osteoporosis as well as other performance related dysfunction.

**PURPOSE:** This study examined whether 25-hydroxy vitamin D (25-OH D) differed between female endurance runners and less active women based in the United Kingdom; whether any seasonal variation in 25-OH D was observed in the runners and examined factors related to vitamin D status.

**METHODS:** Serum 25-OH D was assessed in late spring in 52 endurance runners and 27 controls who did not exceed exercise recommendations for health. All women were aged between 18 and 45 years. Measurements were repeated in the fall in 38 of the runners. Supplement use and vacations were assessed by questionnaires. Vitamin D concentrations were logarithmically transformed to achieve normal distribution prior to comparisons of means by analysis of variance.

**RESULTS:** The runners had lower body mass index than controls (19.8 ± 1.3 vs 22.8 ± 3.4 kgm<sup>-2</sup>) although height did not differ significantly between groups. Serum 25-OH D concentrations in spring were (median [inter-quartile range]) 90.8 [69.3-120.1] nmol/l in runners and 60.6 [49.3-94.6] nmol/l in controls. Log<sub>10</sub> 25-OH D concentrations were significantly higher in runners than controls (mean [SE] 1.98 [0.02] and 1.85 [0.04] respectively; p=0.004) but 25-OH D in runners did not differ between spring and autumn (2.01 [0.03] and 1.99 [0.02] respectively; p=0.694). Log<sub>10</sub>25-OH D was significantly higher in women who took supplements (p=0.003) and in those who had attended warm weather training camps or holidays in the previous 6 months (p=0.012).

**CONCLUSIONS:** Female endurance runners had better vitamin D status in spring than young female controls, with their values being within the range suggested as optimal. The runners did not demonstrate the seasonal changes that have been reported in previous studies in the United Kingdom. The better vitamin D status in runners than controls may be explained by higher sunshine exposure, consumption of supplements and low body fat content.

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2755 Board #27 June 1 11:00 AM - 12:30 PM

**Effects Of Estrogen Deficiency And Resistance Exercise On Serum Undercarboxylated And Carboxylated Osteocalcin**

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(No relationships reported)

Osteocalcin (OCN), a bone formation marker, has two forms: undercarboxylated (uOCN) and carboxylated (cOCN). Each has been linked with differential effects on bone and other tissues. Independent changes in uOCN and cOCN have not been assessed in response to increased bone turnover as occurs with estrogen (E) deficiency.

**PURPOSE:** To determine the effect of E suppression, via gonadotropin-releasing hormone agonist (GnRHag), on serum uOCN and cOCN.

**METHODS:** Premenopausal women (n=15, 36±7 yrs) received 5 months of GnRHag, were randomized to E or placebo (PL) add-back, and half in each drug group were also randomized to resistance exercise 3d/wk (EX). Effects of drug and exercise on the change in serum uOCN and cOCN from baseline to 5 mo were analyzed by ANOVA.

**RESULTS:** uOCN increased only in PL (p=0.046), and there was no EX effect. Due to a trend for a drug\*EX interaction for cOCN (p=0.057), groups were analyzed separately. In PL, there was no EX effect on cOCN; however, a trend for increased cOCN in the E+EX group was seen (p=0.07).

**CONCLUSIONS:** Our findings suggest that E suppression results in increased uOCN and cOCN, which may be indicative of increased bone turnover; however, these data require support from measures of bone resorption. Interestingly, E add-back attenuated the increase in uOCN and stimulated cOCN but only when combined with EX. This result must be interpreted cautiously but may suggest a bone formation effect of exercise only in the E-replete condition.

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2756 Board #28 June 1 11:00 AM - 12:30 PM

**Lifelong Physical Activity and Knee Osteoarthritis Development in Mice**

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(No relationships reported)

Knee osteoarthritis (OA) is a debilitating disease that affects an estimated 27 million Americans. Physical activity may be a way to treat and prevent its occurrence.

**PURPOSE:** To examine the effect of lifelong physical activity on the development of knee OA.

**METHODS:** Fifteen C57Bl/6J mice (8 male and 7 female) were individually caged with a running wheel, magnetic sensor and digital odometer, and fifteen mice (7 male and 8 female) individually housed without a running wheel. Each mouse was provided with standard chow and water ad libitum. Running wheel distance, duration and speed were recorded daily. A diagnostic ultrasound (SONOS 5500 Ultrasound and 15-6L ultrasound probe) was used to measure medial and lateral knee joint space in both hind limbs every month until the end of mice's lifespan.

**RESULTS:** Right medial ( $p=0.002$ ), right lateral ( $p<0.0001$ ), left medial ( $p=0.01$ ), and left lateral ( $p=0.007$ ) knee joint spaces were significantly smaller from months three to nine in the physically active C57Bl/6J mice. However, there was no significant difference between all knee joint spaces of the running and sedentary C57Bl/6J mice throughout the remainder of the lifespan. All hindlimb knee joint spaces significantly declined with aging ( $p<0.0001$ ).

Table 1. RM Joint Space (mm) in RUN and SED mice.

| Group | 3 Months | 16 Months | 30 Months |
|-------|----------|-----------|-----------|
| RUN   | .37±.003 | .13±.002  | .07±.002  |
| SED   | .39±.004 | .13±.007  | .07±.001  |

**CONCLUSIONS:** During the first 9 months of the lifespan, physical activity seemed to protect the joint from degeneration, however; after that there was no protective benefit. This may be due to the fact that C57Bl/6J mice are genetically known to develop OA at 9 months of age. Physical activity may have no impact on this genetic predisposition. But in those not genetically predisposed to develop OA, physical activity may be a method to reduce their risk of OA.

2757 Board #29 June 1 11:00 AM - 12:30 PM

### The Effect Of Life-long Endurance Training On The Mechanical Properties Of The Human Patellar Tendon, In Vivo

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(No relationships reported)

It remains unknown if life-long habitual endurance exercise can influence the aging human tendon. We hypothesise that life-long habitual endurance exercise can influence the mechanical properties of the human patellar tendon.

**PURPOSE:** To examine the effect of aging and life-long habitual endurance exercise on the mechanical properties of the human patellar tendon, *in vivo*.

**METHODS:** We recruited 15 healthy injury free master athletes (old trained men, O-Tr; running distance of 44±17 km/wk over 28±9 yrs (mean±SE)), 12 old untrained controls (O-Un) as well as 10 young men matched for current running distance (young trained, Y-Tr; 48±12 km/week) and 12 young untrained controls (Y-Un). MRI was used to assess whole tendon dimensions. Tendon mechanical properties were assessed with use of simultaneous force and ultrasonographic measurements during ramped isometric contractions. Data was analyzed using 2-way ANOVA.

**RESULTS:** For tendon CSA normalized to bodyweight an increase with age ( $P=0.0004$ ) and training ( $P=0.0003$ ) was observed. There was a significant interaction between age and training ( $P=0.02$ ), namely the master athletes had a greater CSA than any of the other groups (Tendon CSA: O-Tr, 6.4±0.3; O-Un, 4.8±0.2; Y-Tr, 4.8±0.2 and Y-Un, 4.4±0.2 mm<sup>2</sup>/kg<sup>2/3</sup>). The same relation was found using the non-normalized CSA. There was also an effect of age on max tendon stress ( $P<0.001$ ) (Max tendon stress: O-Tr, 45±3; O-Un, 55±4; Y-Tr, 74±5 and Y-Un, 61±7 MPa), which was mostly driven by the difference in CSA since no significant effect of age was observed on the max force. No other differences were found.

**CONCLUSIONS:** To our knowledge, these are the first data that demonstrate a higher tendon CSA in male master athletes. The results suggest that life-long habitual endurance exercise may reduce tendon stress by increasing tendon CSA thereby possibly reducing the risk of injury compared to old or young untrained/trained controls.

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2758 Board #30 June 1 11:00 AM - 12:30 PM

### The Effect Of Post Pubertal Food Restriction On Bone Strength

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(No relationships reported)

Low body weight is a risk factor for osteoporosis and weight loss has been associated with bone loss in animal and human models. However food restriction has also been linked with an increased life span. Food restriction during growth may affect calcium, protein and hormone levels and reduce peak bone mass altering cortical and trabecular bone structure. Timing of weight loss may be a factor because the pubertal years are a major period for bone accrual.

**PURPOSE:** To determine the effect of 30% food restriction in post pubertal (day 65) female rats on bone strength.

**METHODS:** 34 female Sprague Dawley rats (day 23) were randomly assigned into two groups, control (C) and food restriction (FR). On day 65, FR animals were fed 70% of control ad lib food intake for 6 weeks with a food preparation that was replete in micronutrients. After 6 weeks, right femurs were dissected and mechanically tested using a 3-point bend assay. Total fat from retroperitoneal and gonadal regions and triceps surae muscle were weighed.

**RESULTS:** 30% food restriction resulted in an 18% lower body weight compared to control. Statistical differences were found in total fat (13.14g ± 9.10g vs. 3.66g ± 1.50g,  $p<.05$ ) and percent muscle to fat (21.39% ± 15.44% vs. 61.95% ± 34.92%,  $p<.05$ ). However, no significant differences were found in mechanical strength between groups, but normalized to body weight peak moment (470.44 Nm/Kg ± 187.02 Nm/Kg vs. 606.97 Nm/Kg ± 52.37 Nm/Kg,  $p<.05$ ) and stiffness (32736.90 Nmm<sup>2</sup> ± 13979.51 Nmm<sup>2</sup> vs. 51429.80 Nmm<sup>2</sup> ± 5622.55 Nmm<sup>2</sup>,  $p<.05$ ) were significantly greater in the FR group. **Discussion:** Food restriction did not have a negative effect on cortical bone strength in fact strength relative to body weight showed FR bones were stronger. FR fat pads were 72% lower with muscle weights equal between groups indicating that body weight significantly decreased by fat mass. Increased percent muscle to fat weight indicates that lean body mass was maintained in the FR group.

**CONCLUSION:** Lower body weight resulting from short-term food restriction in post pubertal female rats resulted in a significant decrease in fat mass and an increase in bone strength relative to body weight. Food restriction post puberty has a positive effect on bone strength in the short term when micro nutrients are replete and muscle mass is maintained. Supported by NIAMS/NIH 1R03AR0575.

2759 Board #31 June 1 11:00 AM - 12:30 PM

### Bone Density Changes Following Stress Fracture in Female Athletes

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(No relationships reported)

Athletes who sustain stress fractures (FX) typically reduce weight-bearing exercise for 6-8 weeks before returning to loading activities. This reduction in loading may cause bone loss increasing the risk for low bone mineral density (BMD) and FX recurrence.

**PURPOSE:** To evaluate bone changes during the detraining and retraining phases following FX injury.

**METHODS:** A prospective, case-control design assessed bone changes in 8 cases diagnosed with FX and 7 matched controls (C). BMD and content (lumbar spine and femoral neck), hip geometric properties (section modulus and cross sectional area) and body composition were assessed at baseline (within 14 days of FX) and after 6-8 weeks, and 6-8 months using dual energy x-ray absorptiometry. Bone changes were evaluated between baseline and 6-8 weeks (detraining phase) and 6-8 weeks and 6-8 months (retraining phase). Repeated measures analysis of variance with a between-subject group factor was used to determine whether changes differed between FX and control groups. Level of significance was defined as  $P<0.05$ .

**RESULTS:** Three sacral, 2 femoral and metatarsal and 1 tibia FX were diagnosed. At baseline, cases were significantly shorter (FX: 1.639(0.009), C: 1.701(0.016) m,  $p=0.007$ ) and reported a higher prevalence of FX history than C (50% vs 0%), no other significant differences were found between groups. During the detraining phase, there were no statistically significant changes in menstrual function, body fat %, BMD or hip geometric properties in cases or controls. During the retraining phase, femoral neck BMD increased significantly in the injured leg of FX cases (mean (SE) 1.042(0.102) to 1.070(0.102) g/cm<sup>2</sup>,  $p=0.004$ ) with no significant change in the contra-lateral leg (1.036 (0.102) to 1.054(0.109) g/cm<sup>2</sup>). No significant bone gain was found in control subjects (healthy or "injured legs"). Changes in other bone parameters were small and not statistically significant in either group.

**CONCLUSION:** Six-to-eight weeks of reduced training following FX does not cause significant bone loss. Significant bone gain did occur in the injured leg of case athletes within 8-months

following FX once training had resumed. It is not clear why BMD increased above baseline values during retraining but it does seem that factors other than BMD may be associated with FX recurrence.

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**2760 Board #32 June 1 11:00 AM - 12:30 PM**  
**Mechanical Loading With Or Without Weight-bearing Activity: Influence On Bone Strength In Female Adolescent Athletes**

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(No relationships reported)

Bone health is considered not to benefit from water-based sports due to their weight-supported nature, but available evidence primarily relies on DXA technology.

**PURPOSE:** The purpose was to investigate musculoskeletal health in the upper and lower body in well-trained adolescent female athletes using pQCT and compare these athletes with less active, age- and sex- matched peers.

**METHODS:** Bone mineral content, volumetric cortical and trabecular BMD, total and cortical area, and bone strength were assessed at the distal and proximal tibia and radius in four groups of adolescent females (mean age 14.9 years) comprising water polo players (n=30), gymnasts (n=25), track and field athletes (n=34), and non-active controls (n=28).

**RESULTS:** Water polo players did not show any benefit in bone strength or muscle size in the lower leg when compared with controls. In contrast, gymnasts showed 60.1% and 53.4% greater bone strength at the distal and proximal tibia, respectively, than non-active females ( $p < 0.05$ ). Similarly, track-and-field athletes displayed 33.9% and 14.7% greater bone strength at the distal and proximal tibia, respectively, compared with controls ( $p < 0.05$ ). In the upper body, water polo players had 31.9% greater bone strength at the distal radius, but not the radial shaft, and 15.2% larger forearm muscle cross-sectional area than controls ( $p < 0.05$ ). The greatest musculoskeletal benefits in the upper body were found in gymnasts.

**CONCLUSIONS:** Despite training at an elite level, female water polo players did not show any benefits in musculoskeletal health in the lower leg and only limited benefits in the upper body when compared with non-active girls.

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**2761 Board #33 June 1 11:00 AM - 12:30 PM**  
**Ultrasound Evaluation Of The Patellar Tendon Cross-sectional Area And Its Relation To Maximum Force**

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(No relationships reported)

It is widely accepted that the maximal force which can be produced by a muscle is directly proportional to the cross-sectional area (CSA) of its accompanying tendon. Mainly in rehabilitation this relation has to be considered regarding tendon strain with respect to knee joint positioning and related output force. Nevertheless it is unclear, if the theoretical basis could be reproduced in humans in rehabilitation relevant positions of the knee joint.

**PURPOSE:** To measure patella tendon CSA in different angle positions and contraction modes related to maximum output muscle force.

**METHODS:** In this pilot study eight healthy subjects ( $174 \pm 7.4$  cm,  $71.62 \pm 14.66$  kg,  $27.3 \pm 7.7$  yrs..) underwent a maximum isometric strength measurement of knee extension in a seated position at fixed angles ( $90^\circ$  and  $30^\circ$  knee flexion). During the measurements high resolution ultrasonography Patella tendon CSA was measured 2cm from the tendon insertion in the two position angles during rest and at 100% maximal voluntary contraction (MVC) in transverse scan. Data were analysed using T-test and Pearson correlation ( $\alpha = 0.05$ ).

**RESULTS:** Higher maximum force was measured in  $90^\circ$  ( $127.46 \pm 47.74$  F[N]) compared to  $30^\circ$  ( $94.59 \pm 36.10$  F[N]). A statistical significant difference was found between  $90^\circ / 30^\circ$  ( $73.51 \pm 7.22 / 79.22 \pm 17.89$  mm<sup>2</sup>  $p < 0.05$ ) measuring CSA during rest. No statistical significant difference could be shown during contraction ( $78.34 \pm 15.65 / 73.86 \pm 19.70$  mm<sup>2</sup>  $p > 0.05$ ). When normalizing CSA to output force (CSA/F[N]) and to CSA difference between rest and MVC ( $\Delta T / F[N]$ ) it could be shown that less force is related to a thicker tendon during rest and to a greater CSA reduction during contraction. No statistical significant correlation was found between CSA thickness during rest and maximum force in both angle positions ( $p > 0.05$ ) and between CSA reduction during contraction and maximum force ( $p > 0.05$ ).

**CONCLUSION:** Different angle positions can affect tendon thickness, while maximum muscle force production is depending on angle position. These findings might have impact in clinical practice due to the fact that patellar tendon has less strain in  $30^\circ$  in comparison to  $90^\circ$  and this might be related mainly to force and not to tendon CSA.

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**2762 Board #34 June 1 11:00 AM - 12:30 PM**  
**The Painful Shoulder: Ultrasonographic Measurements of Supraspinatus Thickness, Pain Scores and Treatment**

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(No relationships reported)

Shoulder injury and pain complaints are common in the primary care, orthopedic and physiatric outpatient setting. The supraspinatus tendon is a commonly involved tendon in rotator cuff injuries. Musculoskeletal ultrasound is becoming a popular tool to aid in the diagnosis of pathologic conditions of the supraspinatus tendon.

**PURPOSE:** To determine whether a relationship may exist between supraspinatus thickness and pain scores among patients who present with a primary complaint of shoulder pain. We hypothesize that a positive correlation exists and that this could aid clinical development of targeted treatment strategies and earlier identification of those who require a more aggressive therapeutic approach.

**METHODS:** A retrospective analysis of supraspinatus thickness was performed by analyzing ultrasonographic shoulder examinations of patients who presented to the Columbia University musculoskeletal clinic with a primary complaint of shoulder pain. This included 58 separate shoulder studies among 52 different patients. An average thickness was obtained by utilizing the DICOM ultrasonographic software ruler tool. Outpatient records were reviewed including pertinent follow-up visits. Pain scores and treatment at the time of presentation and follow-up were recorded.

**RESULTS:** There was no correlation (Pearson correlation = -0.008) found between supraspinatus tendinous thickness and pain scores at the time of presentation. Average supraspinatus thickness was found to be  $0.506\text{cm} \pm 0.113$  among women and  $0.556\text{cm} \pm 0.157$  among men. Average pain score was found to be  $5.4 \pm 2.2$  among women and  $5.7 \pm 2.28$  among men on initial evaluation. Of those who followed-up, an average pain score at the time of re-assessment was  $3.5 \pm 2.63$ . 73% of patients were referred for physical therapy, 8% were referred for surgical evaluation and 27% underwent a steroid injection upon initial evaluation.

**CONCLUSIONS:** This study did not identify a correlation between ultrasonographically identified supraspinatus thickness and pain scores for patients who present with a primary complaint of shoulder pain. The majority of patients underwent conservative management. Future research should continue to distinguish ultrasonographically identifiable risk factors for the development of shoulder pathologies.

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**2763 Board #35 June 1 11:00 AM - 12:30 PM**  
**Protein Consumption And The Occurrence Of Osteoporosis**

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(No relationships reported)

**PURPOSE:** In many previous studies about amount of dietary protein effect on the risk of the osteoporosis, have showed conflicting results. In those studies, subjects and methods were inconstant and study result from the Asian population was insufficient. Therefore we tried to investigate the relationship between risk of the osteoporosis and the dietary protein of the Korean adults.

**METHOD:** We used the data from Korean National Health and Nutrition Examination Survey 4 (KNHANES 4; 2008-2009) for analysis. Participant who were 19 year-old or over and had never been treated for osteoporosis were included for analysis. Assessment of dietary intake obtained by 24-hour recall method and participants were grouped by the tertile of the amount of protein intake. The diagnostic criteria for the osteoporosis was lumbar or femur neck bone mineral density T-score  $\leq -2.5$  for this study. To analyze the influence of the amount of daily protein intake to the occurrence of osteoporosis, logistic regression analysis was used and the associated factors were adjusted through 4 steps.

**RESULTS:** Total 6,461 subjects were included in this study and 624 of among those were classified to the osteoporosis. For the lumbar osteoporosis, the highest tertile protein intake group has significantly lower odds compared to the lowest tertile group (OR 0.695, 95% CI 0.508–0.952) for women. But the significance was lost after associated factors were adjusted. For men, the highest tertile group has significantly lower odds compared to the lowest tertile group and it kept significance even after the associated factors were adjusted (OR 0.519, 95% CI 0.284– 0.949).

**CONCLUSION:** In this study, we found that sufficient daily protein intake is related with low occurrence of osteoporosis in Korean adults. To confirm the preventive effect of sufficient protein intake, further prospective study might be needed.

**2764 Board #36 June 1 11:00 AM - 12:30 PM**  
**Volumetric Bone Density, Bone Strength in Radius and Tibia in Healthy Chinese Population with Peripheral Quantitative Computed Tomography**  
Chi Kei Li<sup>1</sup>, Abdulaziz Farooq<sup>1</sup>, Bruce Hamilton<sup>1</sup>, Hakim Chalabi<sup>1</sup>, Jean Woo Wong<sup>2</sup>. <sup>1</sup>Aspetar, Doha, Qatar. <sup>2</sup>Chinese University of Hong Kong, Hong Kong, SAR, China.

(No relationships reported)

Peripheral Quantitative Computed Tomography (pQCT) measure volumetric bone density (BMD) of cortical (Cort) and trabecular (Trab) compartments separately in addition to calculating torsional bone strength defined by Polar strength strain index (polar SSI). It is independent of rotation and better reproducible compared with axial SSI which defined as the bending strength with respect to X and Y axis. Since remodeling always occurs early in Trab, unlike Dual Energy X-ray Densitometry which measure only areal bone mineral density, pQCT can monitor metabolic change quickly and precisely. However, baseline database is still limited especially in weight bearing sites (eg. lower limb).

**PURPOSE:** To provide a reference database of BMD and bone strength in radius (R) and tibia (T) for healthy Chinese population.

**METHODS:** A total of 183 males, 206 females aged between 20 - 70 y were scan with pQCT (Stratec XCT3000) on their non-dominant side distal (4%) and middle one third (33%) of R and T. BMD of Total, Cort and Trab region were assessed and polar SSI was calculated.

**RESULTS:** Males presented with significant higher values for all parameters (P<=0.036) compared with females except Cort BMD at T4%. Total BMD at R4% were higher compared to T4% (P<0.001) and Cort BMD at R33% were higher compared to T33% (P<0.001) in both gender. However, Trab BMD at R4% were lower compared to T4% (P<0.001) in both gender. When all parameters were stratified by gender and studied by age, data showed that Total and Trab BMD at R4% and T4% declined significantly in females after 50y (P<0.05) while males declined significantly after 60y (P<0.05). Cort BMD at R33% in females declined significantly after 50y while males declined significantly after 60y (P<0.05). Cort BMD at T33% and Polar SSI in females declined significantly after 50y while in males were stable across age groups (P<0.05).

**CONCLUSIONS:** This information is important in providing reference data for monitoring change in bone mineral density and bone strength using pQCT within a Chinese population.

**2765 Board #37 June 1 11:00 AM - 12:30 PM**  
**An Examination of Foot Parameters in Subjects with and without Chronic Ankle Instability**

Sara Naguib, Kathy Liu, Thomas W. Kaminski, FACSM. *University of Delaware, Newark, DE.*

(No relationships reported)

The foot is the base of the body's kinetic chain; therefore structure and function are essential in providing stability. Even minor differences in intrinsic foot structure can affect the proximal joints in the body and play a role in ankle sprains.

**PURPOSE:** To determine if differences in measurements of intrinsic foot structures exist in subjects with and without chronic ankle instability.

**METHODS:** A total of 47 physically active subjects participated in this study (30 females, 17 males, age=21.9±2.7 yrs., height=168.2±9.1 cm, mass=64.9±13.0 kg). All participants completed the Cumberland Ankle Instability Tool, resulting in 50 ankles in the stable group and 35 ankles in the unstable group. Measurements included: navicular height (NH), plantar fascia thickness (PFT), medial longitudinal arch angle (MLAA), and forefoot to rearfoot ratio (FR). NH was measured as the height of the navicular in a non-weight bearing stance. PFT was quantified using musculoskeletal ultrasound. MA was the angle of medial malleolus to the navicular to the base of the first metatarsal. FR was measured as the ratio of the width of the forefoot to rearfoot. All data were analyzed using an independent t-test (p<0.05).

**RESULTS:** Interestingly there were no significant differences in foot measurements between groups.

| Foot Parameter | Stable (mean±SD) | Unstable (mean±SD) | p-value |
|----------------|------------------|--------------------|---------|
| NH (mm)        | 4.10±0.63        | 3.95±0.59          | 0.086   |
| PFT (mm)       | 0.99±0.16        | 1.05±0.15          | 0.216   |
| MLAA (°)       | 149.48±8.70      | 147.08±6.51        | 0.151   |
| FR             | 1.92±0.17        | 1.85±0.16          | 0.114   |

**CONCLUSION:** Although no significant differences between the two groups were observed, all variables were trending towards statistical significance. Further research examining other characteristics and structures is necessary for a full understanding of the foot. A better understanding of the changes that occur in the foot after ankle sprains are essential to the prevention of ankle instability. Supported by NIH Delaware INBRE Grant P20RR016472-11.

**2766 Board #38 June 1 11:00 AM - 12:30 PM**  
**Site-Specific Increasing Bone Mass by Resistance Exercise**  
Chang-Sun Kim<sup>1</sup>, Jin-Hwan Yoon<sup>2</sup>, Dong-Ho Park<sup>3</sup>, Soon-Gil LIM<sup>4</sup>, Nam-Sub Back<sup>4</sup>. <sup>1</sup>Dongduk Women's University, Seoul, Korea, Republic of. <sup>2</sup>Hannam University, Daejeon, Korea, Republic of. <sup>3</sup>Inha University, Incheon, Korea, Republic of. <sup>4</sup>Yongin University, Gyeonggi, Korea, Republic of.

(No relationships reported)

**PURPOSE:** It is now established that mechanical load such as exercise is important for increase and consequently maintenance of bone mass. However, site differences in change of bone mineral density (BMD) by resistance exercise are unclear. The aim of this study was to evaluate the changes of BMD between the fore- and hind-limb induced by resistance exercise. This study was investigated effects of 12 weeks resistance exercise by climbing an incline on the changes of BMD and serum bone metabolic markers in growing rats.

**METHODS:** Twelve male F344 rats(203±12.4g), aged 8 weeks, were randomly divided into two groups: control rats(CON, n=6) and resistance exercise rats(EXE, n=6). EXE group performed training that climbed the ladder at 8 times a day, 5day a week for 12 weeks. After experimental period, rats were sacrificed and femur and humerus were removed for analysis of BMD and bone mineral content (BMC) by dual energy X-ray absorptiometry (DEXA, Lunar DPXL, USA). Serum calcium (Ca), phosphate (P) and osteocalcin (OC) were determined by biochemical markers of bone metabolism. The statistical difference on the results was analyzed by independent t-test.

**RESULTS:** There were significant differences for femoral BMC(CON 0.505±0.023 vs EXE 0.531±0.033 g, p<.05) and femoral BMD(CON 0.058±0.005 vs EXE 0.065±0.004 g/cm<sup>2</sup>, p<.001) between groups, respectively. There were no significant differences for humerus BMC(CON 0.228±0.016 vs EXE 0.239±0.015 g, p>.05) and humerus BMD(CON 0.033±0.006 vs EXE 0.038±0.006 g/cm<sup>2</sup>, p>.05) between groups, respectively. The serum Ca(CON 10.18±0.20 vs EXE 10.13±0.39 mg/dL, p>.05), P(CON 6.67±1.48 vs EXE 6.70±1.26 mg/dL, p>.05) and OC(CON 6.48±0.79 vs EXE 7.08±1.05 ng/mL, p>.05) showed no significantly difference between groups.

**CONCLUSIONS:** These results suggest that increase of BMD by resistance exercise with climbing the ladder was appeared in only weight-bearing hind-limb, namely this change of BMD might occur by site-specific.

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**2767** Board #39 June 1 11:00 AM - 12:30 PM  
**The Effect of Calorie Restriction and Hypothalamic Suppression on Bone Strength during Puberty**  
Kathryn A. Mitchell, Amie L. McCoy, Megan E. Lunny, Vanessa Yingling, FACSM. Temple University, Philadelphia, PA.  
(No relationships reported)

Low energy availability and hypothalamic amenorrhea are both risk factors for developing insufficient bone mineral density (BMD) in young physically active women. The prevalence of osteopenia in women athletes is estimated to be between 22-50%.

**PURPOSE:** Determine the effect of calorie restriction and hypothalamic suppression on bone strength.

**METHODS:** 16 female Sprague-Dawley rats, age day 23, were randomly assigned to a control (C, n=8) group that received daily saline injections (.2cc) for 28 days and sacrificed at age day 50, or an experimental group (FR-G, n=8) that received daily injections of gonadotropin releasing hormone antagonist (GnRH-a, .2cc, dosage .2mg\*kg<sup>-1</sup>) and a 30% caloric restriction (no deficit in micronutrients) based on the control group's average daily consumption and were sacrificed on age day 50.

**RESULTS:** BW on day of sacrifice of the FR-G was significantly lower than control (15%, p<0.001) and the GnRH-a treatment was successful shown by significantly lower uterine and ovary weights in the FR-G group (80% and 75% respectively, p<0.001). The FR-G group had significantly lower total fat and gastrocnemius muscle weights as compared to control (70%, p<0.001 and 10%, p=0.03 respectively). However, the percent muscle per fat of the FR-G group was significantly higher than control (64%, p=0.001). There was no difference in absolute femoral peak moment, however when normalized for body weight the FR-G group was significantly higher than control (19%, p=0.004).

**CONCLUSION:** Hypothalamic suppression and caloric restriction pre-puberty reduced body weight, body fat, and muscle weight while increasing femoral peak moment relative to body weight. These results could suggest bone strength is more correlated with body composition than hypothalamic function.

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**2768** Board #40 June 1 11:00 AM - 12:30 PM  
**Voluntary Wheel Running Does Not Protect Against Doxorubicin-Induced Osteopenia in the Growing Rat**  
Traci L. Parry<sup>1</sup>, Urszula T. Iwaniec<sup>2</sup>, Russell T. Turner<sup>2</sup>, Chia-Ying Lien<sup>3</sup>, Brock T. Jensen<sup>4</sup>, David S. Hydock<sup>1</sup>, Carole M. Schneider, FACSM<sup>1</sup>, Reid Hayward<sup>1</sup>.  
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(No relationships reported)

Despite numerous negative side effects, including osteopenia, doxorubicin (DOX) continues to be used clinically because of its high success rate in the treatment of an array of cancers. At this time it is unclear whether exercise can attenuate the deleterious effects of DOX on bone architecture.

**PURPOSE:** To determine whether voluntary wheel running attenuates the negative effects of DOX on bone in growing male rats.

**METHODS:** Male Sprague-Dawley rat pups (25 days old) were randomly assigned to one of four groups: sedentary control, SED+C; sedentary DOX, SED+DOX; voluntary wheel run control, WR+C; and voluntary wheel run DOX, WR+DOX. Animals received 2 mg/kg DOX i.p. or an equivalent volume of saline (1 mL) over 7 successive days. Beginning with the first day of injections, SED animals did not exercise while animals in WR groups were allowed free access to cage-mounted running wheels for a total of 10 weeks. Upon completion of the protocol, animals were sacrificed and tibia and femur excised for assessment of bone mineral content and density (tibia) via dual energy x-ray absorptiometry and cancellous and cortical bone architecture (femur) via micro computed tomography.

**RESULTS:** WR+C animals ran an average of 23 ± 3 km/wk while WR+DOX animals ran an average of 12 ± 3 km/wk. Treatment with DOX resulted in significantly lower tibial length and tibial bone mineral content and density (p < 0.05) compared to SED+C. The negative effects of DOX were observed in both the cortical and cancellous envelopes. Midshaft femur cortical cross-sectional area, cortical volume, and polar moment of inertia were significantly lower in DOX-treated rats compared to SED+C. Distal femur metaphysis cancellous bone volume/tissue volume was also lower in DOX-treated compared to SED+C rats. Voluntary wheel running did not protect against the detrimental effects of DOX treatment on the skeleton in developing rats.

**CONCLUSIONS:** DOX treatment in male rat pups suppressed bone growth and resulted in cancellous and cortical osteopenia. Voluntary wheel running during this time did not protect the growing skeleton against the negative effects of DOX treatment.

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**2769** Board #41 June 1 11:00 AM - 12:30 PM  
**The Bone-specific Physical Activity Questionnaire (BPAQ) Predicts pQCT-derived Tibial Bone Strength**  
Benjamin K. Weeks, Belinda R. Beck, FACSM. Griffith University, Gold Coast, Australia.  
(No relationships reported)

The bone-specific physical activity questionnaire (BPAQ) was developed to account for the influence of habitual mechanical loading on the skeleton. A simple questionnaire is scored using algorithms incorporating load data for common activities. We have previously shown that the BPAQ predicts DXA-derived bone mass at clinically important sites in young adults better than other more generic measures of physical activity. The ability of the BPAQ to predict important indices of bone strength such as peripheral quantitative computed tomography (pQCT)-derived volumetric, geometric or composite strength parameters, however, was unknown.

**PURPOSE:** The aim of the current study was to determine the ability of the BPAQ to predict pQCT-derived bone strength parameters of the tibia.

**METHODS:** We recruited 427 healthy males and females between the ages of 5 and 77 years. Participants completed the BPAQ and a current (previous 12 months), past (birth to 12 months prior) and total physical activity score was calculated. Dominant tibiae were scanned using pQCT (XCT-3000, Stratec, Germany) at the 4% and 38% sites. Total density, cortical density, and trabecular density were calculated using host software. Additional composite and density-weighted strength parameters including strength-strain index (SSI) and fracture load were derived. Correlation and regression analyses were performed to determine relationships between BPAQ scores and parameters of tibial bone strength. Additionally, BPAQ predictors of bone strength were determined for young, middle, and older age groups.

**RESULTS:** Positive relationships were found between BPAQ scores and fracture load and SSI at the 38% sites for bending and torsional loads (r = 0.17-0.36, p<0.05). Current and past BPAQ scores predicted 4-19% of the variance in strength parameters (p<0.05). Alone, past BPAQ score predicted around 12% of the variance in bone strength parameters, and current BPAQ score added an additional 8% predictive ability to the model. Stratified by age group, the ability of the BPAQ to predict strength was greater for older subjects (R<sup>2</sup> = 0.20-0.53; p<0.05) than younger subjects (R<sup>2</sup> = 0.04-0.06; p<0.05).

**CONCLUSIONS:** Lifetime habitual mechanical loading determined by BPAQ predicts pQCT-derived bone strength indices of the tibia, and predictions strengthen with age.

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**2770** Board #42 June 1 11:00 AM - 12:30 PM  
**Body Composition and Estrogen Exposure Display Differing Influences on Indices of Bone Health**  
Rebecca J. Toombs, Nancy I. Williams, FACSM, Mary Jane De Souza, FACSM. Penn State University, University Park, PA.  
(No relationships reported)

Dual-energy x-ray absorptiometry (DXA) measures areal bone mineral density (aBMD) rather than true volumetric BMD and geometrical properties. To provide better measurements of bone health when 3-dimensional imaging techniques are not available, DXA estimates of lumbar spine volumetric density and femoral neck strength have been created.

**PURPOSE:** This study explores the roles of body composition and estrogen exposure (E1G AUC) on lumbar spine bone mineral apparent density (BMAD), an estimate of volumetric density, and femoral neck cross sectional moment of inertia (CSMI) and cross sectional area (CSA), indices of bone strength, among exercising women.

**METHODS:** Body composition and aBMD were assessed by DXA in young, exercising women (n=58). BMAD was calculated from lumbar spine bone mineral content and area. In a subset of women, CSMI and CSA were estimated by the DXA software (n=25). Estrone-1-glucuronide was measured in daily urine samples collected for one cycle or monitoring period. Stepwise regression was used to determine the strongest predictors of BMAD, CSMI, and CSA.

**RESULTS:** Exercising ovulatory (Ov, n=31) and amenorrheic (Amen, n=27) women aged 23.1±0.8 years were similar in body mass (58.0±1.0 vs. 56.0±1.5 kg), body mass index (21.4±0.3 vs. 20.4±0.4 kg/m<sup>2</sup>), and lean mass (40.6±0.8 vs. 40.7±0.9 kg); however, Ov women had significantly higher percent body fat (26.2±0.7 vs. 23.4±1.2%, p=0.041) and BMAD (0.164±0.003 vs.

0.146±0.003 g/cm<sup>3</sup>, p<0.001) than the Amen women. CSMI and CSA did not differ between groups (Ov, n=11; Amen, n=14). When percent body fat, lean mass, and EIG AUC were entered into the model, only EIG AUC was a significant predictor of BMAD, explaining 14.0% of the variance, for all exercising women. However, lean mass and percent body fat but not EIG AUC were significant predictors of CSMI and CSA, together explaining 53.4% and 59.2% of the variance, respectively, among a subset of exercising women.

**CONCLUSION:** Among exercising women displaying a wide range of estrogen concentrations and percent body fat, EIG AUC was an important determinant of estimated volumetric density at the lumbar spine; whereas, body composition was a strong predictor of estimates of femoral neck strength.

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2771 Board #43 June 1 11:00 AM - 12:30 PM

**Moderate Alcohol Intake Lowers Biochemical Markers Of Bone Turnover In Postmenopausal Women.**

Gianni F. Maddalozzo, FACSM<sup>1</sup>, Jill A. Marrone<sup>1</sup>, Adam Branscum<sup>1</sup>, Karin Hardin<sup>1</sup>, Lynn Cialdella-Kam<sup>1</sup>, Kenneth A. Philbrick<sup>1</sup>, Anne C. Breggia<sup>2</sup>, Clifford J. Rosen<sup>2</sup>, Russel T. Turner<sup>1</sup>, Urszula T. Iwaniec<sup>1</sup>. <sup>1</sup>Oregon State University, Corvallis, OR. <sup>2</sup>Maine Medical Center Research Institute, Scarborough, ME.  
(No relationships reported)

Epidemiological studies indicate that higher bone mass is associated with moderate alcohol consumption in postmenopausal women. However, the mechanisms for the putative beneficial effects of alcohol on bone are unknown. Excessive bone turnover, combined with an imbalance whereby bone resorption exceeds bone formation, is the principal cause for postmenopausal bone loss.

**PURPOSE:** This study investigated the hypothesis that moderate alcohol attenuates bone turnover following menopause.

**METHODS:** Serum levels of the formation marker osteocalcin and resorption marker CTx were measured following alcohol withdrawal for 14 days in 40 healthy postmenopausal women (56.3 ± 0.5 years of age, mean ± SE) who consumed 19 ± 1 g alcohol/day. Participants then consumed alcohol and were assayed the following morning.

**RESULTS:** Simple linear regression model was used to assess the relationship between alcohol intake and BMD, osteocalcin, and CTx at baseline. The correlation between serum osteocalcin and CTx was evaluated by linear regression using log-transformed data. To determine whether osteocalcin and CTx increased after abstinence from alcohol as predicted, a one-sided paired t-test was performed. One-sided paired t-tests were also used to determine if osteocalcin and CTx decreased on day 15 as predicted after participants consumed alcohol on the evening of day 14. At study initiation, bone mineral density at the trochanter and total hip were positively correlated to level of alcohol consumption. Serum osteocalcin and CTx increased following abstinence (4.1 ± 1.6%; p = 0.01 and 5.8 ± 2.6%; p = 0.02 compared to baseline, respectively). Osteocalcin and CTx decreased following alcohol re-administration compared to the previous day (-3.4 ± 1.4%; p = 0.01 and -3.5 ± 2.1%; p = 0.05, respectively), to values that did not differ from baseline (p>0.05).

**CONCLUSIONS:** Abstinence from alcohol resulted in increased markers of bone turnover whereas resumption of alcohol reduced bone turnover markers. These results suggest a cellular mechanism for the increased bone density observed in postmenopausal moderate alcohol consumers. Specifically, the inhibitory effect of alcohol on bone turnover attenuates the detrimental skeletal consequences of excessive bone turnover associated with menopause.

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**E-22 Free Communication/Poster - Caffeine, Energy Drinks, and Performance**

JUNE 1, 2012 7:30 AM - 12:30 PM  
ROOM: Exhibit Hall

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2772 Board #44 June 1 9:30 AM - 11:00 AM

**Effects Of Caffeine Gum Use On Supramaximal Cycle Time To Exhaustion**

Kelly E. Johnson, Ken R. Drago, Eliseo A. Gonzalez, Wendy E.S. Repovich, FACSM. Eastern Washington University, Cheney, WA.  
(No relationships reported)

**PURPOSE:** This study examined the ergogenic effects of caffeine gum (CG) providing 120 mg of caffeine on total time to exhaustion (TTE) via a supramaximal cycle time to exhaustion test (STTE) at 120% of VO<sub>2peak</sub>.

**METHODS:** Seventeen, moderately active college students (23.2 ± 3.3 yrs old) volunteered for participation. To determine the 120% supramaximal test intensity subjects underwent three exercise bouts. First they completed a VO<sub>2peak</sub> test on an AB 839e cycle ergometer, which consisted of 2 min stages with increases of 50 Watts (W) per stage to volitional exhaustion. Both the respiratory exchange ratio (RER) and VO<sub>2</sub> were averaged over the last 30-s of each stage. The RER and VO<sub>2</sub> were then interpolated to calculate intensities corresponding to 15% and 30% of VO<sub>2peak</sub>. Subjects then cycled at these two intensities for 10-minutes each. The last 1min VO<sub>2</sub> average for each sub maximal test was plotted against their intensity of their VO<sub>2peak</sub> to extrapolate the workload at 120% VO<sub>2peak</sub>. Three STTE sessions were done using the Monark AB 839e cycle ergometer, a familiarization session, followed by two double-blind randomly assigned tests with CG or a placebo (PG). Subjects received and chewed either six pieces of CG or six pieces of PG for 5 minutes followed by 20 minutes of rest and a 10-minute warm up. To start the test subjects cycled at 70 repetitions per minute until there was a one minute plateau in VO<sub>2</sub>. The supramaximal intensity test began when the resistance was applied without warning to avoid anticipatory changes in VO<sub>2</sub> and VCO<sub>2</sub> kinetics. The length of time was recorded as the TTE.

**RESULTS:** Though TTE in seconds was longer with CG - 311.82 ± 119.28 vs. ± 119.28 using a paired t-test no significant differences were found for any variable (condition p=0.268, gender p=0.112, habituation p=0.873, condition by gender p=0.894, condition by habituation p=0.736, and condition by gender by habituation p=0.494).

**CONCLUSIONS:** The results of this study via CG revealed no significant differences for any variables measured. Therefore, this suggests that CG is no different than any other delivery method (patch or pills) for affecting supramaximal exercise.

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2773 Board #45 June 1 9:30 AM - 11:00 AM

**The Effect of Caffeine on Anaerobic Performance: A Preliminary Study**

Steven R. Cherekos, Jonathan M. Engholm, Marie Boo, Anthony Bozzo, Mary C. Stenson. College of Saint Benedict and Saint John's University, Saint Joseph, MN.  
(Sponsor: Vincent J. Paolone, FACSM)  
(No relationships reported)

The ergogenic effects of caffeine on endurance exercise have been well documented; however, the effects of caffeine on maximal anaerobic exercise are not as well researched.

**PURPOSE:** To determine the effects of caffeine ingestion on anaerobic run test performance in college aged male and female club-sport athletes.

**METHODS:** A randomized, double-blind study was conducted on 4 healthy, active women and 4 healthy, active men (n=8). Subjects performed a maximal anaerobic run test (treadmill set at 7 mph at a 20% grade) 60 minutes after ingestion of 6 oz. sugar-free lemonade (placebo) or 6 oz. sugar-free lemonade with caffeine (5 mg/kg body mass). Heart rate, run time, and rating of perceived exertion (RPE) were recorded immediately at the end of the test. A series of 2x2 repeated measures ANOVAs were used to identify the influence of treatment and gender on time, work, power, and RPE.

**RESULTS:** No significant interaction was found between gender and treatment for run time with caffeine (Females (F): 40.25 ± 6.4s, Males (M): 57.3 ± 6.4s p>.05) and without caffeine (F: 34.0 ± 5.8s, M: 61.8 ± 5.8 s, p>.05). Three of the four females increased performance during the caffeine trial by an average of 8.7 ± 8.96s, while three of the four males decreased performance during the caffeine trial by an average of 7.3 ± 5.13s. No significant differences (p>.05) were found for RPE, power, or work between trial and gender.

**CONCLUSIONS:** Ingestion of 5 mg/kg body mass of caffeine 60 min prior to exercise may narrow the gender differences in time to exhaustion during maximal anaerobic exercise.



2774 Board #46 June 1 9:30 AM - 11:00 AM

**The Effect of Caffeine on Tennis Skill Performance in Collegiate Tennis Players**

Courtney S. Klein, Adam Clawson, Michael Martin, Michael J. Saunders, FACSM, Judith A. Flohr, Christopher J. Womack, FACSM, Marta K. Bechtel, Wade Dunham, Melyssa Hancock. *James Madison University, Harrisonburg, VA.*  
(No relationships reported)

Several prior studies confirm the efficacy of caffeine supplementation on endurance performance, yet there exists a paucity of data on the effect of caffeine on tennis performance. Pilot data from our lab suggest that a polymorphism of the CYP1A2 gene is associated with ergogenic caffeine response in cycling but this association is unknown for other athletic events.

**PURPOSE:** This study examined the efficacy of caffeine supplementation on tennis performance and whether a polymorphism of the CYP1A2 gene influenced the ergogenic response to caffeine.

**METHODS:** 18 (nine males, nine females) NCAA Division-1 collegiate tennis players (Ht = 176.0 ± 11.1 cm, Wt = 69.8 ± 12.0 kg, VO<sub>2</sub>max = 51.7 ± 5.9 ml/kg/min) completed two separate trials one hour after the ingestion of either 6 mg/kg of caffeine or a placebo, in double-blind fashion. The trials consisted of both 45 minutes of intermittent treadmill work (TW) and a tennis performance test (TPT). Average RPE and HR were recorded for both the TW and TPT. TPT involved nine repeated sessions in which a 6-ball drill (4 groundstrokes, 1 approach shot and 1 volley) was repeated 6 times. The total number of successful shots that they accrued (out of a possible 324) was recorded. DNA was obtained from whole blood samples and analyzed for presence of the C variant using polymerase chain reaction with allele-specific primers. Subjects were classified as AA homozygotes (N=7) or C allele carriers (N=9). Data were analyzed via a repeated measures ANOVA with treatment (caffeine, placebo) as the within-subjects factor and genotype as the between-subjects factor.

**RESULTS:** There was a main effect for treatment whereby caffeine significantly ( $P < 0.05$ ) improved the number of successful shots during the TPT (Caffeine = 295 ± 11 shots, Placebo = 289 ± 10 shots). There was also a strong trend ( $P = 0.052$ ) for a genotype x treatment interaction for HR during the TPT as caffeine raised HR in the AA homozygotes (Caffeine = 155 ± 17 beats/min, Placebo = 149 ± 13 beats/min) but not the C allele carriers (Caffeine = 150 ± 16 beats/min, Placebo = 153 ± 16 beats/min).

**CONCLUSION:** Caffeine supplementation positively impacts tennis performance in collegiate tennis players. There may be preliminary support for a greater physiological effect of caffeine in AA homozygotes.

2775 Board #47 June 1 9:30 AM - 11:00 AM

**Does Caffeine Intake Increases Energy Expenditure And Habitual Physical Activity? A Double-blind Randomized Crossover Trial**

Pedro B. Júdice, Analiza M. Silva, João P. Magalhães, Catarina N. Matias, Diana A. Santos, Paulo Armada-da-silva, Luís B. Sardinha. *Technical University of Lisbon, Lisbon, Portugal.*  
(No relationships reported)

Although the effect of caffeine on energy expenditure has been studied, its influence on physical activity (PA) during free-living conditions using objective measures of PA is limited.

**PURPOSE:** This study aimed to determine the impact of a moderate dose of caffeine on resting energy expenditure (REE), PA energy expenditure (PAEE), total energy expenditure (TEE), and daily time spent in sedentary (DTSS), light (DTSL), moderate (DTSM), and vigorous (DTSV) intensity activities in non-obese physically active males.

**METHODS:** A total of 30 non-smoker males, low caffeine users (<100 mg/day), aged 20-39 yrs [body mass (BM): 72.7 ± 8.8 kg; Height: 1.77 ± 0.07 m] were followed in a double-blind crossover experimental design with two conditions in a random sequence: caffeine (5 mg per kg of BM/day) and malt-dextrine as placebo, both through capsules. Conditions lasted for 4 days with a 3-day washout period. Evaluations were performed at baseline (visit-1), end of condition 1 (visit-2), and end of condition 2 (visit-3). Fat and fat-free masses (FFM) were assessed by dual energy x-ray absorptiometry. Accelerometry was used to estimate TEE, DTSS, DTSL, DTSM, and DTSV. REE was assessed by indirect calorimetry and PAEE calculated as [TEE - (REE + 0.1TEE)]. Daily food records were obtained. Repeated measures ANOVA and ANCOVA were used.

**RESULTS:** No differences were found ( $p > 0.05$ ) between caffeine and placebo intake for TEE (-0.1 ± 1310.0 kJ/day), REE (48 ± 687 kJ/day), PAEE (48 ± 1269 kJ/day), DTSS (-1 ± 61 min), DTSL (4 ± 36 min), DTSM (-3 ± 31 min), and DTSV (0.3 ± 4.6 min). After adjusting for FFM, caffeine increased DTSL compared to placebo (3.5 ± 5.8 min;  $p = 0.029$ ) but no differences ( $p > 0.05$ ) were observed for TEE (-0.1 ± 243.0 kJ/day), REE (48 ± 130 kJ/day), PAEE (48 ± 237 kJ/day), DTSS (-0.8 ± 10.4 min), DTSM (-3 ± 6 min), and DTSV (0.3 ± 0.8 min). No change in energy and macronutrients intake occurred over the trial ( $p > 0.05$ ).

**CONCLUSION:** Though a large individual variability was observed, a moderate dose of caffeine, independently of FFM, did not increase REE, TEE, and PAEE neither changed the DTSS, DTSM, and DTSV intensity activities in active young males, non-caffeine regular users. However, further research is required to understand the role of FFM as a mediator of the caffeine effect on the increased amount of time spent in light intensity activities.

2776 Board #48 June 1 9:30 AM - 11:00 AM

**Pre-Exercise Caffeine Ingestion Increases Post-Exercise Energy Expenditure**

Valentin E. Fernandez-Elias<sup>1</sup>, Juan Del Coso<sup>2</sup>, Juan F. Ortega<sup>1</sup>, Nassim Hamouti<sup>1</sup>, Ricardo Mora-Rodriguez<sup>1</sup>. <sup>1</sup>University of Castilla La Mancha, Toledo, Spain.  
<sup>2</sup>University of Castilla La Mancha, Madrid, Spain.  
(No relationships reported)

Caffeine is an ergogenic aid widely used prior and during prolonged exercise. However, its effects post-exercise are not well described.

**PURPOSE:** To investigate the metabolic, respiratory and cardiovascular post-exercise responses to graded caffeine ingestion.

**METHODS:** A randomized, double-blind, placebo controlled experimental design was used, with all subjects serving as their own controls. Twelve aerobically trained subjects (6 men and 6 women; mean VO<sub>2</sub>max = 54 ± 7 mL · min<sup>-1</sup> · kg<sup>-1</sup>) cycled for 60-min at 75% VO<sub>2</sub>max after ingesting placebo (0 mg · kg<sup>-1</sup> of caffeine) or 1, 3, 6 and 9 mg of caffeine per kg. Hourly during the 3 hours post-exercise, heart rate, blood pressure, ventilatory parameters were measured and blood samples analyzed for glucose, lactate and fatty acids. From VO<sub>2</sub> and VCO<sub>2</sub>, energy expenditure and substrate oxidation were calculated.

**RESULTS:** Pre-exercise ingestion of 9 mg · kg<sup>-1</sup> of caffeine raised 3-h post-exercise energy cost 15 % in comparison to placebo (233 ± 58 vs. 202 ± 49 kcal;  $P < 0.05$ ). Ventilation rate and tidal volume were elevated after the 9 mg · kg<sup>-1</sup> of caffeine compared to placebo (9.2 ± 2.5 L · min<sup>-1</sup> and 0.67 ± 0.29 L · breath<sup>-1</sup> vs. 7.8 ± 1.5 L · min<sup>-1</sup> and 0.56 ± 0.20 L · breath<sup>-1</sup>, respectively;  $P < 0.05$ ). In these two trials, tidal volume and ventilation were highly correlated ( $R^2 = 0.91$ ;  $P < 0.05$ ). Energy expenditure and ventilation were also highly correlated ( $R^2 = 0.88$ ;  $P < 0.05$ ). No significant differences were found among trials for substrate oxidation, heart rate, blood pressure, plasma glucose, lactate and free fatty acids.

**CONCLUSIONS:** Pre-exercise caffeine ingestion increased by 15% post-exercise energy expenditure only when ingesting a high dose (i.e., 9 mg · kg<sup>-1</sup>). Our data suggest that this increase in energy cost was mediated by increased tidal volume and ventilation. On the other hand, pre-exercise ingestion of a wide range of caffeine doses (1-9 mg · kg<sup>-1</sup>) does not alter the post-exercise cardiovascular response.

2777 Board #49 June 1 9:30 AM - 11:00 AM

**Assessing the Acute Influence of Perceived versus Actual Caffeine Intake on Aspects of Aerobic Performance**

Matthew J. Shaw, Justin D. Roberts. *University of Hertfordshire, Hatfield, United Kingdom.*  
(No relationships reported)

Various mechanisms have been proposed for the ergogenic effect of caffeine. In particular, increased neuromuscular activation, reduced perceptual effort and greater circulating catecholamines may favour endurance performance. However, for shorter high intensity events the potential for 'perceived' benefits may also be pertinent for performance gains.

**PURPOSE:** To determine whether caffeine supplementation is more effective at enhancing aerobic performance compared to both placebo and deception trials.

**METHODS:** Following familiarisation, 10 healthy males (age: 21.36 ± 0.76 years; weight: 73.81 ± 9.21 kg; VO<sub>2</sub>max: 46.91 ± 3.71 mL · kg<sup>-1</sup> · min<sup>-1</sup>) undertook 3x15km performance trials on a cycle ergometer. Subjects were randomly assigned either capsulated low dose caffeine (CA3 - 3mg · kg<sup>-1</sup> · bw<sup>-1</sup>), high dose caffeine (CA9 - 9mg · kg<sup>-1</sup> · bw<sup>-1</sup>) or cornflour placebo (PL). However, in one

of the caffeine trials subjects undertook a deception trial whereby PL was provided instead. During each trial, expired air analysis ( $\text{VO}_2$ :  $\text{L}\cdot\text{min}^{-1}$ ), power: weight ratio (P/W:  $\text{W}\cdot\text{kg}^{-1}$ ), cycling speed (kph), heart rate (HR: bpm), perceived exertion (RPE) and performance times were assessed.

**RESULTS:** Performance times significantly improved in CA9 compared to PL only ( $1708.40\pm 21.53$  and  $1820\pm 26.47$  seconds respectively,  $P=0.05$ ). No significant differences were observed across deception trials for performance times in comparison to PL, despite improvements during perceived CA3 or CA9 trials ( $1759.60\pm 19.06$  and  $1745.00\pm 15.51$  seconds respectively,  $P=0.09$ ). No significant differences were observed across trials for  $\text{VO}_2$ , HR or RPE indicating comparable intensity. No significant differences were observed for P/W, although higher ratios were observed in the perceived CA9 ( $2.55\pm 0.19 \text{ W}\cdot\text{kg}^{-1}$ ), actual CA3 ( $2.58\pm 0.16 \text{ W}\cdot\text{kg}^{-1}$ ) and CA9 ( $2.56\pm 0.37 \text{ W}\cdot\text{kg}^{-1}$ ) trials compared to PL ( $2.26\pm 0.10 \text{ W}\cdot\text{kg}^{-1}$ ). Average speed was significantly greater in CA9 compared to PL only ( $31.63\pm 0.40$  kph and  $29.72\pm 0.42$  kph respectively,  $P=0.04$ ).

**CONCLUSION:** Whilst 'perceived' benefits of caffeine ingestion may support exercise performance, significant effects may only be observed following consumption of higher dosages of actual caffeine. As perceived effort was not reduced, ergogenic benefits may be explained through increased myofibrillar recruitment.

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**2778 Board #50 June 1 9:30 AM - 11:00 AM**  
**Dose-dependence Of Caffeine Supplementation On Cycling Performance**

Michael Martin, Nicholas D. Luden, Courtney S. Klein, Michael J. Saunders, FACSM, Marta K. Bechtel, Wade Dunham, Melyssa Hancock, Christopher J. Womack, FACSM. *James Madison University, Harrisonburg, VA.*  
(No relationships reported)

Prior data on the dose-dependence of caffeine supplementation for cycling performance is equivocal. The mechanisms influencing the variability of caffeine response are not fully known, although our lab has observed that a polymorphism of the CYP1A2 gene influences the ergogenic effect of caffeine.

**PURPOSE:** This study examined the effect of caffeine supplementation at two different dosages (3 and 6 mg/kg body weight) on a 40-km cycling time trial. We further sought to obtain initial data on whether the CYP1A2 polymorphism influenced the response at both a lower and high caffeine dose.

**METHODS:** 16 male cyclists (Ht =  $176.6 \pm 6.8$  cm, Wt =  $71.8 \pm 7.8$  kg,  $\text{VO}_{2\text{max}}$  =  $64.7 \pm 9.1$  ml/kg/min) completed three separate computer-simulated 40-km cycling time trials one hour after the ingestion of 3 mg/kg caffeine, 6 mg/kg caffeine and a placebo. Subjects were genotyped for the polymorphism of the CYP1A2 gene and classified as AA homozygotes (N=6) or C allele carriers (N=10). Data were analyzed via a repeated measures ANOVA with treatment as the within-subjects factor and genotype as the between-subjects factor.

**RESULTS:** There was a main effect for treatment whereby both doses of caffeine significantly ( $P < 0.05$ ) improved 40-km time (Placebo =  $74.1 \pm 5.4$  min, 3 mg/kg =  $72.7 \pm 4.6$  min, 6 mg/kg =  $71.6 \pm 4.7$  min). There were no significant differences between 40-km time at the two different caffeine doses. There was a trend ( $P = 0.10$ ) for a genotype x treatment interaction, whereby a greater magnitude of decrease in 40-km time was evident in the AA homozygotes (4.6% improvement at the 6 mg/kg dose) as compared to the C allele carriers (2.6% improvement at the 6 mg/kg dose).

**CONCLUSION:** Both a 3 mg/kg and a 6 mg/dose of caffeine improve 40-km cycling time. The magnitude of the effect was not significantly different between the two doses although the higher dose resulted in a performance one minute faster than the lower dose. Preliminary data support previous results, in that the effect of caffeine may be larger in AA homozygotes.

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**2779 Board #51 June 1 9:30 AM - 11:00 AM**  
**Caffeine Does Not Affect Improvements In Cognition During Prolonged High-Intensity Exercise In Alert, Well-Trained Individuals**

Dennis P. Pollow, Jr, Brian T. Williams, Donald A. Joyce, Guogen Shan, Jennifer L. Temple, Luc E. Gosselin, FACSM, Peter J. Horvath. *State University of New York at Buffalo, Buffalo, NY.*  
(No relationships reported)

Evidence suggests that caffeine can act as an ergogenic aid during endurance exercise. While caffeine ingestion has been shown to improve cycling performance times in time trial races and exhaustive exercise, few studies have tested for cognitive function improvements during these tests.

**PURPOSE:** 1) To determine if caffeine ingestion can affect cognitive function and exercise performance outcomes during prolonged intense cycling and 2) To determine if the type of exercise trial can alter the effects of caffeine.

**METHODS:** Seven well-trained cyclists and triathletes ( $26.9 \pm 3.9$  y,  $\text{VO}_{2\text{peak}}$   $67.7 \pm 10.3 \text{ mL}\cdot\text{kg}^{-1}\cdot\text{h}^{-1}$ ) completed two trials to exhaustion at 90%  $\text{VO}_{2\text{peak}}$  and two 50k time trials, one hour after consuming a carbohydrate-electrolyte beverage (5ml/kg, 6.3% CHO, 18mmol/l sodium) and a capsule containing either 6 mg/kg caffeine or placebo (double-blind crossover design). Cognitive function was measured before and after exercise using a computerized ANAM® test and Stroop word-color test (also conducted during exercise).

**RESULTS:** Average wakefulness scores at baseline were  $1.9 \pm 0.5$ , indicating that subjects were at near peak alertness. After either exercise trial type, ANAM thruput scores increased by 9.4% compared to baseline ( $P < 0.0001$ ), while Stroop word-color test response time improved by 17.8% ( $P < 0.0001$ ). Neither cognitive test result was altered by the addition of caffeine. Caffeine did not significantly change exercise performance in either trial type. However, subjects were able to cycle an average of 65% longer during their second time to exhaustion trial compared to the first, regardless of supplementation (mean time = 78.4 and 51.5 min. respectively,  $P < 0.001$ ).

**CONCLUSION:** In alert, well trained athletes, high intensity endurance exercise can significantly improve simple and complex cognitive function, but is not enhanced with the addition of caffeine. The type of exercise trial does not alter the exercise-induced changes in cognitive function.

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**2780 Board #52 June 1 9:30 AM - 11:00 AM**  
**Increased Time-trial Performance with Caffeine Ingestion is Independent of Fitness Level**

Jessica Duhon, Trisha Cottrell, Andrea Talhami Lozano, Kylan Aburto-Pratt, Todd A. Astorino. *CSU- San Marcos, San Marcos, CA.*  
(No relationships reported)

Previous data show that caffeine is an ergogenic aid for endurance exercise; however, the exact mechanism explaining its performance-enhancing effect is unidentified. Some speculate that it is only ergogenic in trained muscle.

**PURPOSE:** To examine the effects of caffeine intake on cycling performance in both endurance trained and recreationally active individuals.

**METHODS:** Eight endurance trained and 8 active men completed five trials of cycling on an electrically-braked cycle ergometer, with each bout separated by at least 48 h.  $\text{VO}_{2\text{max}}$  was higher ( $p < 0.05$ ) in trained ( $57.5 \pm 3.9 \text{ mL/kg/min}$ ) versus active men ( $46.5 \pm 6.3 \text{ mL/kg/min}$ ). Subjects completed two familiarization trials and three experimental trials over a 2 - 3 week period, with sessions consisting of a 10 km time trial simulating competitive cycling, characterized by changes in terrain. Drinks administered included two boluses of 5 mg/kg caffeine (C1 and C2) or placebo (PL = 5 mg/kg of glucose), which were mixed with 255 mL of cold water, diet 7-Up, and 1 package of Crystal Light and ingested 1 h pre-exercise. Subjects were blinded to the order of drink assignment, which was randomized, and were told that drinks contained carbohydrate to minimize placebo effects of caffeine. Heart rate (HR), Rating of Perceived Exertion (RPE), and time were recorded every 1.6 km. Repeated measures analysis of variance was used to evaluate differences in variables across distance and treatment.

**RESULTS:** Time trial performance was significantly increased ( $p < 0.05$ ) in both caffeine trials versus placebo for trained (C1 =  $17.07 \pm 0.99$  min; C2 =  $17.01 \pm 1.0$  min; PL =  $17.35 \pm 0.98$  min) and active men (C1 =  $18.50 \pm 0.61$  min; C2 =  $18.65 \pm 0.80$  min; PL =  $18.71 \pm 0.68$  min); however, there was no difference observed across fitness level (treatment X group interaction  $p > 0.05$ ). In both groups, 6 of 8 men revealed improved performance in C1 (-0.21 min) and C2 (-0.23 min) compared to placebo. HR and RPE increased during exercise ( $p < 0.05$ ) but were unaltered across treatment ( $p > 0.05$ ).

**CONCLUSIONS:** Caffeine was ergogenic for brief (< 20 min) "all-out" cycling performance in highly trained and moderately active individuals. Additional research is merited to confirm these findings in men and women varying in fitness level during other modalities of exercise.

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2781 Board #53 June 1 9:30 AM - 11:00 AM

**The Metabolic And Performance Effects Of Caffeine Compared To Coffee During Exercise**

Rebecca Randell, Adrian B. Hodgson, Asker E. Jeukendrup. *University of Birmingham, Birmingham, United Kingdom.*  
(No relationships reported)

**BACKGROUND:** There is consistent evidence supporting the ergogenic effects following caffeine ingestion during exercise. Whether caffeine delivered through coffee has the same effects is still subject to debate.

**PURPOSE:** 1) To investigate the metabolic effects of caffeine and coffee during moderate intensity exercise. 2) To compare the performance enhancing effects of caffeine and coffee.

**METHODS:** In a single-blind, crossover study design, eight trained male cyclists/triathletes (Mean  $\pm$  SD: Age 36 $\pm$ 6y, Height 1.80 $\pm$ 0.04m, Weight 76.3 $\pm$ 7.2kg,  $\dot{V}O_2$  max 56.1 $\pm$ 6.9 ml/kg/min) completed 30 min of steady-state (SS) cycling at approximately 55%  $\dot{V}O_2$ max followed by a time trial (TT) lasting approximately 45 min. One hour prior to exercise each athlete consumed drinks consisting of either caffeine (5mg/kg), instant coffee (5mg/kg), instant decaf coffee or placebo.

**RESULTS:** The set workloads produced similar relative exercise intensities during the SS of 54.6% $\pm$ 0.7%, 55.4% $\pm$ 2.4%, 54.7% $\pm$ 2.7%, 55.0% $\pm$ 2.0%  $\dot{V}O_2$  max for caffeine, coffee, decaf and placebo respectively. There was no observed difference in carbohydrate or fat oxidation during SS for any of the ingested supplements. Performance times during the TT were significantly faster (~4.0%) for both caffeine and coffee when compared to placebo and decaf (39.51 $\pm$ 2.70, 39.40 $\pm$ 2.48, 41.38 $\pm$ 1.10, 40.31 $\pm$ 1.31 min respectively,  $p$ <0.05). The improvements in performance time were similar for both caffeine and coffee. Average power for caffeine and coffee during the TT was significantly greater when compared to placebo and decaf (267 $\pm$ 24W, 269 $\pm$ 24W, 260 $\pm$ 23W, 257 $\pm$ 16W respectively,  $p$ <0.05). No significant differences were observed between placebo and decaf during the TT.

**CONCLUSION:** The present study illustrates that both caffeine (5mg/kg) and coffee (5mg/kg) consumed 1 hour prior to exercise can improve endurance exercise performance. These improvements cannot be attributed to alterations in substrate metabolism as no change in fat oxidation was observed during the SS.

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2782 Board #54 June 1 9:30 AM - 11:00 AM

**Does Effect of Caffeine Ingestion on Acute Hormonal Responses to Resistance Exercise**

Bo-Han Wu<sup>1</sup>, C.H. Yeh<sup>2</sup>, Jung-Chang Lin<sup>3</sup>. <sup>1</sup>Pingtung University of Science and Technology, Pingtung, Taiwan. <sup>2</sup>Chang Jung Christian University, Tainan, Taiwan. <sup>3</sup>Chinese Culture University, Taipei, Taiwan.

(No relationships reported)

Caffeine ingestion has been shown to affect hormonal responses to resistance exercise. However, few studies examined the dose effect of caffeine ingestion on acute hormonal responses to a single bout of resistance exercise.

**PURPOSE:** The purpose of this study was to investigate the dose effect of caffeine ingestion on acute hormonal responses to resistance exercise (RE).

**METHODS:** Twelve well-trained college male students (age, 21 $\pm$ 1.1 yr; mass, 72.8 $\pm$ 12.1 kg) who regularly perform RE participated in this study. All subjects perform 1RM test, then perform four treatments: high dose (HD, 6mg/kg), medium dose (MD, 4mg/kg), low dose (LD, 2mg/kg) and control (CON) in counter balance order. All subject intake caffeine 1 hour prior to RE, then, the subjects perform RE (2 exercises, 3 sets of 10 repetitions at 75% of 1RM). Blood samples collect prior to caffeine intake (pre-60), immediately prior to RE (pre-exe), and 0, 15, 30 min after RE (P0, P15, P30) for analysis of testosterone, cortisol, insulin, growth hormone, glucose, lactate and free fatty acid. Each experiment separated by 7 days. In this study, statistical analysis of a two-way analysis of variance (treatment by time) with repeated measures is applied. Statistical significance set at  $\alpha$  =.05.

**RESULTS:** After ingesting caffeine, the concentrations of free fatty acid (pre-exe) in HD, MD and LD (0.76 $\pm$ 0.12, 0.67 $\pm$ 0.17 and 0.46 $\pm$ 0.11 mmol/L) were significantly higher than CON (0.36 $\pm$ 0.05 mmol/L) ( $p$ <0.05). The responses of testosterone (P0, P15, P30) (10.87 $\pm$ 1.19, 10.23 $\pm$ 1.47 and 9.75 $\pm$ 1.32 vs. 8.15 $\pm$ 2.27, 8.15 $\pm$ 2.38 and 7.88 $\pm$ 2.47 ng/ml,  $p$ <0.05) and cortisol (pre-exe, P0, P30) (43.8 $\pm$ 10.46, 52.5 $\pm$ 10.68 and 48.57 $\pm$ 11.46 vs. 32.89 $\pm$ 11.87, 39.51 $\pm$ 13.88 and 37.72 $\pm$ 11.80 ng/ml,  $p$ <0.05) were significantly higher than CON in HD. In addition, the responses of GH (P15 & P30) (4.48 $\pm$ 2.93, 3.44 $\pm$ 2.15 vs. 6.77 $\pm$ 4.29, 5.32 $\pm$ 3.87 ng/ml,  $p$ <0.05) and insulin (P0, P15, P30) (33.22 $\pm$ 12.09, 32.98 $\pm$ 20.19 and 29.90 $\pm$ 12.78 vs. 45.83 $\pm$ 18.42, 45.82 $\pm$ 21.93 and 38.98 $\pm$ 22.20 pmol/L,  $p$ <0.05) were significantly lower than CON in HD and MD.

**CONCLUSION:** The results of this study indicated that moderate dose ( $\geq$ 4mg/kg) of caffeine ingestion prior to RE will significant affect the responses of anabolic and catabolic hormones around RE.

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2783 Board #55 June 1 9:30 AM - 11:00 AM

**Acute Effects of Caffeine on Strength and Electromechanical Efficiency of the Biceps Brachii**

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(No relationships reported)

**PURPOSE:** Previous studies have suggested that caffeine may provide performance benefits during aerobic activities. The findings for strength and anaerobic performance, however, have been mixed. The purpose of this study was to examine the effects of caffeine on strength, mechanomyographic (MMG) amplitude, electromyographic (EMG) amplitude, and electromechanical efficiency (EME; the ratio of MMG amplitude to EMG amplitude), evaluated as the ratio of MMG amplitude to EMG amplitude of the biceps brachii.

**METHODS:** Thirteen male volunteers (21.4  $\pm$  1.3 y, 173.4  $\pm$  6.9 cm, 86.2  $\pm$  12.2 kg) came to the laboratory four times ( $\geq$  48 hours between visits). During the first experimental visit, subjects ingested a randomly assigned drink, either with or without caffeine (0, 5, or 10 mg $\cdot$ kg<sup>-1</sup> of body mass), and performed three maximal isometric muscle actions of the elbow flexors sixty minutes after ingestion to determine maximal isometric strength. MMG and EMG amplitude were measured from the biceps brachii during the isometric muscle actions. Visit two was identical to visit one, but one of the remaining two drinks not administered was assigned. Visit three was identical to visit two, but the one remaining drink not assigned was administered.

**RESULTS:** The results indicated that there were no significant differences ( $p$  > 0.05) for maximal strength (78.6  $\pm$  22.2, 79.1  $\pm$  19.0, 80.1  $\pm$  20.7 Nm), MMG amplitude (0.55  $\pm$  0.26, 0.68  $\pm$  0.29, 0.75, 0.56 m $\cdot$ s<sup>-2</sup>), EMG amplitude (0.0009  $\pm$  0.0006, 0.0012  $\pm$  0.0009, 0.0011  $\pm$  0.0007 V), or EME (709.6  $\pm$  302.7, 784.4  $\pm$  466.4, 844.9  $\pm$  727.8 rms MMG/rms EMG [m $\cdot$ s<sup>-2</sup>/V]) among the three caffeine conditions (0, 5, and 10 mg $\cdot$ kg<sup>-1</sup> of body mass, respectively).

**CONCLUSIONS:** The results suggested that ingestion of either 5 or 10 mg $\cdot$ kg<sup>-1</sup> of body mass of caffeine does not enhance strength, nor does it affect MMG, EMG, or EME.

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2784 Board #56 June 1 9:30 AM - 11:00 AM

**Caffeine Supplementation and Performance of a Reactive Agility Test in Elite Youth Soccer Players**

J. Bradley Jordan, Ajit D. Korgaokar, Richard S. Farley, Jwa K. Kim, John M. Coons, Jennifer L. Caputo. *Middle Tennessee State University, Murfreesboro, TN.*  
(Sponsor: Don W. Morgan, FACSM)

(No relationships reported)

Caffeine has been shown to provide ergogenic benefits to sports performance. However, limited research is available on the effects of caffeine on agility performance.

**PURPOSE:** The purpose of this study was to examine the effects of 6 mg $\cdot$ kg<sup>-1</sup> body mass of caffeine on performance of a reactive agility test (RAT) in youth soccer players.

**METHODS:** Using a double-blind, repeated-measures design, elite male youth soccer players ( $N$  = 12) completed 4 days of testing on the RAT after a standardized warm-up. Height and body mass were measured and players were accommodated to the RAT on Day 1. Day 2 was used to establish the participants' baseline performance on the RAT. Players were randomly assigned to caffeine or placebo on Day 3 and the condition was reversed on Day 4. Caffeine or placebo was ingested in a gelatin capsule 1 hour prior to performing the RAT. During days 2, 3, and 4, players completed 3 randomized run-throughs of the RAT with at least one run-through to the right and left sides to assess players performance to their dominant and non-dominant sides.

**RESULTS:** There were no significant differences in time to complete the RAT among baseline ( $M = 1.83$  s), caffeine ( $M = 1.78$  s), and placebo ( $M = 1.85$  s) run-throughs to the dominant side, *Wilks' Lambda*  $F(2, 10) = 1.214, p = .337, \eta^2 = .195$ . Also, there were no significant differences in time to complete the RAT between baseline ( $M = 1.85$  s), caffeine ( $M = 1.83$  s), and placebo ( $M = 1.92$  s) run-throughs to the non-dominant side, *Wilks' Lambda*  $F(2, 10) = 3.795, p = .059, \eta^2 = .431$ .

**CONCLUSIONS:** There was a trend toward caffeine improving the time to complete the RAT to the players non-dominant side indicated by the approaching significance value and the effect size. Caffeine may provide ergogenic benefit to elite male youth soccer players on a RAT, and continued research is recommended with a larger sample.

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**2785** Board #57 June 1 9:30 AM - 11:00 AM  
**Caffeine Enhances Time-Trial Performance and Preserves Muscle Activation During Leg, But Not Arm Cycling Exercise**

Christopher D. Black, University of Mississippi, University, MS. (Sponsor: Mark Loftin, FACSM)  
(No relationships reported)

A recent meta-analysis demonstrated that caffeine may lead to greater ergogenic effects on muscular strength and activation in the knee extensors compared to smaller muscle groups of the arms and leg. Few studies have examined whether caffeine exerts differential effects on endurance performance between the knee extensors and other, smaller muscle groups.

**PURPOSE:** To determine the effects of caffeine on muscular strength and activation, and endurance performance during arm and leg cycling.

**METHODS:** Fourteen caffeine naïve (9 women, 5 men) participants were tested on 6 occasions. Arm crank and leg cycling  $VO_{2\text{peak}}$  were determined during the initial two testing sessions. During sessions 3-6, participants performed 2 days of arm cycling and 2 days of leg cycling in a counter-balanced manner. A  $5\text{mg}\cdot\text{kg}^{-1}$  body-weight dose of caffeine or placebo was consumed in a double blind manner, 60 minutes prior to cycling. During the cycling exercise participants cycled for 30 minutes at 60% of  $VO_{2\text{peak}}$ , followed by a 10 minute, maximal effort time-trial. Maximal voluntary isometric strength (MVC), electrically evoked torque (EET), and percent activation (%Act) of the knee extensors (KE) and elbow flexors (EF) were determined using an interpolated-twitch protocol prior to (Pre), 60 minutes post treatment ingestion (Post60), and 20 minutes following the cycling exercise (PostEx).

**RESULTS:** Caffeine demonstrated no effect compared to placebo on  $\Delta\text{MVC}$ ,  $\Delta\text{EET}$ , or  $\Delta\%\text{Act}$  in the KE or EF at the Post60 time point ( $p \geq 0.09$ ) compared to Pre. Caffeine ingestion resulted in significantly greater work during the time-trial during leg ( $115.1 \pm 34$  vs.  $110.5 \pm 36$  kJ;  $p = 0.03$ ), but not arm ( $57.1 \pm 21$  vs.  $56.3 \pm 19$  kJ;  $p = 0.28$ ) cycling compared to placebo. Following the cycling exercise, caffeine preserved  $\Delta\%\text{Act}$  compared to the Post60 values in the KE ( $2.1 \pm 10.5\%$  vs.  $-1.1 \pm 12.5\%$ ;  $p = 0.02$ ) compared to placebo, but not in the EF ( $-7.4 \pm 8.8\%$  vs.  $-6.0 \pm 7.3\%$ ;  $p = 0.59$ ). Significant effects compared to placebo were not found for  $\Delta\text{MVC}$  and  $\Delta\text{EET}$  following cycling.

**CONCLUSIONS:** Caffeine was ergogenic during leg, but not arm cycling and this effect may be attributable to preserved muscle activation in the KE.

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**2786** Board #58 June 1 9:30 AM - 11:00 AM  
**Even if Plasma Caffeine is Initially Elevated, Energy Drink Consumption Improves Cycling Performance**

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(No relationships reported)

Energy drinks have been shown to improve aerobic exercise performance when participants have fasted from caffeine ingestion for 24 hours. The improvement in aerobic exercise performance due to energy drink consumption may be due to low baseline plasma caffeine becoming elevated to a high level.

**PURPOSE:** To compare the effects of an energy drink on cycling time-trial performance in athletes following a 24-hour caffeine abstinence.

**METHODS:** In a randomized crossover design 15 trained cyclists ages 20-45 (7 women,  $VO_{2\text{max}} \geq 45$  mL/kg/min; 8 men  $VO_{2\text{max}} \geq 55$  mL/kg/min) received either an energy drink (ED) (containing caffeine, glucose, taurine, panax ginseng root extract, l-carnitine, caffeine, glucuronolactone, inositol, guarana seed extract, and B vitamins) or a flavor-matched placebo (P) after a 24-hour caffeine abstinence. One hour later, participants completed a 35-kilometer time-trial ride on a cycle ergometer; time-to-finish (TTF) was recorded. Blood was drawn and analyzed for caffeine (CAFF) at three times; before drink ingestion, 40 minutes later, and during the final kilometer of the time-trial ride. Participants whose baseline CAFF was below 1000 ng/mL ( $n = 10$ ) were categorized as LO and those with baseline levels above 1000 ng/mL ( $n = 5$ ) were categorized as HI. Data were analyzed using repeated measures ANOVA.

**RESULTS:** TTF improved in all participants after receiving ED as compared to P ( $64.1 \pm 1.3$  minutes vs.  $66.1 \pm 1.3$ ,  $p < .001$ ). Improvement in cycling performance due to ED was seen in both LO ( $66.1$  to  $64.0$  minutes, a decrease of  $2.1 \pm 0.4$  minutes,  $p = .001$ ) and HI ( $66.2$  to  $64.3$  minutes, a decrease of  $1.9 \pm 0.5$  minutes,  $p = .014$ ) groups.

**CONCLUSIONS:** An ED prior to aerobic exercise can enhance cycling time-trial performance even if there are high circulating levels of caffeine prior to ingestion. Improved performance despite high baseline circulating caffeine levels suggests that other ingredients contribute to the supplement's ergogenic effect. Pre-supplementation with ED may benefit exercise performance when supplementation during exercise is not possible.

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**2787** Board #59 June 1 9:30 AM - 11:00 AM  
**Effects Of Carbohydrate-caffeine Supplementation On Repeated High-intensity Performance In Elite Female Athletes**

Chia-Lun Lee<sup>1</sup>, Ching-Feng Cheng<sup>2</sup>, Todd A. Astorino<sup>3</sup>, Chia-Jung Lee<sup>2</sup>, Hsin-Wei Huang<sup>2</sup>, Yu-Hsuan Kuo<sup>2</sup>. <sup>1</sup>Yu Da University, Miaoli County, Taiwan. <sup>2</sup>National Taiwan Normal University, Taipei, Taiwan. <sup>3</sup>California State University San Marcos, San Marcos, CA.  
(No relationships reported)

Caffeine (CAF) has been shown to improve performance during the early phase of repeated high-intensity sprint exercise (RSE); however some studies show that CAF also increases magnitude of physical stress represented by augmented blood lactate, glucose, and cortisol concentrations during the latter phase of RSE. No studies have investigated efficacy of combined carbohydrate (CHO) and CAF consumption during RSE in female athletes.

**PURPOSE:** To evaluate the effects of CHO and CAF supplementation on metabolism and RSE performance.

**METHODS:** Eleven female athletes (age =  $20 \pm 1$  yr, height =  $163.2 \pm 6.3$  cm, body mass (BM) =  $58.2 \pm 8.3$  kg) completed 4 trials separated by 7 d in a double-blind, randomized, counter-balanced crossover design: CAF, CAF+CHO, CHO, and PLA (placebo). Participants consumed  $6\text{mg}\cdot\text{kg}^{-1}$  BM of CAF or PLA 1 h prior to RSE and  $0.8\text{g}\cdot\text{kg}^{-1}$  BM of CHO drink (glucose) or PLA immediately before the start of the test, which was conducted on a cycle ergometer. RSE consisted of 10 sets of  $5 \times 4$ -s bouts of maximal sprint exercise with 20-s active recovery between bouts. Blood samples were obtained to assess changes in lactate, blood glucose, testosterone, and cortisol across time and treatment.

**RESULTS:** During the first set of RSE, peak power ( $597.0 \pm 107.2$  vs.  $573.6 \pm 110.5$  vs.  $573.2 \pm 121.9$  watts,  $p < 0.05$ ) and mean power ( $557.0 \pm 91.5$  vs.  $535.8 \pm 91.5$  vs.  $539.5 \pm 103.1$  watts,  $p < 0.05$ ) were significantly higher with CAF+CHO than in the CHO and PLA trials, but no significant differences were shown between CAF+CHO and CAF ( $p > 0.05$ ). During sets 6 to 7, peak power and mean power were significantly increased by 6.0 % with CAF+CHO versus CAF ( $p < 0.05$ ), but there were no significant differences in performance between CAF+CHO and CHO ( $p > 0.05$ ). In addition, no significant differences in performance were observed across treatments during sets 2-5 and 8-10 ( $p > 0.05$ ). Compared to placebo, blood lactate and glucose were significantly increased under CAF+CHO, CHO, and CAF ( $p < 0.05$ ), but no significant differences in testosterone or cortisol were found ( $p > 0.05$ ).

**CONCLUSIONS:** In female athletes, a combination of caffeine and carbohydrate improved RSE performance versus CHO alone during the early phases of sprint exercise, and performance during the latter phases may be further enhanced compared to caffeine alone.

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**2788** Board #60 June 1 9:30 AM - 11:00 AM  
**The Effects Of Caffeinated "Energy Shots" On Distance Running Performance**

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(No relationships reported)

**BACKGROUND:** An emerging trend in sports nutrition is the consumption of energy drinks to improve performance. An even newer group of supplements now emerging are "energy shots", which are smaller in volume and calories than energy drinks but lack sugar. Due to their small volume, availability, price, and convenience, energy shots may prove to be a viable ergogenic aid for endurance performance. Caffeine, a widely-used ergogenic aid, is the main ingredient in these substances.

**PURPOSE:** To examine the effects of two commercial energy shots on 5-km treadmill running performance in well-trained runners.

**METHODS:** Six highly trained male runners ( $\text{VO}_{2\text{max}}$ :  $69.1 \pm 5.7 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ ; 5-km personal best:  $15.0 \pm 0.5 \text{ min}$ ) completed three trials separated by a minimum of 5 d, during which 59 mL of placebo (PLA; 0 mg caffeine), Guayakí Yerba Maté Organic Energy Shot™ (YM; 140 mg caffeine), or Red Bull Energy Shot™ (RB; 80 mg caffeine) were ingested 45 minutes before exercise. This was a randomized, single-blind, placebo-controlled crossover research design. During each trial, subjects performed a self-paced 5-kilometer time trial on a motorized treadmill. Subjects were able to control their pace via the treadmill interface, but were unaware of speed, elapsed time, and distance until the final 800 m.

**RESULTS:** Results demonstrated no significant effect of energy shot intake on performance compared to placebo (Mean  $\pm$  SD: PLA= $1046.7 \pm 74.8 \text{ s}$ ; YM= $1071.7 \pm 95.2 \text{ s}$ ; RB= $1053.2 \pm 60.8 \text{ s}$ ;  $p > 0.05$ ). However, magnitude-based inferences revealed that performance in the PLA condition was 2.3% faster than the YM condition, yielding a likely substantial benefit in performance, while the difference in 5-km performance between PLA and RB and RB and YM was unclear.

**CONCLUSIONS:** At the dosages used in this study, energy shot ingestion did not improve high-intensity (~96%  $\text{VO}_{2\text{max}}$ ), moderate duration (< 18 minutes) running performance in trained runners in a laboratory setting compared to a placebo. Though further research is warranted, these findings do not support use of energy shots as potential ergogenic aids in trained runners.

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**2789** Board #61 June 1 9:30 AM - 11:00 AM

**Red Bull Energy Drink and Anhydrous Caffeine have Similar Benefits for Cycling Time Trial Performance**

Michael D. Leveritt<sup>1</sup>, Alannah Quinlivan<sup>2</sup>, Chris Irwin<sup>1</sup>, Gary D. Grant<sup>1</sup>, Sheilandra Dukie<sup>1</sup>, Ben Desbrow<sup>1</sup>. <sup>1</sup>Griffith University, Gold Coast, Australia. <sup>2</sup>University of Melbourne, Melbourne, Australia. (Sponsor: David Bishop, FACSM)  
(No relationships reported)

**PURPOSE:** To investigate the ergogenic effects of a commercial energy drink (Red Bull) compared with an equivalent dose of caffeine provided in capsules.

**METHODS:** Eleven well-trained male cyclists ( $31.7 \pm 5.9 \text{ yrs}$ ,  $82.3 \pm 6.1 \text{ kg}$ ,  $\text{VO}_{2\text{max}} = 60.3 \pm 7.8 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ ) participated in this study which employed a double-blind, placebo-controlled and cross-over design. On three occasions participants were provided with an "energy drink" and some capsules 90 minutes before commencing a time trial equivalent to one hour cycling at 75% peak power output. All treatments were randomly administered and included Red Bull (~9 mL·kg<sup>-1</sup> body mass, containing 3 mg·kg<sup>-1</sup> body mass caffeine + placebo capsules), encapsulated anhydrous caffeine (placebo energy drink + 3 mg·kg<sup>-1</sup> body mass caffeine capsules) or a placebo (placebo energy drink + placebo capsules). Throughout each trial, exercise time, heart rate (HR), blood lactate and rating of perceived exertion (RPE) were recorded.

**RESULTS:** Performance times were improved with Caffeine ( $120 \pm 259 \text{ s}$  or 3.1%) and Red Bull treatments ( $110 \pm 270 \text{ s}$  or 2.9%), compared to the placebo ( $p < 0.05$ ), with no significant difference detected between the two caffeinated treatments ( $p > 0.05$ ). Average HR and RPE was not significantly different across the three treatments, although there was a trend towards increased HR in both the Red Bull and Caffeine trials ( $P = 0.086$  and  $P = 0.068$  respectively). Blood lactate concentrations were greater in both the Caffeine and Red Bull trials after exercise, in comparison with the placebo condition.

**CONCLUSION:** Red Bull significantly improves endurance cycling performance to the same degree as the equivalent dose of anhydrous caffeine. Therefore the ergogenic benefits of red bull energy drink are most likely due to caffeine, with the other ingredients offering no observable additional benefit.

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**2790** Board #62 June 1 9:30 AM - 11:00 AM

**Examining Football Players Energy Drink Use and Motivations for Combining Energy Drinks with Alcohol**

Conrad L. Woolsey<sup>1</sup>, Bert H. Jacobson<sup>2</sup>, Weston S. Kensing<sup>3</sup>, Niels C. Beck<sup>4</sup>, Alex Waigandt<sup>5</sup>. <sup>1</sup>Oklahoma State University, Tulsa, OK. <sup>2</sup>Oklahoma State University, Stillwater, OK. <sup>3</sup>Oswego State University, Oswego, NY. <sup>4</sup>University of Missouri Medical School, Columbia, MO. <sup>5</sup>University of Missouri, Columbia, MO.  
(No relationships reported)

Research suggests football players may be a subgroup of the population that is particularly attracted to the stimulating effects of energy drinks (EDs) both on and off the field. Evidence suggests ED consumption in combination with alcohol has become increasingly prevalent.

**PURPOSE:** To investigate the use of energy drinks among NCAA Division I football players and motivations for combining EDs with alcohol.

**METHODS:** Following IRB approval 41 football players from a large Midwestern NCAA D-I university voluntarily completed the Quick Drink Screen (QDS) quantity-frequency measure for alcohol, combined-use (EDs+alcohol), and ED use without alcohol. To measure motivations for combining EDs with alcohol, participants also completed the Brief Comprehensive Effects of Alcohol and Combined-Use Questionnaires.

**RESULTS:** Nearly half (42.5%) of participants consumed EDs without alcohol and 27.5% used EDs 2 or more days/wk during the previous year. Additionally, 20% reported ED-binge drinking (having 3 or more EDs on one occasion). Among alcohol drinkers ( $n = 33$ ), 39.4% mixed EDs with alcohol and 69% of those combined-users reported ED-binge drinking with alcohol. An ANOVA on age and combined-use indicated older players were significantly more likely to combine EDs with alcohol than younger players  $F(4,23) = 5.006$ ,  $p = .003$ . An ANOVA on race (white/black) and combined-use indicated significant differences on the number of alcoholic drinks when combining  $F(1,39) = 4.146$ ,  $p < .05$ , and greatest number of alcoholic drinks when combining  $F(1,39) = 4.135$ ,  $p < .05$ , with white players drinking more. Positive motivations for using EDs with alcohol yielded higher mean scores while combining on enjoying sex, being more sociable ( $M = 3.38$  alcohol; 3.88 EDs+alco), and feeling stronger ( $M = 2.88$  alcohol; 3.5 EDs+alco); however, no significant differences were found.

**CONCLUSIONS:** Mixing EDs with alcohol appears to be a common trend which may contribute to the increased risk for ED-binge drinking. ED use has previously been reported as a predominantly white male behavior. In this sample, ED use was proportionate with 42% of white and 45% of black players using EDs; however, results did indicate white players had a higher prevalence of combining EDs with alcohol. The use of EDs among athletes and their motivations for using EDs needs further study.

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**2791** Board #63 June 1 9:30 AM - 11:00 AM

**High But Not Low Caffeine Ingestion Has An Acute Diuretic Effect At Rest**

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(S.A. Kavouras: Consulting Fee; Gatorade Sports Science Institute.)

It is documented that low levels of caffeine ingestion does not induce chronic dehydration at rest, while it not clear if larger doses do have an acute diuretic effect.

**PURPOSE:** The aim of the present investigation was to examine the effect of low and high level of caffeine on fluid balance in habitual coffee drinkers at rest.

**METHODS:** Twenty-five healthy male and female adults (age:  $28 \pm 5 \text{ y}$ , body mass index:  $28 \pm 5$ , weight:  $84.6 \pm 7.7 \text{ kg}$ , height:  $1.79 \pm 0.01 \text{ m}$ ) ingested 200 ml of water (W) or coffee with low caffeine (3 mg/kg, LCAF), on two separate occasions. Nine subjects of them participated one a third trial ingesting coffee with high caffeine (6 mg/kg, HCAF). All subjects remained in the laboratory while urine samples were collected every 60 min for three hours. Mean caffeine consumption for LCAF was 254 mg and 552 mg for the LCAF and HCAF, respectively. The subjects were habitual coffee drinkers (2-3 cups per day) who abstained from foods and drinks containing caffeine or other methylxanthines 24 h before each study. All sessions were performed at 09:00 in the morning in a counterbalance, crossover manner, at least 5 days apart.

**RESULTS:** Cumulative urine volume during the 3 h period after caffeine ingestion induced greater diuresis in the HCAF trial ( $630 \pm 391 \text{ ml}$ ) when compared to W ( $292 \pm 165 \text{ ml}$ ) and LCAF ( $316 \pm 194 \text{ ml}$ ). No differences were found between the W and LCAF trials. Urine specific gravity was lower during the HCAF trial ( $1.011 \pm 0.006 \text{ g/ml}$ ) when compared to W ( $1.016 \pm 0.007 \text{ g/ml}$ ) and LCAF ( $1.016 \pm 0.006 \text{ g/ml}$ ).

**CONCLUSIONS:** The data suggest that high caffeine intake in the form of coffee can induce an acute diuretic effect, while low levels do not disturb fluid balance in healthy casual coffee drinking adults at rest.

**2792 Board #64 June 1 9:30 AM - 11:00 AM**  
**Effects of Increasing Dosages of Caffeine on Predicted VO2 Max**

Sarah Yenchik, Timothy A. VanHaitma, Andrea T. White, FACSM, Kerry M. Jacques. *University of Utah, Salt Lake, UT.*  
 (No relationships reported)

Caffeine is a mild stimulant that acts on the central nervous system and skeletal muscles, overriding fatigue signals, increasing heart rate at rest, and eliciting greater motor unit recruitment. Caffeine also positively affects performance by increasing endurance and increasing performance at high altitude. Other research has suggested that caffeine can decrease heart rate (HR) during submaximal exercise. Several submaximal exercise tests use heart rate to predict VO2max. Therefore, due to the varying response of heart rate to caffeine, the response of the predicted VO2max to caffeine is unknown.

**PURPOSE:** The purpose of this study was to determine the effect of caffeine ingestion on heart rate during submaximal exercise and on the subsequent predicted VO2max of active college age males.

**METHODS:** 12 moderately trained males (age 18-30 yrs) completed four testing procedures on four separate days: 1) VO2max test; 2-4) single-blind dosage of caffeine (0 (A), 3.5 (B) or 7 (C) mg/kg) administered orally 1 hour before testing. Participants completed the Forestry Step test and the Astrand Cycling test. Relative and absolute predicted VO2 max values were recorded and comparisons between caffeine dosages were made using repeated measures ANOVA.

**RESULTS:** There were no significant differences in mean predicted VO2 max following any of the caffeine trials for either the Forestry or Astrand test as compared to the placebo ( $p > .05$ ). However, according to Bland-Altman plots, Absolute Astrand (C-A) and the Relative Forestry (B-A) have trend lines with significant slope, which is indicative of some systematic variability and thus poor agreement and bias in the data.

**CONCLUSIONS:** These results suggest that consumption of caffeine does not have a measurable effect in moderately trained males on predicted VO2 Max from the Forestry or the Astrand tests. This also suggests that it may not be necessary to restrict participant's caffeine intake before clinical submaximal testing.

**2793 Board #65 June 1 9:30 AM - 11:00 AM**  
**Caffeine Ingestion Reverses the Circadian Rhythm Effects on Neuromuscular Performance in Highly Resistance-Trained Men**

Alvaro Lopez-Samanes, Jesus Garcia-Pallares, Juan F. Ortega, Valentin E. Fernandez-Elias, Ricardo Mora-Rodriguez. *University of Castilla La Mancha, Toledo, Spain.*  
 (No relationships reported)

Following a circadian rhythm pattern, neuromuscular performance declines in early mornings and late nights while peaks during midday. In turn, caffeine ingestion, an adenosine receptor inhibitor, has been accepted as an ergogenic aid with potential to improve neuromuscular performance (i.e., muscle strength and power).

**PURPOSE:** Investigate whether caffeine ingestion counteracts the morning reduction in neuromuscular performance associated with circadian rhythm.

**METHODS:** Twelve highly resistance-trained men underwent a battery of neuromuscular tests under three different conditions; *i*) morning (10:00 a.m.) with caffeine ingestion (i.e., 6 mg · kg<sup>-1</sup>; AM<sub>CAFF</sub> trial); *ii*) morning (10:00 a.m.) with placebo ingestion (AM<sub>PLAC</sub> trial); and *iii*) afternoon (18:00 p.m.) with placebo ingestion (PM<sub>PLAC</sub> trial). A randomized, double-blind, placebo controlled experimental design was used, with all subjects serving as their own controls. The test battery consisted in the measure of bar displacement velocity during free-weight full-squat (SQ) and bench press (BP) exercises against loads that elicit maximum strength (75% 1RM load) and muscle power adaptations (1 m·s<sup>-1</sup> load). In addition, maximum voluntary and electrically evoked (EVO<sub>C<sub>LEG</sub></sub>) isometric leg extension strength were measured to identify the caffeine's action mechanisms. Plasma norepinephrine concentration (NE) was measured after a standardized SQ intense bout (6 x 85% 1RM) as surrogate of maximal muscle sympathetic nerve activity since plasma NE is mostly derived from the spillover of the terminal nerve endings of the motoneurons.

**RESULTS:** In the PM<sub>PLAC</sub> trial, dynamic muscle strength and power output were significantly enhanced compared with AM<sub>PLAC</sub> (4.7%-7.5%;  $P < 0.05$ ). During the AM<sub>CAFF</sub> trial, strength and power increased above AM<sub>PLAC</sub> levels (4.6%-5.7%;  $P < 0.05$ ) except for BP velocity with 1 m·s<sup>-1</sup> load. Lastly, during AM<sub>CAFF</sub>, EVO<sub>C<sub>LEG</sub></sub> and NE were increased above AM<sub>PLAC</sub> trial (14.6% and 96.8%, respectively;  $P < 0.05$ ).

**CONCLUSIONS:** Overall, caffeine ingestion reversed the morning decreases in muscle strength and power output, raising performance to levels of the afternoon trial. The electrical stimulation data, along with NE, suggests that caffeine increases the neuromuscular performance via a direct effect in the muscle.

**2794 Board #66 June 1 9:30 AM - 11:00 AM**  
**The Effects of Caffeine on Long-Term Anaerobic Exercise**

Elizabeth M. Hendricks, Harold S. Kieffer, Jodie L. Haak. *Messiah College, Grantham, PA.* (Sponsor: Dan Drury, FACSM)  
 (No relationships reported)

**PURPOSE:** The purpose of this study was to examine effects of caffeine on a long-term anaerobic exercise protocol using the 90-second Wingate Test (WAnT90).

**METHODS:** Thirteen (5 males and 8 female, Age = 20.15±0.99 years) anaerobically trained athletes who were habitual caffeine consumers participated in a double-blind study that was randomized and counterbalanced using caffeine (5 mg/kg) and a placebo (equivalent mg of rice flour). One hour after ingesting the caffeine or placebo capsule, the subjects underwent a 2-minute prescribed warm-up on Monarch bicycle ergometer. The participant then performed a WAnT90 protocol using 0.05 kg per body weight as a constant resistance. Paired t-tests were conducted between the caffeine and placebo for peak power (PP), total power (TP), total power 30-s (TP30), total power 60-s (TP60), total power 90-s (TP90), and power decline for total work, 30-s, 60-s, and 90-s (PDT, PD 30, 60, and 90, respectively). The significance was set at  $p \leq 0.05$ .

**RESULTS:** The caffeine did not show a difference in PP; however, the caffeine trial did improve performance for TP, TP30 and TP60. In addition, TPD was improved with caffeine however; the rate of decline did not change across the 30-s intervals.

|          | TP (Watts) | TP60 (Watts) | TP90 (Watts) | TPD (% decline) |
|----------|------------|--------------|--------------|-----------------|
| Caffeine | 5850.47#   | 1733.53^     | 1366.36#     | 63.12%*         |
| Placebo  | 5593.26    | 1617.33      | 1242.66      | 67.29%          |

\* $p < 0.05$ , # $p < .01$ , ^ $p < 0.001$

**CONCLUSIONS:** As with other studies, peak power did not change following the ingestion of caffeine; however, caffeine did have a significant effect on long-term anaerobic performance. The increased power output with caffeine could be due adenosine antagonism and a decrease in pain perception and fatigue.

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**E-23 Free Communication/Poster - Cardiovascular II**

JUNE 1, 2012 7:30 AM - 12:30 PM  
ROOM: Exhibit Hall

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**2795** Board #67 June 1 11:00 AM - 12:30 PM

**A Moderate Exercise Protocol that Produces Significant Cardiac Hypertrophy in Rats**

Joseph W. Stames, FACSM, Bryan J. Feger, Lindsay A. Hixson. *University of North Carolina at Greensboro, Greensboro, NC.*  
(No relationships reported)

Chronic treadmill exercise by rats can result in cardiac hypertrophy and improved function; however, the intensity required is very high. At normal room temperature, core temperature during exercise rises to potentially lethal levels. In 2001, we carried out a study to investigate the interaction of temperature and exercise on myocardial phenotype using a moderate exercise protocol with environmental conditions adjusted to prevent exercise-induced increased core temperature (Am J Physiol 280:H2271,2001). As expected, the room temperature exercisers did not develop cardiac hypertrophy; however, to our surprise the group exercising at the same intensity but in a colder environment developed significant cardiac hypertrophy.

**PURPOSE:** To determine whether hypertrophy following moderate exercise training in the cold environment is associated with enhanced function consistent with exercise-induced hypertrophy following intense exercise training.

**METHODS:** Male, 10-wk-old Sprague-Dawley rats were divided into sedentary (S) and exercised (E) groups. E ran on a treadmill 5 days/week up a 6° incline for 4- or 9-wks. During wk 1, running time and speed was gradually increased to 30 minutes at 20 m/min (~70% VO<sub>2</sub>max). During wk 2 rats began running in a refrigerated room (6-8°C) with fur dampened and running time gradually increased to one hour per day, then held constant for the remaining wks. Animals were housed at 23°C when not running. Twenty-four hrs after the last exercise bout, hearts were weighed and connected to an isolated perfused working heart apparatus for evaluation of cardiac functional performance. Ventricular gene expression of  $\alpha$ - and  $\beta$ -MHC (myosin heavy chain) was determined in the 9-week group.

**RESULTS:** E displayed an increase in heart wt (P<0.05) compared to S of 9% and 23% after 4 and 9 wks, respectively. Cardiac function improved in E vs S as indicated by increases (P<0.05) of 24% in external work performed (Cardiac output x Systolic pressure, normalized for wt) and 20% in efficiency of external work (work/VO<sub>2</sub>). Gene expression was not different from sedentary values consistent with physiological hypertrophy.

**CONCLUSION:** Compared to exercise at ambient temperature, the cold-room exercise protocol is a more humane way to produce exercise-induced hypertrophy and improvement in function.

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**2796** Board #68 June 1 11:00 AM - 12:30 PM

**Prevalence Of Cardiac Abnormalities In College Athletes When Exposed To Physiological And Thermal Stressors**

James D. Kingsley, Matt Tucker, Susan Yeargin. *Indiana State University, Terre Haute, IN.* (Sponsor: Lynn Panton, FACSM)  
(No relationships reported)

Cardiovascular pre-participation screening of collegiate student athletes is underutilized according to the American Heart Association. Physiological stress in the form of submaximal exercise and heat exposure can both alter cardiovascular function, possibly elucidating an abnormality via electrocardiogram (ECG).

**PURPOSE:** To investigate prevalence of cardiac abnormalities in college athletes when exposed to physiological and thermal stress.

**METHODS:** Eleven participants (males n=5; females n=6; 21 ± 1 yrs; 1.68 ± 0.05m; 60.0 ± 4.5kg; 56.1 ± 12.2 ml/kg/min) currently participating at the NCAA Division I level (track and field as well as cross country) volunteered for this study. Participants completed one maximal treadmill test and two submaximal treadmill tests (70% of VO<sub>2</sub> max) in two different environmental conditions: thermoneutral (TN: 24.8 ± 1.6°C) and hyperthermic (HT: 38.0 ± 2.2 °C) for 30 minutes. ECGs were recorded over 15 seconds at five minute intervals. PR interval duration, ST segment elevation/depression, and R and S wave amplitude were measured; ECGs were further analyzed for abnormalities. A repeated measures ANOVA was used to test the effects of condition by time.

**RESULTS:** No significant condition by time interactions were found for any variable (p>0.05). There were also no main effects (p>0.05) of condition. However, there were significant differences across time (p<0.05) manifested as a decreased PR interval (-19.1 ± 18.2%), R wave amplitude (-15.1 ± 12.3%), and increased S wave amplitude (+34.8 ± 29.1%). No main effects (p>0.05) were found for ECG abnormalities. However, high occurrences (56%) of incomplete left bundle branch block (ILBBB) were found.

**CONCLUSION:** Submaximal exercise in the hyperthermic condition did not significantly alter cardiovascular function in the parameters measured. In addition, the total number of ECG readings with abnormalities was higher in the hyperthermic condition compared to thermoneutral, most notable in incidences of ILBBB. Supported by funding from the College of Graduate and Professional Studies at Indiana State University

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**2797** Board #69 June 1 11:00 AM - 12:30 PM

**Influence of the Menstrual Cycle on Resting and Exercise Left Ventricular Volumes and Twist Mechanics**

Amanda Q.X. Nio, Eric J. Stöhr, Michael Stembridge, Rob Shave. *University of Wales Institute, Cardiff, Cardiff, United Kingdom.* (Sponsor: Keith George, FACSM)  
(No relationships reported)

Currently, there is no consensus on the impact of cyclical changes in circulating female sex hormones across the menstrual cycle, on cardiac function at rest or during exercise.

**PURPOSE:** To compare left ventricular (LV) function at rest and during exercise across the early-follicular (EF) and mid-luteal (ML) phases of the menstrual cycle.

**METHODS:** Eight healthy females (mean±standard deviation; age 26±2 years; height 164.9±8.0 cm; body mass 58.5±7.6 kg; body fat 29±4%), with regular menstrual cycles (25-33 days), completed progressive supine cycling exercise during EF (Day 3-5) and ML (Day 19-27) phases. Participants completed four 4-min exercise stages at 10, 30, 50 and 70% peak power (151±52 W). LV volumes, septal wall velocity, isovolumic relaxation time and twist mechanics were assessed using cardiac ultrasound (Vividq, GE Healthcare), at rest and during each stage of exercise. Statistical analysis was performed using t-test for resting measures and two-way ANOVA for exercise measures. Alpha was set at 0.1.

**RESULTS:** At rest and during incremental exercise, diastolic blood pressure, cardiac output, heart rate, stroke volume, ejection fraction, end-systolic volume and peak systolic septal wall velocity at the level of the mitral annulus were similar between menstrual cycle phases. However, resting systolic blood pressure (ML 112±12 vs. EF 125±9 mmHg; p=0.05), peak apical rotation (ML 9.1±4.8 vs. EF 10.2±4.7 deg; p=0.01) and peak apical rotation velocity during diastole (ML -68±15 vs. EF -80±13 deg/s; p=0.03) were reduced during the ML phase. End-diastolic volume was influenced by the interaction between menstrual cycle phase and exercise intensity (p=0.06), with a larger volume at 70% exercise during the ML phase (ML 103±18 vs. EF 95±24 mL; p=0.09). Isovolumic relaxation time differed between menstrual cycle phase (p=0.001), and was shorter during the ML phase at 30% peak power (ML 53±7 vs. EF 64±10 ms; p=0.01) and 70% peak power (ML 44±8 vs. EF 49±9 ms; p=0.07).

**CONCLUSION:** Although global parameters of resting cardiac function were similar between the EF and ML phases, greater increases in apical rotation and diastolic rotation velocity with exercise in the ML phase likely result in greater LV suction during diastole. This might explain the enhanced EDV observed during moderate intensity exercise.

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2798 Board #70 June 1 11:00 AM - 12:30 PM

### Exercise Training Does Not Enhance Diastolic Function In Non-alcoholic Fatty Liver Disease Patients

Helen Jones<sup>1</sup>, Christopher K. Wong<sup>2</sup>, Malcolm I. Burgess<sup>2</sup>, Christopher J. Pugh<sup>1</sup>, Keith George, FACSM<sup>1</sup>, Margot Umpleby<sup>3</sup>, Fariba Shojaae-Moradie<sup>3</sup>, Graham J. Kemp<sup>4</sup>, Daniel J. Cuthbertson<sup>5</sup>. <sup>1</sup>Liverpool John Moores University, Liverpool, United Kingdom. <sup>2</sup>University Hospital Aintree, Liverpool, United Kingdom. <sup>3</sup>University of Surrey, Guildford, United Kingdom. <sup>4</sup>University of Liverpool, Liverpool, United Kingdom. <sup>5</sup>Univeristy Hospital Aintree, Liverpool, United Kingdom.  
(No relationships reported)

**PURPOSE:** Non-Alcoholic Fatty Liver Disease (NAFLD), the accumulation of triglycerides in the liver, is the hepatic manifestation of the metabolic syndrome. NAFLD is associated with an increased risk of chronic liver disease including cirrhosis, liver failure and hepatocellular carcinoma although cardiovascular disease (CVD) remains the leading cause of mortality. We have recently shown diastolic dysfunction in NAFLD patients when compared to age and BMI matched controls. The aim of this study was to examine the effect of exercise training on diastolic dysfunction in patients with NAFLD.

**METHODS:** Twelve sedentary patients with NAFLD, aged 50.9±11.7y, underwent a 16-week supervised exercise training program (30-45min, 3-5 times per week). Each patient underwent transthoracic echocardiography to determine left ventricular (LV) mass index, peak early (E) and atrial (A) diastolic flow velocities, the E/A ratio, peak early (E') diastolic tissue velocity at the septal mitral annulus and the E/E' ratio. Proton Magnetic Resonance (MR) Spectroscopy was used to determine liver fat and whole body MR imaging quantified abdominal visceral (VAT) and subcutaneous (SAT) adipose tissue. Fasting glucose, lipids, liver enzymes and V<sub>O<sub>2</sub></sub>max were assessed prior to and following training. Differences between baseline and post-training were analysed using paired t-tests.

**RESULTS:** Exercise training resulted in a significant improvement in V<sub>O<sub>2</sub></sub> max from 24.9±6.2 to 31.3±8.4 ml.kg.min<sup>-1</sup>, liver fat significantly reduced (25±2 vs 16±1%). There was a significant reduction in BMI (30.1±2.4 vs 29.4±2.8 kg/m<sup>2</sup>) and abdominal SAT (8.6±2.5 vs 8.0±2.5 L, P<0.05) but abdominal VAT was not different following exercise training. Despite these reductions in body composition and liver fat, there were no significant changes in any variable of myocardial performance: differences in LV mass (73.4±16.7 vs 82.7±18.2 g/m<sup>2</sup>), diastolic flow velocities (E/A ratio 1.10±0.30 vs 1.03±0.26) or diastolic tissue velocity (E' 6.6±1.4 vs 7.1±2.3 cm/s and E/E' 11.1±2.9 vs 11.0±3.0 cm/s).

**CONCLUSIONS:** These data indicate that exercise training did not improve diastolic function in NAFLD patients. Given that LV function is partially mediated by visceral adiposity the lack of improvement in diastolic function could be due to a lack of change in VAT volume.

2799 Board #71 June 1 11:00 AM - 12:30 PM

### Influence of Sex on Carotid Baroreflex Resetting and Function during Dynamic Exercise in Humans

Areum Kim<sup>1</sup>, Shekhar H. Deo<sup>1</sup>, James P. Fisher<sup>2</sup>, Paul J. Fadel, FACSM<sup>1</sup>. <sup>1</sup>University of Missouri, Columbia, MO. <sup>2</sup>University of Birmingham, Birmingham, United Kingdom.  
(No relationships reported)

Young men tend to exhibit greater pressor responses to exercise compared to age-matched women; however, the reason for these differences remains unclear. Appropriate arterial baroreflex resetting and function are requisite for normal blood pressure responses to dynamic exercise. However, to date, no studies have examined whether there are sex differences in arterial baroreflex resetting and function during dynamic exercise.

**PURPOSE:** To compare carotid baroreflex (CBR) resetting and function during dynamic exercise between young men and women.

**METHODS:** We studied 16 young men and 18 young women at rest and during leg cycling at 50% heart rate (HR) reserve. All women were studied during the early follicular phase of the menstrual cycle (days 2-5). Beat-to-beat HR (ECG) and mean arterial pressure (MAP; finger photoplethysmography) were measured. Five second pulses of neck pressure and neck suction (NS) from +40 to -80 Torr were applied to determine full CBR stimulus response curves for MAP and HR. In order to estimate the magnitude of exercise-induced baroreflex resetting, differences in the sum of the changes in centering point (CP), minimum response, threshold, and saturation from rest to exercise were calculated.

**RESULTS:** An upward and rightward resetting of the CBR function curve was observed during exercise in both men and women with a similar magnitude of CBR resetting for MAP (+68±10 women vs. +81±13 men a.u.; P>0.05) and HR (+160±12 women vs. +155±13 men a.u.; P>0.05) between sexes. However, for CBR control of MAP, young women exhibited significantly greater depressor responses to NS at rest that were not present during exercise. For CBR control of HR, there was a greater bradycardic response to NS in young women with the operating point (OP) located further away from CP on the CBR-HR curve during rest (OP-CP; -13±3 women vs. -3±3 men mmHg; P<0.05) and exercise (-31±2 women vs. -15±3 men mmHg; P<0.05).

**CONCLUSION:** Collectively, these findings suggest that sex does not influence exercise resetting of the arterial baroreflex. However, young women exhibit greater CBR control of HR during dynamic exercise, specifically against acute hypertension.

Supported by R01HL093167

2800 Board #72 June 1 11:00 AM - 12:30 PM

### The Effects Of A Multi-flavonoid Supplement On Vascular And Hemodynamic Parameters In Older Prehypertensives

Chelsea D. Curry<sup>1</sup>, Steven R. McAnulty<sup>1</sup>, Lisa S. McAnulty<sup>1</sup>, Hannah E. Wheeler<sup>1</sup>, Janice Welsh<sup>1</sup>, Rebecca M. Kappus<sup>2</sup>, Martin Hubner<sup>1</sup>, Scott R. Collier, FACSM<sup>1</sup>. <sup>1</sup>Appalachian State University, Boone, NC. <sup>2</sup>University of Illinois at Urbana-Champaign, Urbana, IL.  
(No relationships reported)

Antioxidants have been shown to increase vasodilation leading to increases in vascular distensibility, which would be of great benefit to individuals with elevated blood pressure. Our laboratory has shown beneficial changes in blood pressure (BP) and augmentation index (AIx) immediately post-exercise in young prehypertensives following two weeks of anti-oxidant supplementation. The purpose of this study was to investigate the potential additive effects of an acute aerobic exercise bout paired with two weeks of anti-oxidant supplementation (1 day=1000mg quercetin, 120 mg epigallocatechin 3-gallate [EGCG], 400 mg isoquercetin and 400 mg EPA-DHA (Q-EGCG)) on post-exercise hypotension in middle-aged (40-60 year old) pre-to stage-one hypertensives.

**METHODS:** 18 subjects (51.7±1.8, 50.8±1.8 years old, treatment and placebo group respectively) were randomly assigned either supplement or placebo group in double-blinded fashion. Systolic blood pressure (SBP), diastolic blood pressure (DBP) (Finometer), Augmentation Index (AIx), central and peripheral pulse wave velocity (cPWV, pPWV, respectively, SphygmoCor) were assessed pre- and post-exercise prior to and following 2 weeks of supplementation in a double-blind, counterbalanced design.

**RESULTS:** Following two weeks of supplementation, there was a significant decrease in resting SBP (132.2±5.4 pre-supplementation to 124.9±5.4 post, p<0.05) and mean arterial pressure (100.2±2.2 pre-supplementation to 94.6±4.4 post, p<0.05) following supplementation. No significant differences existed in DBP, AIx, cPWV or pPWV.

**CONCLUSION:** Two weeks of multi-flavonoid supplementation elicited a significant decrease in systolic blood pressure and mean arterial pressure in the treatment group.

This study was partially funded by an Appalachian State University research grant (Collier-PI).

2801 Board #73 June 1 11:00 AM - 12:30 PM

### The Influences Of Protocatechuic Acid On Blood Pressure And Insulin-mediated Vascular Function In Hypertension

Sih-Han Wu<sup>1</sup>, Ai-Lun Yang<sup>1</sup>, Chia-Ting Su<sup>2</sup>. <sup>1</sup>Taipei Physical Education College, Taipei, Taiwan. <sup>2</sup>Fu Jen Catholic University, Taipei, Taiwan. (Sponsor: Chia-Hua Kuo, FACSM)  
(No relationships reported)

**PURPOSE:** Hypertension has been known to induce vascular impairments with the decrease of nitric oxide (NO) bioavailability. Moreover, oxidative stress has been recognized as an important factor for the pathogenesis of endothelial dysfunction and hypertension. Recently, protocatechuic acid (PCA; 3,4-dihydroxybenzoic acid), a simple phenolic acid, has been found to be a strong antioxidant. However, whether PCA induces beneficial effects on cardiovascular function in hypertensive status remains unknown. Therefore, we investigated the influences of PCA on blood pressure and vascular function in hypertension.



**METHODS:** Male spontaneously hypertensive rats were randomly divided into control (SHR) and PCA supplement (SHR+PCA) groups. Wistar-Kyoto (WKY) rats were used as the normotensive control group. The SHR+PCA group was supplemented with PCA adjusted from their daily water consumption for 8 weeks. At the end of experiments, resting blood pressure, glucose, and insulin level were measured and compared among three groups. In addition, the insulin-mediated vasorelaxation was evaluated in rat aortas using the organ bath system. The aortic protein expression, such as insulin receptor and endothelial nitric oxide synthase (eNOS), was also examined by Western blot analysis. This study was approved by the Institutional Animal Care and Use Committee of Taipei Physical Education College (Taipei, Taiwan).

**RESULTS:** We found that the PCA supplement significantly reduced the systolic blood pressure, glucose, and insulin level in the SHR+PCA group compared with the SHR group ( $p < 0.05$ ). Also, the PCA supplement induced higher insulin-mediated vasorelaxation in the SHR+PCA group than that in the SHR group ( $p < 0.05$ ). However, the endothelium-denuded insulin-mediated vasorelaxation was comparable among three groups. Moreover, the protein expression of insulin receptor and eNOS was significantly increased after the PCA supplement.

**CONCLUSIONS:** The 8-week PCA supplement could ameliorate the blood pressure and insulin-mediated vasorelaxation in hypertension. This vascular improvement was associated with the increase of insulin receptor and eNOS protein via the endothelium-dependent pathway.

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**2802** Board #74 June 1 11:00 AM - 12:30 PM

### **Prenatal Programming of Hypertension by Dietary Protein Deprivation Alters Skeletal Muscle Reflex Function in Rats**

Masaki Mizuno, Khurum Siddique, Michel Baum, Scott A. Smith, FACSM. *University of Texas Southwestern Medical Center, Dallas, TX.* (Sponsor: Jere H. Mitchell, FACSM)

(No relationships reported)

The cardiovascular response to exercise is enhanced in hypertension. Recent studies using a rat model of essential hypertension have suggested that this exaggerated responsiveness is mediated, in part, by the skeletal muscle exercise pressor reflex (EPR). It remains unknown, however, whether EPR dysfunction manifests in other forms of this disease.

**PURPOSE:** To address this issue, EPR function was investigated in adult rats that were prenatally programmed to express hypertension as a result of maternal dietary protein deprivation. Prenatal programming of hypertension (PPH) in this manner is a commonly used model for the hypertension that develops in adults that were born small for gestational age.

**METHODS:** Pregnant Sprague-Dawley rats were fed either a 6% (PPH) or 20% (control) protein diet during the last half of the gestational period. In 10 PPH and 11 control adult offspring, EPR function was assessed by electrically-inducing hindlimb muscle contraction. The mechanically-sensitive component of the EPR was selectively activated by passively stretching hindlimb muscle while the chemically-sensitive component was stimulated by locally administering capsaicin (1.0  $\mu\text{g}/100 \mu\text{l}$ ) into the circulation of the hindlimb.

**RESULTS:** Resting systolic blood pressure was significantly higher ( $P < 0.05$ ) in PPH compared to control rats ( $140 \pm 3$  vs.  $128 \pm 3$  mmHg, respectively). Stimulation of the EPR evoked significantly larger increases in mean arterial pressure ( $\Delta\text{MAP}$  from baseline:  $40 \pm 7$  vs.  $20 \pm 4$  mmHg,  $P < 0.05$ ), heart rate ( $\Delta\text{HR}$  from baseline:  $19 \pm 3$  vs.  $5 \pm 1$  bpm,  $P < 0.05$ ) and renal sympathetic nerve activity ( $\Delta\text{RSNA}$ :  $198 \pm 29$  vs.  $68 \pm 14$  %,  $P < 0.05$ ) in PPH compared to control whereas developed tension was not different between groups ( $\Delta\text{Tension}$ :  $0.84 \pm 0.07$  vs.  $0.81 \pm 0.07$  kg). The MAP, HR and RSNA responses to selective activation of the mechanically and chemically-sensitive components of the EPR were likewise significantly greater in PPH compared to control.

**CONCLUSIONS:** These data demonstrate that the EPR is overactive in prenatally programmed hypertension. This is an important finding as it suggests that muscle reflex dysfunction is not unique to essential hypertension but may play a significant role in the generation of abnormal cardiovascular control during exercise in other forms of the disease. *Supported by NIH HL-088422*

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**2803** Board #75 June 1 11:00 AM - 12:30 PM

### **Effect Of Resistance Exercise Training On Arterial Reservoir Pressure In Prehypertensive Men And Women**

Kevin S. Heffernan<sup>1</sup>, Eun Sun Yoon<sup>2</sup>, Justin Davies<sup>3</sup>, James E. Sharman<sup>4</sup>, Bo Fernhall, FACSM<sup>5</sup>, Sae Young Jae<sup>2</sup>. <sup>1</sup>Syracuse University, Syracuse, NY. <sup>2</sup>University of Seoul, Seoul, Korea, Republic of. <sup>3</sup>Imperial College, London, United Kingdom. <sup>4</sup>University of Tasmania, Hobart, Australia. <sup>5</sup>University of Illinois- Chicago, Chicago, IL

(No relationships reported)

**BACKGROUND:** The central blood pressure (BP) waveform is viewed as a composite of overlapping incident and reflected pressure waves. Recently, it has been suggested that the capacitance property of large central arteries also contribute to the morphology of the BP waveform (i.e. reservoir pressure). Resistance exercise training (RET) reduces central BP yet it appears to do this without changing pressure from wave reflections.

**PURPOSE:** The purpose of this study was to examine the contribution of the arterial reservoir to changes in central BP following RET in men and women with pre-hypertension.

**METHODS:** Twenty-one participants (age  $61 \pm 1$  yrs,  $n = 6$  male) with pre-hypertension (average SBP/DBP = 138/84 mmHg) were randomized to either 12-weeks of RET ( $n = 11$ ) or an inactive control group. Central aortic BP was derived from radial pressure waveforms using tonometry and a generalized transfer function. Also derived from BP waveforms were forward wave pressure, excess wave pressure, augmented pressure, augmentation index (AIx), left ventricular pressure effort, and reservoir pressure.

**RESULTS:** A significant group-by-time interaction for central systolic blood pressure (SBP) was noted ( $p < 0.05$ ). There was a reduction in central SBP following RET ( $134 \pm 5$  to  $129 \pm 4$  mmHg) and a slight increase in central SBP in the control group ( $130 \pm 5$  to  $133 \pm 4$  mmHg). There were also significant group-by-time interactions for forward wave pressure ( $p < 0.05$ ), excess pressure ( $p < 0.05$ ), and reservoir pressure ( $p < 0.05$ ). Following RET there were reductions in forward wave pressure ( $32 \pm 2$  to  $30 \pm 2$  mmHg) excess pressure ( $42 \pm 3$  to  $40 \pm 3$  mmHg) and reservoir pressure ( $38 \pm 3$  to  $35 \pm 3$  mmHg). There were slight increases in forward wave pressure ( $27 \pm 2$  to  $30 \pm 2$  mmHg), excess pressure ( $35 \pm 3$  to  $39 \pm 3$  mmHg), and reservoir pressure ( $31 \pm 3$  to  $35 \pm 3$  mmHg) in the control group. There were no changes in augmented pressure, AIx or left ventricular pressure effort in either group ( $p > 0.05$ ).

**CONCLUSIONS:** RET reduces central SBP in pre-hypertensive men and women. Changes in forward wave/excess wave pressure and reservoir pressure without changes in augmented pressure suggest that central SBP reduction with RET may be due to changes in the impedance and capacitance properties of arteries and not changes in pressure from wave reflections.

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**2804** Board #76 June 1 11:00 AM - 12:30 PM

### **The Hemostatic Responses to Acute Exercise of an At Risk Obstructive Sleep Apnea Population**

Paul Nagelkirk, Steve Vesbach, Amanda Mallory, Trent Hargens. *Ball State University, Muncie, IN.* (Sponsor: Christopher Womack, FACSM)

(No relationships reported)

Obstructive sleep apnea (OSA) is a sleep disorder that places one at increased risk for cardiovascular disease (CVD) and CVD related events. Patients with OSA exhibit elevated coagulation and decreased fibrinolytic potential, both of which are associated with incidence of CVD and its sequelae. The hemostatic response to a stressor such as maximal exercise may differentiate clinical and demographic groups better than baseline profiles. Hemostatic exercise responses are also related to CVD morbidity and mortality. To date, no research has examined the impact of exercise on measures of coagulation and fibrinolysis in this population.

**PURPOSE:** To compare the fibrinolytic and coagulation responses to exercise between subjects at high risk for OSA and control subjects.

**METHODS:** Seventeen obese men and women (BMI =  $32.1 \pm 5.7$  kg/m<sup>2</sup>) completed the study: 8 at risk for OSA (apnea-hypopnea index =  $10.6 \pm 8.2$  events/hour) and 9 control subjects. Subjects performed maximal exercise tests on a cycle ergometer. Plasma concentrations of fibrinogen, active tissue plasminogen activator (tPA) and plasminogen activator inhibitor (PAI-1) were assessed at rest and immediately after exercise. Body composition was assessed by DXA. Risk for OSA was established through a screening result from an at-home sleep assessment device (Embletta).

**RESULTS:** OSA and CTRL groups were not different in regard to VO<sub>2</sub> max ( $21.7 \pm 5.5$  vs  $24.3 \pm 5.4$  ml/kg/min, respectively), BMI ( $34 \pm 6.5$  vs  $31.2 \pm 5.2$  kg/m<sup>2</sup>) or body composition ( $39.6 \pm 8.6$  vs  $38.1 \pm 11.1$  % fat). The OSA group was older than the CTRL group (47 and 30 yrs, respectively), but no hemostatic variable was correlated to age. Maximal exercise induced significant changes in each hemostatic variable, but no differences were observed between groups. tPA activity (OSA =  $0.99 \pm 0.13$  to  $7.21 \pm 1.64$  IU/ml; CTRL =  $1.02 \pm 0.12$  to  $6.76 \pm 1.86$  IU/ml) and fibrinogen concentration (OSA =  $367.6 \pm 94.9$  to  $377.7 \pm 91.1$  mg/dl; CTRL =  $365.9 \pm 76.2$  to  $413.3 \pm 114.4$  mg/dl) increased significantly ( $p < 0.05$ ). PAI-1 decreased in both groups (OSA =  $4.70 \pm 1.83$  to  $2.25 \pm 0.58$  IU/mL; CTRL =  $7.13 \pm 4.73$  to  $5.21 \pm 3.39$  IU/mL).

**CONCLUSIONS:** Results suggest that mild OSA (AHI 5-15 events/hr) may not impact coagulation or fibrinolytic potential. Future research needs to evaluate this response in subjects with more severe OSA.

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2805 Board #77 June 1 11:00 AM - 12:30 PM

**Racial Differences in Blood Pressure Response and Vascular Function following 8-weeks of Aerobic Training**

Sushant M. Ranadive, Huimin Yan, Abbi D. Lane, Peng Sun, Rebecca Kappus, Marc D. Cook, Bo Fernhall, FACSM. *University of Illinois, Champaign, IL.*  
(No relationships reported)

African-Americans (AA) have higher prevalence of hypertension than Caucasians (CA) in the United States. In addition, AA have lower endothelial function and blunted peripheral vascular dilatation. These factors are known to directly contribute to end-organ damage.

**PURPOSE:** The purpose of this study was to examine the effects of aerobic exercise training on blood pressure response and vascular function in young white and African American individuals.

**METHODS:** 32 AA (9 men and 23 women) and 34 CA (19 men and 15 women) between the ages of 18-35 volunteered for the study, and completed a 4 week control period, followed by a 8 week aerobic exercise training period (30-60 min of exercise at 60-90% of maximal heart rate, 3 times/week). Women were tested during menses. Carotid, brachial and aortic blood pressures were measured using sphygmomanometry and applanation tonometry. Forearm blood flow (FBF) was measured by strain-gauge plethysmography before and during reactive hyperemia (RH). RH was induced by 5-min of brachial artery occlusion. All measurements were conducted in a supine position.

**RESULTS:** Brachial SBP decreased significantly in both groups ( $118 \pm 2$  to  $117 \pm 2$  to  $114 \pm 3$  vs.  $122 \pm 2$  to  $119 \pm 2$  to  $119 \pm 2$  mmHg;  $p < 0.05$ ), but the decrease in response to training was not significant, and there were no group differences. Aortic SBP was also not different between groups, and did not change with training ( $102 \pm 2$  to  $103 \pm 2$  to  $101 \pm 2$  vs.  $103 \pm 2$  to  $100 \pm 2$  to  $101 \pm 2$  mmHg;  $p > 0.05$ ). However, AA had a significantly lower peak FBF ( $18.04 \pm 1.49$  ml $\cdot$ min $^{-1}$  $\cdot$ 100 $^{-1}$ ) compared to CA ( $23.30 \pm 1.35$ ) only at the baseline but training had no significant effect on peak FBF in either group.

**CONCLUSIONS:** These data suggest that 8 weeks of aerobic training had no effect on BP in normotensive CA and AA, but our data suggest that a control period before initiation of training is important to assess the true effects of training on BP. Interestingly, AA have lower microvascular function despite similar BP compared to CA, but aerobic training had no effect on this. Future work is needed to determine if other interventions can affect the lower endothelial function in AA.

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2806 Board #78 June 1 11:00 AM - 12:30 PM

**Resveratrol Treatment Reverses Doxorubicin-Induced Vascular Dysfunction In Old Rat Mesenteric Arteries**

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(No relationships reported)

Doxorubicin is an anti-tumor agent used in cancer chemotherapy. Unfortunately, doxorubicin is associated with endothelial damage and vascular dysfunction. Reactive oxygen species production may play a role in doxorubicin-induced vascular dysfunction. Resveratrol, a natural phytoalexin produced in grapes functions as an antioxidant and has been shown to exert cardioprotective effects.

**PURPOSE:** To determine the impact of resveratrol on doxorubicin-induced vascular dysfunction in old rat mesenteric arteries.

**METHODS:** Old (26 months) male F-344xBN rats were randomly divided into four groups; control (CON), doxorubicin (DOX), resveratrol (RES) and resveratrol + doxorubicin (RES + DOX). Resveratrol (5 mg/kg/day) was given to the rats in food pellets for 6 weeks while DOX (10 mg/kg body weight) was administered intraperitoneal 24 hours prior to sacrifice. Concentration-response curves to acetylcholine (ACh 10 $\cdot$ 9-10 $\cdot$ 5 M) with and without L-NAME (10  $\mu$ M) were evaluated in pressurized isolated second-order mesenteric arteries.

**RESULTS:** ACh-induced endothelium-mediated relaxation was significantly reduced in DOX treated rats when compared with controls. Relaxation to ACh (10 $\cdot$ 5 M) was  $76 \pm 2\%$  in control and  $38 \pm 4\%$  in DOX ( $P < 0.001$ ) arteries. While the low dose of RES failed to improve endothelium-dependent dilation in the old arteries ( $76 \pm 2\%$  vs.  $78 \pm 4\%$ ), RES significantly attenuated the DOX-induced reduction in dilation (ACh 10 $\cdot$ 5 M,  $70 \pm 4\%$  vs.  $38 \pm 4\%$ ,  $P < 0.01$ ). L-NAME decreased responses to ACh in CON and RES arteries and inhibited the already reduced responses in the DOX mesenteric arteries.

**CONCLUSION:** These findings demonstrate that a low dose of resveratrol contributes to the reversal of vascular endothelial dysfunction associated with doxorubicin treatment. This may have therapeutic potential when dealing with the cardiovascular complications associated with doxorubicin.

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2807 Board #79 June 1 11:00 AM - 12:30 PM

**Exercise Training And Impaired Glucose Tolerance (IGT): Effects On Oxidative Stress And Arterial Stiffness.**

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(No relationships reported)

Compared to normoglycaemic individuals, those with impaired glucose tolerance (IGT) have a greater risk of developing diabetes and subsequent cardiovascular complications. Research examining the efficacy of exercise in such individuals for measures of vascular function remains scarce.

**PURPOSE:** To examine the effects of aerobic exercise training on metabolic control, regional arterial stiffness and oxidative stress in individuals with IGT.

**METHODS:** Twelve obese participants (7 males and 5 females;  $48.0 \pm 9.4$  yrs;  $168.0 \pm 7.0$  cm;  $90.7 \pm 16.8$  kg; BMI  $32.4 \pm 7.0$  kg/m $^2$ ) with IGT participated in a 12 week training programme consisting of walking at 65% of maximum predicted heart rate (HR) for 5 d $\cdot$ wk $^{-1}$ . Pulse wave velocity (PWV) and blood pressure (BP) were examined pre and post training, while venous blood samples were also drawn for determination of glucose, blood lipids and indices of oxidative stress (lipid hydroperoxides - LOOH and superoxide dismutase - SOD).

**RESULTS:** Following training PWV ( $9.10 \pm 1.20$  m/sec vs.  $8.39 \pm 1.16$  m/sec), glucose ( $5.70 \pm 0.60$  mmol $\cdot$ L $^{-1}$  vs.  $5.45 \pm 0.60$ ), LOOH ( $1.20 \pm 0.47$   $\mu$ M $\cdot$ L $^{-1}$  vs.  $0.79 \pm 0.32$   $\mu$ M $\cdot$ L $^{-1}$ ), triacylglycerols (TAGs;  $1.53 \pm 0.51$  mmol $\cdot$ L $^{-1}$  vs.  $1.32 \pm 0.52$  mmol $\cdot$ L $^{-1}$ ), systolic BP ( $145 \pm 14$  vs.  $136 \pm 14$  mmHg) and body mass ( $90.7 \pm 16.8$  kg vs.  $87.6 \pm 15.7$  kg) decreased, respectively ( $P < 0.05$ ). There were no changes in SOD, high-sensitivity C-reactive protein (hs-CRP) or blood cholesterol (high-density lipoprotein cholesterol; HDL-C; low-density lipoprotein cholesterol; LDL-C), respectively ( $P > 0.05$ ).

**CONCLUSIONS:** This study illustrates that 12 weeks of moderate intensity aerobic training can improve upper limb vascular function in obese subjects with IGT. The observed changes are most likely due to improvements in TAGs and glucose metabolism, which may subsequently reduce oxidative stress generation.

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2808 Board #80 June 1 11:00 AM - 12:30 PM

**Effects of Exercise on Endothelial Progenitor Cells in a High Glucose Environment**

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(No relationships reported)

**INTRODUCTION:** Endothelial Progenitor Cells (EPCs) are adult stem cells that play a key role in the repair and maintenance of the vascular endothelium. Diabetic individuals have impaired vascular function, which may be related to hyperglycemia and dysfunctional EPCs. Exercise may be a potent method to increase EPC function in patients with diabetes.

**PURPOSE:** To study the effects of a high glucose on EPC function and gene expression before and after an acute bout of exercise.

**METHODS:** 6 healthy males between the ages of 18-30 were recruited for the study. Blood draws were performed before and after an acute bout of exercise. Exercise consisted of treadmill running for 30mins at 70% HRRmax. Mononuclear cells were isolated and cultured using the CFU-Hill assay for a period of 5 days. Cells from before and after exercise were incubated either in control media (5mmol of glucose) or media with 15mmol of glucose. At the end of the 5 days, colony forming units (CFUs) were counted and RNA was isolated. Gene expression was determined via RT-PCR for NF $\kappa$ B, TGF $\beta$ 1, eNOS, MAPK, and TNF $\alpha$  and normalized to GAPDH. Efficiency was  $> 90\%$  for all targets and gene expression was calculated as fold-change from pre-exercise/low glucose condition using the  $\Delta\Delta C_t$  method

**RESULTS:** While there was no difference with acute exercise in the low-glucose condition, EPC eNOS gene expression tended to increase with exercise in the high glucose condition ( $p = 0.17$ ). MAPK gene expression tended to be higher after exercise (low glucose,  $p = 0.10$ ) with no changes in expression with high glucose. TGFB1 expression was highest after exercise in the high glucose condition ( $p = 0.16$ ). CFU-Hill counts and EPC gene expression for NFkB and TNFa did not differ between conditions.

**CONCLUSION:** These data suggest that gene expression of major factors associated with vascular dysfunction in diabetes are minimally changed in EPCs of healthy young men in response to glucose or exercise.

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**2809** Board #81 June 1 11:00 AM - 12:30 PM  
**Comprehensive Vascular Function Testing Across The Menstrual Cycle**

Karen M. Birch, University of Leeds, Leeds, United Kingdom. (Sponsor: Keith George, FACSM)  
(No relationships reported)

Studies evaluating the impact of menstrual cycle variability in vascular function have shown decreased brachial artery flow mediated dilation (FMD) in the early luteal phase. However, a comprehensive quantification of FMD, low-flow mediated constriction (L-FMC) and the reactive hyperaemic response has not been evaluated.

**PURPOSE:** To determine the impact of menstrual cycle phase on FMD, L-FMC and reactive hyperaemia.

**METHODS:** 9 women ( $34 \pm 9$  yrs) attended the lab in the early follicular, late-follicular and mid-luteal phases of the menstrual cycle. After 30 min of supine rest, brachial artery vascular function was assessed using a 5-minute forearm ischemia protocol and ultrasound. Peak blood flow within 30 s of cuff deflation and FMD from 20s of end-diastolic diameters at baseline, compared to the mean of 3 maximal end-diastolic diameters during 2.5 min post ischemia were assessed. L-FMC was determined from the mean of 3 minimum end-diastolic diameters in the 30s before cuff deflation.

**RESULTS:** FMD did not differ with menstrual phase (**FMD Early Follicular:**  $8.2 \pm 1.4\%$ , **Late Follicular:**  $6.6 \pm 0.8\%$ , **Mid-luteal:**  $6.5 \pm 1.0\%$   $p = 0.20$ ). L-FMC exhibited a non-significant inverse pattern when compared to FMD with more constriction apparent at phases when FMD was greater (**L-FMC Early Follicular:**  $-0.65 \pm 1.0\%$ , **Late Follicular:**  $-1.1 \pm 0.6\%$ , **Mid-luteal:**  $-2.2 \pm 0.6\%$   $p = 0.35$ ). Total vascular reactivity (sum of the absolute values of FMD and L-FMC) was unaltered (**Total vascular reactivity Early Follicular:**  $9.6 \pm 1.3\%$ , **Late Follicular:**  $8.5 \pm 0.9\%$ , **Mid-luteal:**  $8.0 \pm 0.9\%$   $p = 0.28$ ). Normalization to the shear response had no effect. Finally, peak blood flow after cuff deflation (a measure of resistance vessel function) was also unaltered by menstrual phase.

**CONCLUSIONS:** These preliminary results suggest a lack of menstrual cycle fluctuation in vasodilatory and vasoconstrictive responses to the forearm ischemia protocol.

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**2810** Board #82 June 1 11:00 AM - 12:30 PM  
**Endothelial Progenitor Cell Quantification in Young Adult Non-Smokers and Smokers by a Novel Gating Strategy**

Michael Kairaira, Deborah L. Fearheller, Ingrid Schmid, Christian K. Roberts, FACSM. UCLA, Los Angeles, CA.  
(No relationships reported)

**PURPOSE:** Endothelial progenitor cells (EPC) are an accepted predictor of cardiovascular disease risk. Accurate identification of EPC is debatable, and to date identifying markers and isolation techniques remain to be clearly established. Primitive EPC are conventionally defined as  $CD34^+CD133^+KDR^+$ . Few studies have investigated  $CD34^+$  EPC that are endothelial in nature, and their phenotype and relation to subsets of hematopoietic cells remain elusive. Thus, reliable flow cytometry acquisition and analysis strategies are needed as EPC comprise  $<1\%$  of peripheral blood mononuclear cells. Previously, it has been shown that long-term smoking decreases circulating  $CD34^+$  cells in older individuals. We designed and optimized a novel cytometry protocol for accurate enumeration of EPC in recreationally-active, non-smoking young adults ( $n=36$ ,  $23.3 \pm 0.6$ yr) compared to chronic smokers ( $n=28$ ,  $25.0 \pm 0.8$ yr) as part of a randomized-controlled trial (RCT) to investigate the effects of resistance training (RT) on vascular function in young, adult chronic smokers.

**METHODS:** Using a whole blood lysing method,  $2 \times 10^7$  cells were stained with a 5-color antibody panel and propidium iodide for dead cell exclusion.  $4 \times 10^6$  cells were acquired to achieve sufficient events to classify PC reliably as viable, side scatter<sup>low</sup>,  $CD45^{dim}$ ,  $CD3^+CD19^+CD33^+CD34^+$  and subdivide them into  $CD133^+$  and  $KDR^+$ . To improve the accuracy of rare EPC analysis in samples with varied red cell contamination of the gating region, we based our calculation of EPC frequency not on lymphocyte scatter gating, but on a novel strategy of a combination gate of  $CD45^{bright}$  and  $CD34^+$ .

**RESULTS:** Preliminary data show that compared to non-smokers, smokers have a higher percentage of  $CD133^+$  ( $50 \pm 2.1\%$  vs.  $42 \pm 2.9\%$ ,  $p=0.03$ ), but lower  $KDR^+$  within the  $CD34^+$  subset of cells ( $1.9 \pm 0.44\%$  vs.  $4.8 \pm 0.94\%$ ,  $p<0.01$ ). Interestingly though, smokers had a higher proportion of  $CD45^{bright}$  lymphocytes than non-smokers ( $88 \pm 2.4\%$  vs.  $72 \pm 4.6\%$ ,  $p<0.01$ ).

**CONCLUSION:** We demonstrated the ability to detect specific circulating EPC subsets using our novel gating strategy. In young smokers, compensatory mechanisms may prevent the decline in  $CD34^+$  cells before true endothelial dysfunction exists. Our ongoing RCT will determine if RT has an effect on the number of EPC and EPC subsets in chronic smokers.

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**2811** Board #83 June 1 11:00 AM - 12:30 PM  
**Interactive Effects of Stress Reactivity and Usual Stress on Adolescents Cardiovascular Health**

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(No relationships reported)

Adolescents experience stressful situations at high rates during school. Psychological stress is associated with the progression of cardiovascular disease (CVD). The diathesis-stress model suggests that youth experiencing the greatest cumulative stress are at greatest risk for developing antecedents of CVD. Thus, youth with the greatest reactivity to a stressor may be at most risk for CVD pathogenesis, especially if they also incur frequent daily stressors, such as during a year of high school.

**PURPOSE:** To determine the relationships between the magnitude of CV stress reactivity and the amount of daily stress with the pathogenesis of CVD as characterized by carotid artery intima-media thickness (IMT) at the end of the school year.

**METHODS:** 23 boys and 19 girls age 13-16 y were studied for cardiovascular reactivity to an interpersonal speech stressor and usual stress (perceived stress scale-14) in August just before the start of the school year. Usual stress was measured again in October after the beginning of the school year. Carotid artery IMT was measured immediately after the school year the following June. Multiple regression was used to determine the interactive association of CV stress reactivity (e.g., systolic blood pressure (SBP) reactivity) and school year (October) stress on carotid artery IMT and BAR when covarying for resting SBP and baseline (August) level of usual stress.

**RESULTS:** As main effects, SBP reactivity to the speech stressor was associated with IMT ( $\beta = 0.005$ ,  $p < 0.005$ ), while school year usual stress was not ( $\beta = 0.002$ ,  $p \geq 0.17$ ). The interaction of SBP reactivity and school year usual stress was significant ( $p < 0.02$ ). The overall interaction model predicted that youth with low stress reactivity and low school stress; low reactivity and high stress; high reactivity and low stress; and high reactivity and high stress would have IMT of 0.44, 0.48, 0.55, and 0.50 mm, respectively.

**CONCLUSIONS:** With the methods used, higher stress reactivity and usual stress increased IMT by a predicted 25% and 12%, respectively. SBP stress reactivity predicts IMT better than usual stress, and children with the greatest reactivity to a stressor may be at the greatest risk for subclinical progression of CVD.

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**2812** Board #84 June 1 11:00 AM - 12:30 PM  
**Associations Between Sedentary Behaviour, Cardiometabolic Biomarkers And Vascular Health In Children**

Nicola D. Hopkins<sup>1</sup>, Gareth Stratton<sup>1</sup>, Nicola Ridgers<sup>2</sup>, Lee E F Graves<sup>1</sup>, Lynne M. Boddy<sup>1</sup>, Rebecca Gobbi<sup>1</sup>, Lawrence Fowweather<sup>1</sup>, Nigel T. Cable<sup>1</sup>, Daniel J. Green<sup>1</sup>.  
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(No relationships reported)

**PURPOSE:** Vascular function, measured via flow mediated dilation (FMD), is the earliest detectable manifestation of cardiovascular disease (CVD). Vascular dysfunction is a strong independent predictor of CV events and is present in children with CVD risk factors. Emerging evidence suggests that sedentary behaviour (SB) is independently associated with CVD and mortality. Currently the relationship between SB, vascular function and artery wall thickness is unknown. We therefore aimed to assess the association between FMD, carotid artery intima-medial thickness (cIMT) and SB in children.

**METHODS:** Using high resolution Doppler ultrasound we measured endothelial function and cIMT in 118 children (72[12.1±0.7; 46[12.1±0.7yrs). Sedentary behaviour was assessed using objective uni-axial accelerometry. Cardiometabolic biomarkers (insulin, glucose, HbA1c, C-peptide, triglycerides, total, HDL and LDL cholesterol, C - reactive protein and adiponectin) were measured in a subgroup of children (N=53, 28 female). Data was adjusted for age, maturation and physical activity level.

**RESULTS:** Daily, children engaged in 496.7±90.2 min of SB. There was no significant difference between girls and boys for percentage of accelerometer wear time spent in SB ((SB%) 68.6±12.9 vs 65.0±11.7 respectively p>0.05), FMD (9.3±4.3 vs 9.2±4.4 respectively, p>0.05) or cIMT (0.47±0.09 vs 0.49±0.08 respectively, p>0.05). Neither FMD (r=-0.00, p>0.05) nor cIMT (r=0.00, p>0.05) was associated with SB. FMD was significantly related only to C - peptide only (r=0.38 , p=0.01).

**CONCLUSION:** Our data suggest that SB is not associated with vascular health in children. This implies that interventions that aim to reduce SB *per se* in children may not be effective in terms of improving/maintaining vascular health. Further research is necessary to describe the mechanistic relationship, if any, between sedentary behaviour and cardiovascular risk. Additionally, our findings imply that C-peptide may contribute to regulation of vascular function.

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**2813** Board #85 June 1 11:00 AM - 12:30 PM

**Cardiopulmonary Fitness and Cognitive Function: Association with Peripheral Vascular and Cerebrovascular Function**

Takashi Tarumi, Mitzi M. Gonzales, Bennett A. Fallow, Nantinee Nualnim, Hirofumi Tanaka, FACSM, Andrea P. Haley. *The University of Texas at Austin, Austin, TX.*

(No relationships reported)

Midlife cardiovascular and cerebrovascular disease risk is associated with an elevated incidence of late-life dementia. Habitual exercise has been suggested as an efficacious lifestyle intervention to prevent or delay the onset of cognitive decline. However, it is not clear how habitual exercise influences cognitive function and whether these relations may be mediated by enhanced peripheral vascular and/or cerebrovascular function.

**PURPOSE:** To examine the association between cognitive function and the key features of vascular and cerebrovascular function among middle-aged sedentary and endurance-trained adults.

**METHODS:** We studied 29 healthy sedentary and 32 endurance-trained adults aged between 41-65 years (24 males and 37 females) underwent a variety of vascular function measurements (carotid artery distensibility, brachial artery flow-mediated dilatation, and cerebrovascular reactivity to hypo- and hypercapnia) and a comprehensive battery of neuropsychological tests.

**RESULTS:** There were no significant differences in age, body mass, education level, and blood pressure between sedentary and endurance-trained subjects. Endurance-trained group demonstrated greater maximal oxygen consumption (VO<sub>2</sub>max) (44.6±1.6 vs. 26.1±1.1 ml/kg/min), common carotid artery distension (4.81±0.25 vs. 3.96±0.20 mm<sup>2</sup>) and distensibility coefficient (4.92±0.28 vs. 4.08±0.22 10<sup>-3</sup>/mmHg), brachial artery flow-mediated dilatation (6.63±0.61 vs. 4.87±0.63%), and total cognitive composite score (z-score: 0.13±0.08 vs. -0.15±0.10) than the control group (all P<0.05). Cerebrovascular reactivity to hypo- and hypercapnia was not different between the groups. Partial correlation analyses adjusted for age, sex, and education revealed that total cognitive composite score is significantly associated with VO<sub>2</sub>max (r=0.32) and cerebrovascular reactivity index (r=0.29). Moreover, VO<sub>2</sub>max was correlated with cerebrovascular reactivity index (r=0.29).

**CONCLUSION:** A greater cognitive function in endurance-trained adults is associated with aerobic fitness and cerebrovascular reactivity independent of potential covariates.

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**2814** Board #86 June 1 11:00 AM - 12:30 PM

**The Effect Of Interrupting Prolonged Sitting With Intermittent Activity On Markers Of Thrombotic Risk**

Bethany J. Howard<sup>1</sup>, Steve F. Fraser<sup>2</sup>, Pameet Sethi<sup>1</sup>, Ester Cerin<sup>3</sup>, Neville Owen<sup>1</sup>, Bronwyn A. Kingwell<sup>1</sup>, David W. Dunstan<sup>1</sup>. <sup>1</sup>Baker IDI Heart & Diabetes Institute, Melbourne, Australia. <sup>2</sup>Deakin University, Melbourne, Australia. <sup>3</sup>The University of Hong Kong, Hong Kong, China. (Sponsor: Charles Matthews, FACSM)

(No relationships reported)

Prolonged sitting has been associated with an elevated risk of cardiovascular mortality and venous thrombosis. While the mechanisms underlying such relationships have not been fully elucidated, activation of blood coagulation pathways may be involved. The impact of interrupting acute prolonged sitting with intermittent activity on markers of thrombotic risk has not been studied. **PURPOSE:** To examine the acute effects of a single 7 hour period of prolonged sitting on blood coagulation markers with and without intermittent bouts of light- or moderate-intensity activity in sedentary older (45-65 yrs) overweight/obese adults.

**METHODS:** 19 overweight/obese adults (11 males/8 females; 53.8 ± 4.9yrs, BMI: 31.2 ± 4.1 kg.m<sup>-2</sup>) participated in a randomized three-period, three-treatment acute cross-over trial: 1) uninterrupted sitting; 2) sitting with 2-minute bouts of light-intensity treadmill walking every 20 minutes; and 3) sitting with 2-minute bouts of moderate-intensity treadmill walking every 20 minutes. Blood was collected at baseline (0hrs) whilst seated prior to consumption of a standardised mixed meal and at the completion of each condition (7hrs). Blood coagulation markers were measured and corrected for blood volume changes. All analyses were adjusted for age, sex, body mass, baseline outcome values and order effects.

**RESULTS:** Compared to uninterrupted sitting, plasma fibrinogen decreased (0.17g.l<sup>-1</sup> [0.01, 0.32], P <0.05) in the sitting with the light-intensity activity condition, but not the moderate-intensity activity condition. Both activity conditions resulted in small reductions in thrombin clotting time relative to uninterrupted sitting (light-intensity: 0.70s, [0.37, 1.02], P <0.001 and moderate-intensity: 0.57s, [0.25, 0.9], P <0.001). There were no significant between-condition differences in prothrombin time, activated partial thromboplastin time, von Willebrand factor and D-dimer.

**CONCLUSION:** Interrupting prolonged sitting with short, intermittent bouts of light-intensity walking reduced circulating fibrinogen in overweight/obese adults relative to uninterrupted sitting. Further investigation to optimise the timing and intensity of activity breaks is warranted to reduce possible thrombotic risk associated with prolonged sitting.

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**2815** Board #87 June 1 11:00 AM - 12:30 PM

**Racial Differences In Cardiovascular Response Following An Acute Bout Of Aerobic Exercise**

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(No relationships reported)

Post-exercise hypotension (PEH) is widely observed in Caucasians (CA). It is usually due to a reduction in peripheral vascular resistance that is not completely offset by a rise in cardiac output. It appears that African Americans (AA) may not exhibit PEH following aerobic exercise.

**PURPOSE:** To examine the cardiovascular responses following an acute bout of aerobic exercise in AA and CA.

**METHODS:** 24 young healthy Caucasians (CA, n = 12) and African Americans (AA, n = 12) performed 45 min of moderate intensity aerobic exercise on a treadmill at 70% of heart rate reserve. Before at rest, 20 min postexercise, and 40 min postexercise, cardiac output (CO), total peripheral resistance (TPR) and arterial compliance (compliance) were measured by finometer. Aortic blood pressures (BP), central (carotid-femoral), leg (carotid-femoral) and brachial (carotid-radial) pulse-wave velocity (PWV) were measured by applanation tonometry. An additional brachial BP was taken at 60 min after exercise. Time by race two-way ANOVA was used for statistical analyses.

**RESULTS:** See Table 1. Significant time effect was found in brachial SBP, aortic BPs, brachial PWV and CO (# p<.05). Significant race effect was found in brachial and central PWV (\$ p<.05). Significant interaction was found in brachial DBP (\* p<.05).

**CONCLUSIONS:** Although AA have higher central and peripheral arterial stiffness than CA, both groups exhibited comparable hemodynamic responses up to 40 min following acute aerobic exercise. AA did not exhibit PEH 60 min after exercise, in contrast to CA. Future work is needed to extend the time course of measurement and to examine the mechanisms underlying the BP response.

Table 1. Hemodynamic responses to an acute bout of aerobic exercise. Mean (SE)

|                   | CA          |             |             |             | AA          |
|-------------------|-------------|-------------|-------------|-------------|-------------|
|                   | baseline    | 20 min post | 40 min post | 60 min post | baseline    |
| Brachial SBP #    | 119 (3)     | 120 (4)     | 118 (4)     | 113 (4)     | 121 (3)     |
| Brachial DBP *    | 67 (2)      | 66 (1)      | 64 (2)      | 68 (2)      | 66 (2)      |
| CO #              | 5.7 (0.5)   | 5.9 (0.5)   | 5.7 (0.5)   |             | 6.1 (0.6)   |
| TPR               | 0.07 (0.01) | 0.06 (0.01) | 0.06 (0.01) |             | 0.07 (0.01) |
| compliance        | 2.5 (0.1)   | 2.4 (0.1)   | 2.5 (0.1)   |             | 2.4 (0.1)   |
| aortic SBP #      | 100 (2)     | 104 (4)     | 96 (2)      |             | 101 (3)     |
| aortic DBP #      | 68 (2)      | 70 (2)      | 67 (2)      |             | 67 (2)      |
| brachial PWV # \$ | 7 (0.2)     | 7.2 (0.2)   | 7.1 (0.3)   |             | 8.3 (0.3)   |
| central PWV \$    | 5.2 (0.2)   | 5.5 (0.2)   | 5.2 (0.2)   |             | 6.2 (0.4)   |
| leg PWV           | 9.4 (0.5)   | 8.3 (0.5)   | 8.2 (0.2)   |             | 8.8 (0.5)   |

**2816 Board #88 June 1 11:00 AM - 12:30 PM**

**Reduced Exercise Cerebral Blood Flow in Normotensive Young Adult Blacks with Exaggerated Exercise Pressor Response**

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(No relationships reported)

Cardiovascular disease is a major health disparity in the African American (AA) population. Extensive elevation in systolic blood pressure during exercise is an indicator for future hypertension and possible risk for cerebrovascular stroke.

**PURPOSE:** The purpose of this study was to monitor unilateral cerebral blood flow during exercise on an ergometer cycle in young normotensive AAs with and without an exaggerated blood pressure response to exercise (EEBPR).

**METHODS:** Five normotensive AA s (3 female, 2 male/18-28 yrs.) with an EEBPR, and five AA s (3 female, 2 male/18-28 yrs.) without an EEBPR were studied before and during exercise while monitoring unilateral cerebral blood flow. The EEBPR was defined in the study as an increase in systolic blood pressure  $\geq 50$  mm Hg above resting systolic blood pressure at a work intensity of 50% peak oxygen uptake (VO<sub>2</sub>peak). At rest and during six-minute steady state submaximal work at 30% and 50% VO<sub>2</sub>peak, blood flow in the right middle cerebral artery (MCAv) was measured using a 2 MHz pulse Doppler ultrasound system. Cardiac output (CO) was determined using cardiac impedance. Nonlinear spectral method of heart rate variability (HRV) was used to measure cardiac autonomic modulation. Blood pressure (BP) was determined by an automatic monitoring device. End tidal carbon dioxide (EtCO<sub>2</sub>) was assessed using a capnograph.

**RESULTS:** VO<sub>2</sub>peak and body composition did not differ significantly between groups. Baseline values of MCAv, HRV, BP, CO, and EtCO<sub>2</sub> were similar between groups with and without an EEBPR (P> 0.05). However, during submaximal exercise at 30% and 50% VO<sub>2</sub>peak, MCAv was lower by 40% and 37% respectively, in the EEBPR group compared to the group without an EEBPR (p value <0.05). Corresponding systolic BP during exercise was higher in the EEBPR group (P< 0.05). These differences in MCAv occurred in the absence of any differences in CO, HRV and EtCO<sub>2</sub> or cardiac Heather index between groups.

**CONCLUSIONS:** These findings suggest a diminished cerebral vascular function in the EEBPR group. This may be a result of changes in vascular structure and/or factors and metabolites involved in vasodilation.

This study was supported in part by NIH/NCRR/RCMI Grant 2G12RR003048 to Howard University

**2817 Board #89 June 1 11:00 AM - 12:30 PM**

**Whole Body Vibration Effects on Hemodynamics and Oxygen Consumption in Individuals with Spinal Cord Injury**

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(No relationships reported)

**BACKGROUND:** Considering the potential of whole body vibration (WBV) exercise for activating paralyzed muscles via the Ia reflex loop and increasing the skeletal muscle metabolism, WBV exercise may provide a sufficient training stimulus for the cardiovascular system in individuals with spinal cord injury (SCI).

**Objective:** 1) Investigate the acute effects of WBV with varying frequencies on hemodynamic responses and steady-state oxygen consumption (VO<sub>2</sub> in ml/kg lean mass/min) in individuals with SCI and able-bodied individuals (AB); 2) Compare physiological responses between groups and among three different WBV frequencies.

**Design:** A 2 (group) x 3 (treatment) x 4 (time) repeated measures factorial design with repeated measures across treatment and time.

**Subjects:** 11 males with SCI (C4-T6; ASIA A and B; ages: 50.4±8.2) and 10 age and gender matched AB individuals (ages: 48.2±6.8).

**METHODS:** Using a randomized design subjects completed three WBV exercise sessions at 30, 40 and 50 Hz. Heart rate (HR), mean arterial blood pressure (MAP), stroke volume (SV), cardiac output (CO), VO<sub>2</sub>, and relative changes in oxygenated ( $\Delta$ HbMbO<sub>2</sub>), deoxygenated ( $\Delta$ HHbMb), and total ( $\Delta$ THbMb) heme groups were obtained during pre-WBV standing, WBV first minute, WBV steady-state, and post-WBV standing.

**RESULTS:** Both groups demonstrated a significant increase in VO<sub>2</sub>,  $\Delta$ HbMbO<sub>2</sub>, and  $\Delta$ THbMb; yet the increase was larger in the SCI group for VO<sub>2</sub> during WBV steady-state at 40 (p= 0.01; SCI: 6.1±0.6, AB: 5.4±0.7) and 50 Hz (p= 0.001; SCI: 6.9±1.2, AB: 5.3±0.7); and for  $\Delta$ HbMbO<sub>2</sub> (p≤ 0.0001) and  $\Delta$ THbMb (p≤ 0.0001) during post-WBV standing at 30 and 40 Hz.  $\Delta$ HHbMb did not significantly change in the AB group; where as a significant decrease was revealed in the SCI group following WBV. HR, MAP, SV, or CO did not significantly change in either group and no frequency effect was revealed.

**CONCLUSION:** The WBV parameters used in the present study do not appear to induce significant cardiovascular benefits for the individuals with SCI. Although the increase in VO<sub>2</sub> was higher in the SCI group as compared to the able-bodied group, these changes are comparatively small in relation to cardiovascular changes elicited by aerobic exercise. Future studies should investigate the potential mechanisms responsible for the observed increase in  $\Delta$ HbMbO<sub>2</sub> and  $\Delta$ THbMb in response to WBV.

**2818** Board #90 June 1 11:00 AM - 12:30 PM  
**Exercise Training Does Not Protect Skeletal Muscle Contractile Function During Acute Femoral Artery Occlusion**

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(No relationships reported)

Exercise training is known to enhance vascular transport capacity in skeletal muscle through both arteriogenesis and angiogenesis which presumably enhances support for contractile activity. Not surprisingly, acute femoral artery ligation results in an abrupt fall in blood flow and microvascular PO<sub>2</sub> (PO<sub>2m</sub>) and an accelerated rate of muscle fatigue during subsequent contractions.

**PURPOSE:** The purpose of this study was to test the hypothesis that exercise training would enhance the development of collateral circulation to the lower leg thereby attenuating the fall in PO<sub>2m</sub> and the rate of fatigue during acute femoral artery occlusion.

**METHODS:** Female Sprague-Dawley rats (225-250 g) accustomed to treadmill running were randomly divided into exercise trained (ET, n=11) and sedentary (SED, n=8) groups. The training protocol consisted of 8 wks during which intensity and duration were progressively increased to 20 m/min at 20 degree incline for 60 min/d. After pentobarbital anesthesia (50 mg/kg ip) a snare was placed around the left femoral artery and the left extensor digitorum longus muscle (EDL) was isolated and the distal tendon was attached to a load cell interfaced with a Muscle Tension Analyzer. PO<sub>2m</sub> was measured with the phosphorescence quenching method using Oxyphor G2. PO<sub>2m</sub> and muscle tension were measured during a 30 s baseline, and continuously during 10 min of femoral artery occlusion 10 min and muscle contractions (1 Hz, 6V), and for 5 min after restoration of femoral artery flow.

**RESULTS:** Resting PO<sub>2m</sub> in the EDL was similar between groups (ET, 32 ± 3; SED 35 ± 3 mmHg). During femoral occlusion PO<sub>2m</sub> in ET and SED rats fell to 10 ± 1 and 11 ± 1 mmHg, respectively. Muscle twitch tension and fatigue (ET, 40 ± 9; SED, 33 ± 6%) during femoral occlusion were not different. After the reestablishment of femoral flow, the time constant for recovery of PO<sub>2m</sub> (ET 12 ± 6; SED 12 ± 3 s) and the recovery PO<sub>2m</sub> (ET 28 ± 2; SED 26 ± 2 mmHg) were similar. The time constants for the recovery of twitch tension were also not different between groups (ET, 38 ± 11; SED, 19 ± 6 s).

**CONCLUSION:** The results of this study do not support the notion that exercise training in healthy rats will enhance oxygen delivery and attenuate the decrement in contractile function during an acute low blood flow state. (Supported by the Graduate Program Committee, KCOM-ATSU.)

**2819** Board #91 June 1 11:00 AM - 12:30 PM  
**Regulation of Cardiovascular Variables during Lower Body Negative Pressure and Cold.**

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(No relationships reported)

**PURPOSE:** To determine the effects cold has on cardiovascular variables during exposure to lower body negative pressure (LBNP).

**METHODS:** Eleven college aged men participated in two trials. Subjects were supine on a gurney with their lower extremities inserted into a LBNP box up to the level of the anterior superior iliac spine. Each trial consisted of a control period of 100 min followed by application of LBNP for 20 min and concluded with a 15 min recovery period. Both trials were carried out in the environmental chamber; the cold trial was performed at 10°C (cold) and the ambient trial was performed at 23°C (ambient). The order of trials was counterbalanced. Cardiovascular variables were measured using bioimpedance and brain oxygen saturation was measured using near infrared spectroscopy. A repeated measures analysis of variance was used to compare trials across time.

**RESULTS:** Brain oxygen saturation was significant for time, condition and there was an interaction. There was a greater decrease in brain oxygenation (SaO<sub>2</sub> ambient = 81 ± 7% vs. cold = 81 ± 7%) to recovery in the cold condition vs. the ambient condition (SaO<sub>2</sub> ambient = 81 ± 6% vs. cold = 73 ± 7%). Mean arterial pressure (MAP) was significant for time, condition and there was an interaction. There was a greater increase in mean arterial pressure (MAP= 74 ± 8 mmHg ambient vs. cold = 84 ± 13mmHg) to recovery in the cold condition vs. the ambient condition (MAP ambient = 79 ± 8 vs. cold = 95 ± 11mmHg). Refer to Table 1 for pre-LBNP, LBNP and recovery data, \* means p<0.05.

| Table 1                       | Pre-LBNP     | LBNP         | Recovery     |
|-------------------------------|--------------|--------------|--------------|
|                               | Ambient cold | Ambient cold | Ambient cold |
| Mean Arterial Pressure (mmHg) | 80±8 93±15*  | 81±7 93±9*   | 79±8 95±11*  |
| RSaO <sub>2</sub> (%)         | 80±5 62±8*   | 77±5 61±9*   | 81±6 62±9*   |

**CONCLUSION:** Increased MAP from cold exposure may maintain perfusion to the brain during an orthostatic challenge.

**2820** Board #92 June 1 11:00 AM - 12:30 PM  
**Cardiovascular And Perceptual Responses To Blood Flow Restricted Resistance Exercise Performed With Different Restrictive Cuffs**

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(No relationships reported)

Low-intensity blood flow restricted (BFR) resistance exercise causes similar strength and hypertrophy adaptations compared to high-intensity resistance exercise. The type of restrictive cuff used during BFR resistance exercise may affect the response to this type of exercise.

**PURPOSE:** To determine if the type of restrictive cuff used during BFR resistance exercise influences the cardiovascular and perceptual responses during and following an acute bout of BFR exercise.

**METHODS:** In a randomized, cross-over study design, twenty-seven young men and women completed two bouts (4 sets each) of BFR knee extension exercising at 20% 1-RM while wearing either 5 cm (narrow cuffs) or 13.5 cm (wide cuffs) wide pneumatic cuffs inflated to 130% of their brachial systolic blood pressure. Measurements of brachial (bBP) and aortic (aBP) blood pressure (BP), heart rate (HR), and augmentation index (AIx) were taken before and after the restrictive cuffs were applied and inflated, after the 2<sup>nd</sup> (mid) and 4<sup>th</sup> (post) set of resistance exercise, and 5- and 15-min into recovery. Ratings of perceived exertion (Borg, 6-20 scale; RPE) and pain (1-10 scale) were assessed before exercise and after the 2<sup>nd</sup> and 4<sup>th</sup> set of exercise.

**RESULTS:** Applied cuff pressure was not different between the narrow and wide cuff bouts (152 vs 154 mmHg, p=0.616). During BFR exercise (mid), compared to the narrow cuffs, wide cuffs caused a greater elevation in HR (92 vs 78 bpm, p<0.05), central BP (systolic: 133 vs 119 mmHg, p<0.05; diastolic: 104 vs 86 mmHg, p<0.05), RPE (14 vs 13, p<0.05) and pain (5 vs 3, p<0.05) and a greater decrease in AIx (-4 vs 1 %, p<0.05).

**CONCLUSIONS:** These findings suggest that during low-intensity BFR resistance exercise wide cuffs cause greater demands on the cardiovascular system and increase ratings of pain and RPE to a greater extent compared to BFR resistance exercise with narrow cuffs inflated to the same pressure. Cuff application pressure may need to be adjusted depending on the width of the restrictive cuff to improve subject comfort and to standardize the degree of blood flow restriction.

**2821** Board #93 June 1 11:00 AM - 12:30 PM  
**Impact Of Cardiovascular Fitness On Pentraxin 3 Levels In Response To Concurrent Stressors**

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(No relationships reported)

Pentaxin 3 (PTX3) is primarily generated by endothelial cells and monocytes/macrophages and has recently been identified as a biomarker of vascular inflammation in predicting cardiovascular events. Although recent studies have shown that exercise has a positive/negative effect on the release of plasma PTX3, no studies have examined whether cardiovascular fitness is associated with plasma PTX3 response to a combined (exercise and mental) stress.

**PURPOSE:** The purpose of this study was to examine the effect of cardiovascular fitness on plasma PTX3 and catecholamine (epinephrine [EPI] and norepinephrine [NE]) levels to a dual stress model. To elucidate possible mechanisms for the elevated PTX3 in response to dual stress, the relationships of EPI and NE with PTX3 were examined.

**METHODS:** Fourteen subjects were classified into high fit (N=7; VO<sub>2</sub>max = 50.99 ± 2.19 ml•kg<sup>-1</sup>•min<sup>-1</sup>) and low fit (N=7; VO<sub>2</sub>max = 36.27 ± 3.51 ml•kg<sup>-1</sup>•min<sup>-1</sup>) groups and completed two counterbalanced experimental conditions. The exercise-alone condition (EAC) consisted of cycling at 60% VO<sub>2</sub>max for 37 minutes, while the dual-stress condition (DSC) included 20 minutes of a mental stress while cycling for 37 minutes.

**RESULTS:** Plasma PTX3 revealed significant increases over time in both high fit and low fit group in response to EAC and DSC (p < 0.02). No difference in PTX3 levels was observed between EAC and DSC. Furthermore, significant time effect and time by fitness level interaction in plasma EPI and NE were found in both EAC and DSC with greater levels in high fit group (p < 0.05). Additionally, plasma PTX3 was not correlated with EPI and NE neither EAC nor DSC.

**CONCLUSION:** These results suggest that cardiovascular fitness may not affect the release of plasma PTX3 to stress reactivity although exacerbated EPI and NE are seen in DSC and high fit group. In addition, plasma PTX3 could be used as an inflammatory biomarker for exercise while mental stress does not modulate PTX3 levels.

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**2822** Board #94 June 1 11:00 AM - 12:30 PM

### Femoral Blood Flow and Cardiac Output during Blood Flow Restricted Leg Press Exercise

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(No relationships reported)

Low load blood flow restricted resistance exercise (LBFR) causes muscle hypertrophy that may be stimulated by the local ischemic environment created by the cuff pressure. However, local blood flow (BF) during such exercise is not well understood.

**PURPOSE:** To characterize femoral artery BF and cardiac output (CO) during leg press exercise (LP) performed at a high load (HL) and low load (LL) with different levels of cuff pressure.

**METHODS:** Eleven subjects (men/women 4/7, age 31.4±12.8 y, weight 68.9±13.2 kg, mean±SD) performed 3 sets of supine left LP to fatigue with 90 s of rest in 4 conditions: HL (%1-RM/cuff pressure: 80%/0); LL (20%/0); LBFR<sub>DBP</sub> (20%/1.3 x diastolic blood pressure, BP); LBFR<sub>SBP</sub> (20%/1.3 x supine systolic BP). The cuff remained inflated throughout the LBFR exercise sessions. Artery diameter, velocity time integral (VTI), and stroke volume (SV) were measured using Doppler ultrasound at rest and immediately after each set of exercise. Heart rate (HR) was monitored using a 3-lead ECG. BF was calculated as VTI x vessel cross-sectional area. CO was calculated as HR x SV. The data obtained after each set of exercise were averaged and used for analyses. Multi-level modeling was used to determine the effect of exercise condition on dependent variables. Statistical significance was set *a priori* at p < 0.05.

**RESULTS:** Artery diameter did not change from baseline. BF increased (p < 0.05) after exercise in each condition except LBFR<sub>SBP</sub> in the order of HL (12.73±1.42 cm<sup>3</sup>•mean±SE) > LL (9.92±0.82 cm<sup>3</sup>) > LBFR<sub>DBP</sub> (6.47±0.79 cm<sup>3</sup>) > LBFR<sub>SBP</sub> (3.51±0.59 cm<sup>3</sup>). Blunted exercise induced increases occurred in HR, SV, and CO after LBFR compared to HL and LL. HR increased 45% after HL and LL and 28% after LBFR (p < 0.05), but SV increased (p < 0.05) only after HL. Consequently, the increase (p < 0.05) in CO was greater in HL and LL (~3 L/min) than in LBFR (~1 L/min).

**CONCLUSION:** BF during LBFR<sub>SBP</sub> was 1/3 of that observed in LL, which supports the hypothesis that local ischemia stimulates the LBFR hypertrophic response. As the cuff did not compress the artery, the ischemia may have occurred because of the blunted rise in CO or because arterial BP cannot overcome the cuff pressure. As LBFR<sub>DBP</sub> effectively reduced BF and CO with cuff pressures less than systolic BP, future studies should investigate the hypertrophic potential of LBFR at even lower cuff pressures.

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**2823** Board #95 June 1 11:00 AM - 12:30 PM

### The Influence Of Spontaneous Sympathetic Bursts On Conduit Artery Shear Rate And Diameter In Humans

Seth T. Fairfax, Jaume Padilla, Paul J. Fadel, FACSM. *University of Missouri, Columbia, MO.* (Sponsor: Paul J. Fadel, FACSM)

(No relationships reported)

Recently, there has been interest in understanding the interaction between muscle sympathetic nerve activity (MSNA) and shear-induced dilation. This has primarily been examined using flow-mediated dilation (FMD) before and after perturbations that cause reflex-mediated increases in MSNA. However, whether spontaneous changes in resting MSNA alter conduit artery shear rate and diameter on a beat-by-beat basis has not been examined.

**PURPOSE:** To test the hypothesis that, under resting conditions, individual bursts of MSNA decrease shear rate and consequently decrease diameter of the common femoral artery (CFA).

**METHODS:** In 8 healthy young men, MSNA (peroneal nerve microneurography), heart rate (ECG), arterial blood pressure (finger photoplethysmography), and the diameter and mean velocity of the common femoral artery (duplex Doppler ultrasound) were measured continuously during 20 minutes of supine rest. Signal averaging was used to characterize the beat-by-beat changes in mean arterial blood pressure (MAP), CFA diameter and calculated CFA shear rate for 15 cardiac cycles following each MSNA burst.

**RESULTS:** A consistent and significant decrease in CFA shear rate occurred following spontaneous bursts of MSNA, reaching a peak change at about 8 seconds (-5.7% ± 1.6%, p < 0.05 vs. baseline). However, during this same time, an increase in CFA diameter (peak change of 0.3% ± 0.0%, p < 0.05 vs. baseline) was observed along with a rise in MAP (peak change of 3.0% ± 0.4%, p < 0.05 vs. baseline).

**CONCLUSIONS:** These preliminary findings indicate that on a beat-by-beat basis, CFA diameter does not decrease in response to a spontaneous burst of MSNA, but rather it increases. This suggests that CFA diameter is not influenced by spontaneous decreases in shear rate following MSNA bursts. In contrast, the increase in CFA diameter appears to be associated with an increase in blood pressure. Future studies examining the influence of MSNA burst pattern and size on shear-induced conduit artery dilation during resting conditions warrant consideration. Supported by NIH RO1HL093167

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**2824** Board #96 June 1 11:00 AM - 12:30 PM

### Effect of Statins on Creatine Kinase Levels Before and After a Marathon Run

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<sup>1</sup>Hartford Hospital, Hartford, CT. <sup>2</sup>University of Connecticut, Storrs, CT. <sup>3</sup>Children's Hospital, Boston, MA.

(No relationships reported)

**PURPOSE:** We sought to determine if statin users running a marathon exhibited greater evidence of muscle damage assessed by serum CK levels than marathon runners not using these medications.

**METHODS:** We measured serum levels of myoglobin, total creatine kinase (CK) and the CK myocardial (CK-MB), muscle (CK-MM) and brain (CK-BB) isoenzymes in 37 individuals treated with statins and in 43 non-statin treated controls running the 2011 Boston Marathon. Venous blood samples were obtained the day before (PRE) as well as within 1-hour (FINISH) and 24-hours after (POST) the race. Hematocrit and hemoglobin were used to adjust for changes in plasma volume. CK distribution was normalized using log transformation before analysis.

**RESULTS:** The increase in CK-MB 24 hours after exercise was also greater in statin users (PRE to POST: 1.1±3.9 to 8.9±7.0 U/L) than controls (PRE to POST: 0.0±0.0 to 4.2±5.0 U/L; p < 0.05 for comparison) whereas increases in muscle myoglobin did not differ at any time point between groups. Increases in CK at both FINISH and POST race measurements were directly related to age in the statin users (r<sup>2</sup>=0.13 and 0.14; p < 0.05) but not in controls (r<sup>2</sup>=0.02 and 0.00; p=0.42) suggesting that susceptibility to exercise-induced muscle injury with statins increases with age.

**CONCLUSIONS:** We conclude that statins increase exercise-related muscle injury.

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2825 Board #97 June 1 11:00 AM - 12:30 PM

**Training Status Does Not Influence Acute Exercise-induced Increases in Plasma Angiogenic Cytokines in Young Men**

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(No relationships reported)

Angiogenic growth factors can provoke angiogenesis by acting directly on the endothelium or by initiating mobilization and/or enhancing function of circulating angiogenic cells (CACs) from the bone marrow. Endurance exercise may increase plasma levels of angiogenic cytokines, anti-inflammatory cytokines and colony-stimulating factors.

**PURPOSE:** To test the hypothesis that basal and acute exercise-induced levels of angiogenic cytokines differ between trained and untrained young men.

**METHODS:** Ten endurance-trained and ten sedentary healthy young men were studied. Maximal oxygen uptake (VO<sub>2</sub>max) was assessed using a graded treadmill running protocol. Subjects performed 30 minutes of treadmill running at 75% VO<sub>2</sub>max. Blood samples were obtained before and after exercise. Plasma levels of VEGF, basic fibroblast growth factor (bFGF), placental growth factor (PlGF), and soluble VEGF receptor (sFlt-1) were measured by multiplex ELISA. Data are presented as means ± SEM.

**RESULTS:** Contrary to our hypothesis, there were no statistically significant differences between groups in VEGF, bFGF, PlGF, or sFlt-1 before or after acute exercise ( $P > 0.05$ ). Examination of the main effect of acute exercise with groups combined indicated that VEGF did not change significantly ( $P > 0.05$ ), bFGF increased by ~25% ( $6.2 \pm 0.2$  vs.  $7.8 \pm 0.9$  pg/mL;  $P = 0.06$ ), PlGF increased by ~16% ( $16.2 \pm 0.7$  vs.  $18.7 \pm 1.3$  pg/mL;  $P < 0.05$ ), and sFlt-1 increased by 36% ( $166 \pm 7$  vs.  $225.6 \pm 11.5$  pg/mL;  $P < 0.001$ ). Previous data indicate a role for VEGF and angiogenic cytokines in acute exercise-induced mobilization of CACs from bone marrow and CAC function. However, our data do not support such a correlation between circulating angiogenic cytokines and previously published data on functional measures in CACs from these same subjects (Jenkins et al., J Appl Physiol., 2011).

**CONCLUSIONS:** Acute endurance exercise increases plasma bFGF, PlGF, and sFlt-1 levels in sedentary and endurance-trained young men, but cytokine levels did not differ by training status. We speculate that the relationship between training status and acute exercise-induced increases in angiogenic growth factors associated with CACs occur locally at the tissue level and may not be detectable at the systemic level.

Supported by NIH AGT320068 and UMD Kinesiology Graduate Research Initiative Fund

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2826 Board #98 June 1 11:00 AM - 12:30 PM

**Arterial Compliance and Ultra-Endurance Aerobic Exercise: Analysis of Training and Racing Characteristics with Vascular Response**

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(No relationships reported)

It is well established that regular moderate intensity aerobic exercise training is associated with increased arterial compliance; however, the vascular response to an acute bout of exercise is currently less clear. There exists evidence that some exercise (high intensity and long duration) may lead to decreases in arterial compliance (at least transiently).

**PURPOSE:** To assess training and racing-related characteristics of ultra-endurance running with regard to arterial compliance.

**METHODS:** Applanation tonometry (CR-2000, HDI) was used to measure both large (LA) and small artery (SA) compliance in competitive ultra-runners ( $n=10$ ) at rest, and following 45 km and 75 km of trail running. Maximal aerobic power (VO<sub>2</sub>max) was measured prior to competition and training practices including: running distance, duration and training intensity (RPE) were documented. Heart rate was recorded throughout the race. We used Pearson correlation for associations and a 3 (compliance) by 2 (high/low fitness) ANOVA for comparisons.

**RESULTS:** Baseline compliance was not associated with differences in training practices. However, a higher training RPE was associated with a higher VO<sub>2</sub>max ( $r=0.69$ ,  $p=0.03$ ) and race intensity (HR estimated VO<sub>2</sub> for 75 km;  $r=0.67$ ,  $p=0.05$ ). Higher VO<sub>2</sub>max and training RPE were associated with less SA stiffening at marathon distance ( $r=0.83$ ,  $p=0.006$ , and  $r=0.86$ ,  $p=0.003$ , respectively). The participants capable of maintaining the highest percentage of maximum throughout the race presented with the smallest changes in LA compliance ( $r=0.76$ ,  $p=0.02$ ) at 45 km. Comparison of arterial compliance at baseline with 45 km and 75 km revealed differential effects by fitness level ( $F=4.32$ ,  $p=0.04$ ) with decreased compliance at the 45 km mark in the least fit competitors. The SA compliance trended toward decreases at 75 km ( $p=0.056$ ).

**CONCLUSIONS:** The acute effects of exercise on arterial compliance appear to be largely intensity dependent and directly linked to aerobic fitness. Recent marathon-related findings demonstrating the lack of an effect on arterial compliance may be partially explained by the training and racing demands of marathon competition.

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2827 Board #99 June 1 11:00 AM - 12:30 PM

**Influence of Sleep Quality on Antioxidant Status, Vascular Function and Physical Performance in Heart Failure**

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(No relationships reported)

Recent evidence indicates that a reduced quality of sleep is associated with increased risk for or exacerbation of cardiovascular disease. The mechanisms are unclear. We hypothesize poor sleep, contributes to increased oxidative stress, reduced vascular function and lower exercise tolerance.

**PURPOSE:** (1) to examine sleep quality in patients with chronic heart failure (CHF) and controls (CON), and (2) to determine the associations to antioxidant status, vascular function and physical performance.

**METHODS:** Fifteen CHF (age=62±8 yrs) and fifteen CON (age=55±5 yrs) cases were examined. The Pittsburgh Sleep Quality Index (PSQI) was used to assess sleep behavior. The PSQI assesses sleep quality and disturbances over several domains. A total PSQI score >5 characterizes individuals with poor sleep quality. Brachial artery flow-mediated dilation (BAFMD) was determined using ultrasonography. Total antioxidant status was determined using commercially available kits. Six-min walk distance and isometric handgrip strength were used to evaluate physical performance.

**RESULTS:** Total PSQI scores were higher (CHF:  $8.9 \pm 3.14$ ; CON:  $2.9 \pm 1.8U$ ;  $p=0.001$ ) and antioxidant status lower in CHF patients (CHF:  $22.52 \pm 5.43$ ; CON:  $35.82 \pm 10.12$  mM/mg;  $p=0.001$ ). BAFMD (CHF:  $2.98 \pm 1.49$ ; CON:  $6.21 \pm 1.21$ ;  $p=0.01$ ), 6-min walk distance (CHF:  $351.11 \pm 87.7$ ; CON:  $438.5 \pm 75.3$  m;  $p=0.001$ ) and handgrip strength (CHF:  $57.65 \pm 16.5$ ; CON:  $71.67 \pm 15.65$  kg;  $p=0.001$ ) were higher in CON subjects. PSQI total score was inversely related to BAFMD ( $r=-0.52$ ;  $p=0.03$ ). A MANOVA revealed that individuals scoring >5 on the PSQI had significantly lower BAFMD, antioxidant status, 6-min walk distance and handgrip strength ( $p=0.01$ ).

**CONCLUSION:** The "poorer" sleep quality consistently observed in CHF is associated with lower antioxidant capacity, lower vascular function and lower physical performance.

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2828 Board #100 June 1 11:00 AM - 12:30 PM

**Sprint Interval and Sprint Continuous Training Improves Aerobic Fitness but not Vascular Function or Repair**

Emma Harris, Mark Rakobowchuk, Karen M. Birch. University of Leeds, Leeds, United Kingdom. (Sponsor: Harry B. Rossiter, FACSM)  
(No relationships reported)

Shear stress is cited as a mechanism for exercise mediated improvements in vascular function. Sprint interval training (SIT) has been shown to be a time-efficient method for improving skeletal muscle oxidative capacity. However, little is known about the effects of repeated increments in shear stress during SIT on vascular function and repair, especially when compared to a continuous high intensity shear stress stimulus.

**PURPOSE:** To determine whether two types of sprint training programmes (interval vs. continuous) matched for total work can improve markers of vascular function and repair.



**METHODS:** 12 women (22 ± 2 yrs) completed 4 weeks of either SIT (n = 6) or continuous sprint training (CST; n = 6) on 3 days/week. SIT consisted of four 30 s Wingate tests separated by 4.5 min recovery. CST involved sprint cycling for ~3-4 min, until the participant reached the equivalent work achieved in four 30 s Wingate tests performed in their first training session. Prior to and following training,  $VO_{2peak}$  and lactate threshold (LT) were estimated from a cycling incremental exercise test. Vascular function was assessed from brachial artery flow-mediated dilation (FMD) and total vessel reactivity (TVR). Circulating progenitor cells (CPCs), an index of vascular repair, were defined as triple positive cells (CD45<sup>dim</sup>CD34<sup>+</sup>KDR<sup>+</sup>).

**RESULTS:** 4 weeks of SIT or CST improved  $VO_{2peak}$  (Pre SIT 2279 ± 360 ml/min, Post SIT 2523 ± 318 ml/min; Pre CST 2315 ± 222 ml/min, Post CST 2380 ± 160 ml/min;  $P \leq 0.05$ ) and increased LT (Pre SIT 773 ± 106 ml/min, Post SIT 877 ± 164 ml/min; Pre CST 819 ± 129 ml/min, Post CST 908 ± 136 ml/min;  $P \leq 0.05$ ), with no group x time interaction ( $P > 0.05$ ). CPCs did not significantly increase post training (Pre SIT 0.0020 ± 0.0012%/leukocytes, Post SIT 0.0026 ± 0.0022%/leukocytes; Pre CST 0.0024 ± 0.0023%/leukocytes, Post CST 0.0031 ± 0.0023%/leukocytes; time:  $P = 0.09$ ). FMD and TVR did not change following training in either group ( $P > 0.05$ ).

**CONCLUSION:** Despite the differences in the shear stress profile and training time, SIT and CST produced similar results. The improvement in aerobic fitness is consistent with previous studies and is suggestive of enhanced skeletal muscle metabolism. Conversely, training had minimal effect on vascular function and repair. This may be due to healthy vasculature at baseline, or a lack of systemic adaptation.

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**2829** Board #101 June 1 11:00 AM - 12:30 PM

**Critical Microvascular Po<sub>2</sub> And Muscle Fatigue During Acute Femoral Artery Occlusion**

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(No relationships reported)

Muscle function is impaired in low flow states due, in part, to the reduction in oxygen delivery (QO<sub>2</sub>) relative to oxygen consumption (VO<sub>2</sub>). Surprisingly however, the degree of muscle fatigue during acute femoral artery occlusion is variable and may be associated with subtle differences in the QO<sub>2</sub> to VO<sub>2</sub> ratio, which can be estimated by measurement of microvascular PO<sub>2</sub> (PO<sub>2m</sub>) in the contracting muscle. Preliminary observations suggested that even small increases in PO<sub>2m</sub> during femoral artery ligation can attenuate muscle fatigue.

**PURPOSE:** The purpose of this study was to characterize the relationship between PO<sub>2m</sub> and muscle fatigue during acute femoral artery ligation in the rat extensor digitorum longus muscle (EDL).

**METHODS:** Female Sprague-Dawley rats (n=18, 243 ± 3 g) were anesthetized (pentobarbital, 45 mg/kg ip) and a 5-0 suture snare was placed around the left femoral artery. The left EDL was isolated and the distal tendon was cut and attached to a load cell interfaced with a Muscle Tension Analyzer. PO<sub>2m</sub> was measured using phosphorescence quenching (and Oxyphor G2). PO<sub>2m</sub> and twitch tension were recorded continuously throughout 30 s of baseline, femoral occlusion, 10 min of electrically-stimulated contractions (1 Hz, 6V), and for 4 min after release of the femoral artery snare.

**RESULTS:** After 30 s of baseline recording the femoral artery was occluded and PO<sub>2m</sub> fell from 23 ± 1 mmHg to 10 ± 1 mmHg within 40s. PO<sub>2m</sub> during contractions varied between 4 and 15 mmHg. When %fatigue was plotted against PO<sub>2m</sub>, a sharp inflection was noted a PO<sub>2m</sub> ~8 mmHg. When PO<sub>2m</sub> was greater than 8 mmHg (12 ± 1 mmHg) during femoral occlusion there was less muscle fatigue (12 ± 2%, n=8). However, when PO<sub>2m</sub> was less than 8 mmHg (6 ± 1 mmHg) there was marked fatigue (46 ± 7%, n=10).

**CONCLUSIONS:** These results suggest that, despite femoral artery occlusion, in some rats there was sufficient collateral blood flow to the EDL to maintain a critical PO<sub>2m</sub> (>8 mmHg) and sustain muscle twitch tension. However, in those rats in which PO<sub>2m</sub> in the EDL fell below 8 mmHg there was marked muscle fatigue. These results suggest there is a critical PO<sub>2m</sub> necessary to sustain contractile function in the rat EDL muscle. (Supported by the Graduate Program Committee, KCOM - ATSU.)

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**2830** Board #102 June 1 11:00 AM - 12:30 PM

**Chronic Heart Failure Alters nNOS-mediated Control of Skeletal Muscle Microvascular O<sub>2</sub> Delivery and Utilization**

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(No relationships reported)

Chronic heart failure (CHF)-induced reductions in NO bioavailability impair peripheral vasomotor control and lower the resting and contracting microvascular O<sub>2</sub> delivery/O<sub>2</sub> utilization ratio (which sets the microvascular O<sub>2</sub> partial pressure,  $P_{O_{2mv}}$ , and represents the pressure head for capillary-myocyte O<sub>2</sub> flux). Given well-documented CHF derangements of endothelial function, the tacit presumption has been that reductions in NO bioavailability result exclusively from impaired eNOS function.

**PURPOSE:** To test the hypothesis that CHF alters nNOS-mediated control of skeletal muscle  $P_{O_{2mv}}$ .

**METHODS:** 10 healthy (left ventricular end diastolic function, LVEDP: 6±1 mmHg) and 12 CHF (coronary artery ligation, LVEDP: 13±1 mmHg,  $P < 0.05$ ) rats had their right spinotrapezius muscle exposed. Silver wire electrodes elicited 1 Hz (~6-8 V) twitch contractions for 3 minutes before and after acute nNOS inhibition via S-methyl-L-thiocitrulline (SMTC, 0.56 mg/kg i.a.).  $P_{O_{2mv}}$  was measured via infusion of the R2 probe and phosphorescence quenching. Blood flow was determined via infusion of radiolabelled microspheres and the reference sample technique. VO<sub>2</sub> was estimated from blood flow and  $P_{O_{2mv}}$  measurements via direct Fick calculation.

**RESULTS:** **Healthy:** SMTC increased resting baseline  $P_{O_{2mv}}$  (Con: 31±2, SMTC: 37±2 mmHg,  $P < 0.05$ ) via a 28% reduction in VO<sub>2</sub> and, upon contractions onset, speeded the time to reach 63% of the overall kinetics response (mean response time, MRT, Con: 23±2, SMTC: 17±1 s,  $P < 0.05$ ). During the contracting steady-state, SMTC reduced blood flow (↓17%,  $P < 0.05$ ) and VO<sub>2</sub> (↓17%,  $P < 0.05$ ) such that  $P_{O_{2mv}}$  was unaltered (Con: 23±2, SMTC: 23±2 mmHg,  $P > 0.05$ ). **CHF:** Conversely, SMTC did not alter resting baseline blood flow, VO<sub>2</sub>, or  $P_{O_{2mv}}$  (Con: 26±2, SMTC: 29±2 mmHg,  $P > 0.05$ ) or the MRT (Con: 23±3, SMTC: 21±3 s,  $P > 0.05$ ) upon contractions onset. Moreover, SMTC did not change steady-state blood flow or VO<sub>2</sub> thus resulting in an unchanged  $P_{O_{2mv}}$  (Con: 17±1, SMTC: 18±2 mmHg,  $P > 0.05$ ).

**CONCLUSION:** nNOS-mediated control of skeletal muscle microvascular function is compromised (and may be abolished) in CHF. The present data provide a clear mandate to pursue improvements in nNOS function when designing therapeutic interventions aimed at restoring NO bioavailability in CHF patients.

Funding: AHA Midwest Affiliate, NIH HL-108328

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**2831** Board #103 June 1 11:00 AM - 12:30 PM

**Heart Rate Variability Following Two Different Exercise Modalities**

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(No relationships reported)

Various components of exercise prescription, e.g., intensity and duration, have been found to be associated with cardiac-autonomic recovery. However, it is not fully known if the recovery of the autonomic nervous system varies between different modes of exercise.

**PURPOSE:** The purpose of this study was to analyze cardiac-autonomic control, via heart rate variability (HRV), between acute bouts of treadmill (T) and cycle (C) exercise at the same intensity.

**METHODS:** Fourteen apparently healthy men participated in this study. Each subject performed maximal graded exercise tests on T and C ergometers on two separate days. The subjects returned to the lab on two additional days that were separated by 72 hours to 1 week. During these visits, they performed, in random order, 30-minute exercise bouts on T or C at 70% of their mode-specific VO<sub>2peak</sub>. Electrocardiography (ECG) was analyzed for 10-minutes before and 30-minutes after each exercise bout. The ECG was divided into three 5-minute segments during which paced breathing (12 breaths.min<sup>-1</sup>) took place as follows: the last 5-minutes of the pre-exercise period (Pre), and between 15-20 minutes (Post-1) and 25-30 minutes (Post-2) of the post-exercise period. HRV was analyzed for each 5-minute epoch via frequency domain as follows: normalized high frequency power (HFnu); normalized low frequency power to HFnu ratio (LF:HF).

**RESULTS:** HFnu (ms2) at Pre, Post-1, and Post-2 for T was  $50.9 \pm 11.7$ ,  $43.1 \pm 9.0$ , and  $47.4 \pm 7.9$ , respectively, and for C was  $50.7 \pm 10.0$ ,  $41.8 \pm 9.5$ , and  $44.8 \pm 8.4$ , respectively. LF:HF at Pre, Post-1, and Post-2 for T was  $0.8 \pm 0.5$ ,  $0.9 \pm 0.5$ , and  $0.8 \pm 0.3$ , respectively, and for C was  $0.8 \pm 0.5$ ,  $1.1 \pm 0.5$ , and  $1.0 \pm 0.4$ , respectively. There were no significant differences between HFnu or LF:HF ratio between T and C at Pre ( $p > 0.05$ ). HFnu and LF:HF at Post-2 were significantly different between the two modes ( $p < 0.05$ ). HFnu and LF:HF were significantly lower between Pre and Post-1 and 2 in C ( $p < 0.05$ ). However, HFnu was only significantly different between Pre and Post-1 ( $p < 0.05$ ), but not between Pre and Post-2 in T. LF:HF was not significantly different between Pre and either of the Post time points in T ( $p > 0.05$ ).

**CONCLUSIONS:** The results of this study suggest that C is associated with a greater disturbance of post-exercise cardiac-autonomic control compared to T.

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**2832** Board #104 June 1 11:00 AM - 12:30 PM

**Heart Rate Response To An Orthostatic Challenge In The Early Postpartum Period**

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(No relationships reported)

Cardiovascular adaptations occur early in pregnancy and persist throughout gestation. Some of these cardiovascular changes may still be apparent in postpartum women for an unknown period of time. To date there is a paucity of research examining the postpartum period regarding the duration and magnitude of these cardiovascular changes, especially in regards to autonomic regulation. The actual role of the autonomic nervous system during pregnancy is poorly understood and therefore understudied in the postpartum period.

**PURPOSE:** To investigate the heart rate response to an orthostatic challenge in active women at two months postpartum.

**METHODS:** Women who were active throughout pregnancy were recruited at two months postpartum (PP; n=20). The control group was composed of similar active, non-pregnant women (in luteal phase of their menstrual cycle) with comparable physical activity backgrounds (NP; n=20). Heart rate (HR) was assessed after 20 minutes in a seated position and after 5 minutes in the standing position (standard 4-lead electrocardiogram, Sensor Medics, Vmax 29c).

**RESULTS:** HR measured in the seated position was significantly lower in the PP group (PP:  $68 \pm 2$  vs. NP:  $75 \pm 2$  bpm;  $p < 0.05$ ). After five minutes of standing, HR was also significantly lower in the PP group (PP:  $77 \pm 2$  vs. NP:  $85 \pm 2$  bpm,  $p[[\text{Unsupported Character - \&\#8249}]]0.001$ ). No difference occurred in the Delta HR response (standing HR - seated HR) between groups (PP:  $13 \pm 4$  vs. NP:  $9 \pm 3$ ,  $p = 0.454$ ).

**CONCLUSION:** Reactivity to an orthostatic challenge in postpartum women is similar to the non-pregnant response despite absolute HR values being significantly lower. The early postpartum period may reflect changes in the cardiovascular response at rest (in both positions related to a higher stroke volume (not yet returned to pre-pregnancy values) from late pregnancy. The fact that the relative values are not different between groups (i.e. their autonomic reactivity is the same) when HR is lower is an interesting observation that warrants further investigation.

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**2833** Board #105 June 1 11:00 AM - 12:30 PM

**Autonomic and Cardiovascular Function of Hormone-Receptor Positive Breast Cancer Patients Following Treatment with Anthracycline-Containing Chemotherapy**

Whitney E. Hornsby<sup>1</sup>, Michel G. Khouri<sup>1</sup>, Susan G. Lakoski<sup>2</sup>, Phil Ainslie<sup>3</sup>, Jonathon Smirl<sup>3</sup>, Miranda West<sup>1</sup>, Amy Lane<sup>1</sup>, April Coan<sup>1</sup>, Fernando Ona<sup>4</sup>, James E. Klaunig<sup>5</sup>, David M. Kocaja<sup>5</sup>, Robert F. Chapman, FACSM<sup>6</sup>, Lee W. Jones<sup>1</sup>. <sup>1</sup>Duke University Medical Center, Durham, NC. <sup>2</sup>University of Texas Southwestern Medical Center, Dallas, TX. <sup>3</sup>University of British Columbia, Kelowna, BC, Canada. <sup>4</sup>Boston University, Boston, MA. <sup>5</sup>Indiana University, Bloomington, IN.  
(No relationships reported)

Anthracycline-containing chemotherapy [e.g., doxorubicin or epirubicin] is considered standard treatment for early-stage breast cancer, however it causes left ventricular (LV) dysfunction. This cardiac impairment manifests as increased cavity size (LV remodeling) and reduced left ventricular ejection fraction (LVEF), which may lead to heart failure. Current detection techniques (resting LVEF) are insensitive to detecting early cardiac impairment.

**PURPOSE:** To evaluate autonomic and cardiovascular function in breast cancer patients with preserved cardiac function (i.e., LVEF >50%).

**METHODS:** Thirty-nine women (26  $\pm$  23 months post chemotherapy) and 11 age-matched healthy women were studied. Autonomic function was assessed using heart rate (HR, ECG), heart rate variability (HRV, spectral analysis) and baroreflex sensitivity (BRS, transfer function analysis). A cardiopulmonary exercise test and echocardiography were performed to assess peak cardiovascular function ( $VO_{2peak}$ ) and cardiac function (LV volumes and LVEF), respectively. To explore time-based differences since completion of chemotherapy, patients were sub-classified into two distinct groups: Cohort I:  $8 \pm 5$  and Cohort II:  $45 \pm 18$  months.

**RESULTS:** Resting HR was higher among patients compared to controls ( $81 \pm 10$  versus  $63 \pm 8$ , beats.min<sup>-1</sup>;  $p < 0.01$ ); no differences were identified for HRV or BRS.  $VO_{2peak}$  was reduced in patients ( $24.3 \pm 4.6$  versus  $33.4 \pm 6.6$  mL.kg<sup>-1</sup>.min<sup>-1</sup>;  $p < 0.001$ ). Resting HR and  $VO_{2peak}$  were similar between breast cancer cohorts despite normalized LV volumes for Cohort II.

**CONCLUSION:** Breast cancer patients approximately 2 years after the completion of chemotherapy have significant impairments in cardiovascular (reduced  $VO_{2peak}$ ) and autonomic (elevated resting HR) function despite preserved LVEF. The magnitude of autonomic dysfunction and  $VO_{2peak}$  impairment was similar regardless of time since the completion of chemotherapy. Measurement of cardiac function alone may be insufficient to characterize cardiovascular health in early breast cancer patients. These results suggest an urgent need for therapeutic strategies (e.g. aerobic training) to prevent and/or treat global cardiovascular dysfunction in breast cancer patients.

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**2834** Board #106 June 1 11:00 AM - 12:30 PM

**Volume of Physical Activity and Hemostatic Variables in Pregnant Women**

Christine Nicewonger<sup>1</sup>, Kelly Mattran<sup>2</sup>, Christopher J. Womack, FACSM<sup>2</sup>, Robert E. Lee<sup>2</sup>, Judith A. Flohr<sup>2</sup>. <sup>1</sup>Michigan State University, East Lansing, MI. <sup>2</sup>James Madison University, Harrisonburg, VA.  
(No relationships reported)

**PURPOSE:** To evaluate potential relationships between hemostatic variables and physical activity (PA) during pregnancy.

**METHODS:** Fasted blood draws (6-10AM) were obtained from 23 pregnant women (19-34yrs) and analyzed for tissue plasminogen activator (tPA) antigen, tPA activity, plasminogen activator inhibitor-1 (PAI-1) antigen, and vonWillebrand factor (vWF) antigen. PA was assessed by Modifiable Activity Questionnaire (MAQ) and converted to METmin/wk (MET). Average daily step count (STEP) was obtained from 2 week pedometer logs. Participants were grouped by MET as "meeting" (n=15) or "not meeting" (n=8) the American College of Obstetricians and Gynecologists' PA recommendations (450 MET) and by STEP as "sedentary" (<5,000 steps/day; n=12) or "at least low active" (5,000+ steps/day; n=4). Gestational age (GA), MET, STEP, and pre-pregnancy PA were possible predictors for hemostatic variables using forward stepwise multiple regression. Multiple linear regression provided y-intercept and slope, allowing extrapolation of pre-pregnancy dependent variables and mean expected changes over GA. ANCOVA determined if differences existed in hemostatic variables among PA groups, controlling for GA and pre-pregnancy PA.

**RESULTS:** Multiple regression results suggest that PAI-1 and tPA antigen were higher and tPA activity lower with increased GA ( $p < 0.05$ ) and GA and MET were significant predictors of tPA antigen ( $p < 0.01$ ). Linear regression using STEP classifications resulted in a significant difference in y-intercept for tPA antigen ( $p < 0.05$ ), suggesting that tPA antigen may be lower pre-pregnancy in women accumulating at least 5,000 steps/day vs. those who are sedentary. No significant slope differences were observed in hemostatic variables in relation to PA. ANCOVA analysis indicated a significant difference in tPA activity based on MET classifications ( $p = 0.04$ ).

**CONCLUSION:** The associations between PA and 1)tPA antigen and 2)tPA activity are novel and suggest that PA may help attenuate the extent of hypercoagulation in normal pregnancy. Future research is warranted as regular PA, independent of pregnancy, is known to enhance fibrinolytic profile and reduce blood coagulation potential in women of child-bearing age and pregnant women are predisposed to hypercoagulation-related health issues.

Funded by the Morrison Bruce Center for the Promotion of Physical Activity for Girls and Women.

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**2835** Board #107 June 1 11:00 AM - 12:30 PM  
**Sympathetic Nerve System May Contribute To Microvasculature Responses During Reactive Hyperemia In Women**  
Masahiro Horiuchi<sup>1</sup>, Tomoyasu Kadoguchi<sup>2</sup>, Koichi Okita<sup>1</sup>. <sup>1</sup>Hokusho University, Ebetsu, Japan. <sup>2</sup>Hokkaido University, Sapporo, Japan. (Sponsor: Kevin K McCully, FACSM)  
(No relationships reported)

Aging is associated with impaired endothelial function and menopause may accentuate endothelial dysfunction. Increased sympathetic nerve activity with advancing age is also associated with impaired endothelial dysfunction. These alterations might also affect not only vasodilatation of large arteries but also small artery function. Near infrared spectroscopy (NIRS) can allow to determine the relative changes of oxygenated hemoglobin (HbO<sub>2</sub>) in the small artery with high temporal resolution. However, little is known about small artery function of aged women.

**PURPOSE:** To determine the influence of aging and sympathetic nerve activity on small artery during reactive hyperemia in women.

**METHODS:** Ten young (22±0.4yrs, means± S.E.M.), 11 middle (42±0.5yrs) and 13 old healthy women (62±0.7yrs) were studied. Post occlusive reactive hyperemia was performed in supine position. NIRS signals were measured during 5 min of arterial cuff occlusion (cuff pressure > 50mmHg above systolic blood pressure), and during 3 min of post occlusive reactive hyperemia at their forearm muscle with and without sympathetic stimulation. Sympathetic nerve activity was stimulated induced by the cold pressor test (CPT) from the last 1-min during occlusion to the first 2-min during reactive hyperemia. The recovery time of HbO<sub>2</sub> is half the time required for the HbO<sub>2</sub> to reach maximal value in response to cuff release from the time of cuff occlusion.

**RESULTS:** Recovery time of HbO<sub>2</sub> without CPT in old (12.0±0.7sec) was significantly slower than that in young (8.4±0.4 sec) and middle women (10.2±0.5 sec, p<0.05, respectively), whereas no difference was observed between young and middle women. In contrast, CPT slowed the recovery time in HbO<sub>2</sub> in middle (12.0±0.6sec) and old (15.3±0.7sec) but not in young (9.5±0.5 sec). Moreover, there were significant differences in the recovery time of HbO<sub>2</sub> with CPT among subjects (p<0.05 respectively).

**CONCLUSIONS:** These results indicate that post menopausal women exhibit a delayed HbO<sub>2</sub> response during reactive hyperemia. Furthermore, sympathetic nerve system may be related to HbO<sub>2</sub> responses after middle age. We suggest that these alterations in HbO<sub>2</sub> kinetics are indicative of microvasculature dysfunction in these subjects.

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**2836** Board #108 June 1 11:00 AM - 12:30 PM  
**Skeletal Muscle Metaboreflex is Enhanced in Postmenopausal Women**  
Jong-Kyung Kim<sup>1</sup>, Hosung Nho<sup>1</sup>, Charles L. Stebbins, FACSM<sup>2</sup>, Hyun-Tae Seo<sup>1</sup>, Kyung-Ae Kim<sup>1</sup>, Kwang-Il Kim<sup>1</sup>, Joon-Sung Park<sup>1</sup>, Hyun-Min Choi<sup>1</sup>. <sup>1</sup>Kyung Hee University, Yong In, Korea, Republic of. <sup>2</sup>University of California, Davis, Davis, CA. (Sponsor: Charles L. Stebbins, FACSM)  
(No relationships reported)

**PURPOSE:** To determine whether an elevated muscle metaboreflex contributes to the excessive blood pressure response to exercise in postmenopausal women.

**METHODS:** Thirty healthy female volunteers were studied (15 postmenopausal and 15 premenopausal). Stroke volume (SV), heart rate (HR), cardiac output (CO), systolic blood pressure (SBP), diastolic blood pressure (DBP), and total vascular conductance (TVC) were continuously assessed throughout the experiment. To activate the muscle metaboreflex, occlusion of the vasculature was induced via inflation of a blood pressure cuff (2 min) on the upper arm following static handgrip exercise.

**RESULTS:** Muscle metaboreflex activation increased mean arterial pressure (MAP) in both groups. However, this pressor response was greater in the postmenopausal women ( $\Delta$ MAP: 21.4±3 vs. 14.5±2 mmHg) (p<0.05) even though the corresponding increase in CO was less ( $\Delta$ CO: 0.0±0.2 vs. 0.3±0.2 L/min) (p<0.05). TVC decreased in both groups but was more pronounced in the postmenopausal group ( $\Delta$ TVC: -10.7±2.6 vs. -17.1±3.6 ml/min/mmHg) (p<0.05).

**CONCLUSION:** In conclusion, the exaggerated blood pressure response to exercise in postmenopausal women is mediated, in part, by an overactive metaboreflex that is associated with enhanced peripheral vasoconstriction.

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**2837** Board #109 June 1 11:00 AM - 12:30 PM  
**Increases in Cerebrovascular Resistance in Patients with Mild Cognitive Impairment**  
Rosemary Parker<sup>1</sup>, Yongsheng Zhu<sup>1</sup>, Benjamin Tseng<sup>1</sup>, Estee Brunk<sup>1</sup>, Kyle Armstrong<sup>1</sup>, Kristen Martin-Cook<sup>2</sup>, Myron Weiner<sup>2</sup>, Rong Zhang<sup>1</sup>. <sup>1</sup>Institute for Exercise and Environmental Medicine, Dallas, TX. <sup>2</sup>University of Texas Southwestern Medical Center at Dallas, Dallas, TX.  
(No relationships reported)

**INTRODUCTION:** Brain perfusion is reduced in patients with Alzheimer's disease (AD). Whether this is a primary or contributing factor has not been established. Changes in cerebral hemodynamics in patients with mild cognitive impairment (MCI), often a prodromal stage of AD, has not been carefully studied.

**PURPOSE:** This study tested the hypothesis that global cerebral blood flow (CBF) is reduced in patients with MCI relative to age and education matched cognitively normal older adults.

**METHODS:** Twenty-one MCI patients (10 females, 67 ± 6 yr BMI: 24 ± 5 kg/m<sup>2</sup>) and 20 normal control subjects (14 females, 68 ± 7 yr, BMI: 22 ± 4 kg/m<sup>2</sup>) participated. Patients with MCI had a global Clinical Dementia Rating (CDR) score of 0.5 and scores ≤ 1SD below the appropriate norm on the Wechsler Logical Memory Test. Blood flow was measured using high resolution 2D and color Doppler ultrasonography in the internal carotid (ICA) and vertebral arteries (VA). Global CBF was calculated as a sum of both the ICA and VA measures. Transcranial Doppler (TCD) was used to measure CBF velocity (CBFV) in the middle cerebral artery (MCA). Cerebrovascular resistance (CVR) was calculated as mean blood pressure (MBP) divided by global CBF.

**RESULTS:** Baseline MBP did not differ significantly between MCI and control groups (91 ± 10 mmHg and 86 ± 12 mmHg respectively (p=0.11)). CBF was 10% lower in MCI than the normal controls (594.3 ± 105.4 vs. 657.4 ± 130.6 ml/min, p=0.10), but not statistically significant. No difference in CBFV was observed (MCI 51.8 ± 11.4 vs. Control 57.1 ± 16.2 cm/sec, p=0.24). However, cerebrovascular resistance was increased by 23% in MCI subjects (0.16 ± 0.03 vs. 0.13 ± 0.13 mmHg-min/ml, p=0.02).

**CONCLUSION:** The observed increase in CVR in MCI suggests that vascular mechanisms may be at play in prodromal AD. Development of pharmacological and/or non-pharmacological interventions such as exercise training to reduce CVR may improve brain perfusion to prevent or slow AD.

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## E-24 Free Communication/Poster - Cognition and Physical Activity

JUNE 1, 2012 7:30 AM - 12:30 PM  
ROOM: Exhibit Hall

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**2838** Board #110 June 1 9:30 AM - 11:00 AM  
**Cognitive Decline Precedes Physical Function Change in Patients with Early Mild Cognitive Impairment.**  
Benjamin Y. Tseng<sup>1</sup>, Estee Brunk<sup>2</sup>, Kristen Martin-Cook<sup>1</sup>, Kyle Armstrong<sup>2</sup>, Vincent L. Aengevaeren<sup>2</sup>, Myron Weiner<sup>1</sup>, Benjamin D. Levine, FACSM<sup>1</sup>, Rong Zhang<sup>1</sup>. <sup>1</sup>University of Texas Southwestern Medical Center, Dallas, TX. <sup>2</sup>Institute for Exercise and Environmental Medicine, Dallas, TX. (Sponsor: Benjamin Levine, FACSM)  
(No relationships reported)

Physical function and motor control deteriorate with aging. These deficits are likely to be exacerbated in patients with Alzheimer's disease (AD). However, whether this is the case for patients with Mild Cognitive Impairment (MCI), often a transitional stage between normal aging and AD, is not known.

**PURPOSE:** To evaluate physical function in patients with MCI.

**METHODS:** Twenty eight MCI patients (13 males, age 68±6 yrs, BMI 28±5), and 21 age and education matched cognitively normal adults (6 males, age 68±7 yrs, BMI = 26±4) underwent physical function assessment including level of aerobic fitness (VO2max), gait velocity, timed-up-and-go, functional reach, and reaction time. Diagnosis of MCI required a memory complaint, objective evidence of memory impairment as measured by the Logical Memory subscale of the Wechsler Adult Intelligence Test and no subjectively or objectively reported overall functional impairment indicated by a Clinical Dementia Rating (CDR) score ≤ 0.5.

**RESULTS:** No differences in physical function were observed in MCI patients when compared to the normal controls (see Table 1).

**CONCLUSION:** We did not find physical function deficits in patients with MCI. These findings suggest that exercise testing and training can be implemented safely in these patients to prevent further physical function decline at the early stage of neurodegenerative disease.

Table 1. Aerobic fitness, physical function, and cognitive performance in MCI and normal subjects.

|                  | VO2max<br>(ml/kg/min) | Gait<br>Velocity<br>(m/sec) | Timed Up-<br>and-Go (sec) | Functional<br>Reach (cm) | Reaction<br>Time (cm) | Logical<br>Memory<br>(immediate) | Logical<br>Memory<br>(delayed) |
|------------------|-----------------------|-----------------------------|---------------------------|--------------------------|-----------------------|----------------------------------|--------------------------------|
| MCI<br>(n=28)    | 22.98±5.21            | 1.16±0.18                   | 9.32±1.64                 | 29.67±5.95               | 30.41±8.90            | 11±2                             | 8±2                            |
| Normal<br>(n=21) | 22.51±4.89            | 1.08±0.13                   | 9.87±1.56                 | 30.39±8.78               | 28.89±6.61            | 15±2                             | 14±2                           |
| P-value          | 0.784                 | 0.142                       | 0.299                     | 0.774                    | 0.56                  | <0.001                           | <0.001                         |

**2839 Board #111 June 1 9:30 AM - 11:00 AM**

**Aerobic Exercises Improve Cognition Function in Chronic Unpredictable Mild Stress-Induced Depressive Rats**

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(No relationships reported)

Studies had reported that aerobic exercises can improve cognition function in depression. Whether aerobic exercise is viable treatment for chronic unpredictable stress (CUMS)-induced depression is unclear, especially if it could prevent cognition decline when subjects were exposed to CUMS is still unknown.

**PURPOSE:** To investigate the effect of aerobic exercises on the cognition in CUMS-induced depression rats; to determine that the lack of 5-HT is the mechanism underlying the cognitive impairment in depressive rats.

**METHODS:** 32 four-month-old male SD rats were divided into 4 groups: common group (C), CUMS depression model group (D), CUMS and aerobic exercise group (DE), CUMS and fluoxetine group (DF). The D, DE and DF groups were exposed to CUMS for 4 weeks with or without access to 18-days 64%VO<sub>2</sub>max treadmill running or intragastric injection of antidepressant fluoxetine. On the end of CUMS, open-field test was performed, hippocampus and brain raphe nucleus were collected for 5-HT measurement. Group comparisons were made using one-way ANOVA.

**RESULTS:** Compared to the C group, the score of activity (43.00±16.56 vs. 80.17±19.17 frequency/5min, p<0.05) and space exploration tend (20.92±9.50 vs. 47.42±5.32, p<0.05) in open-field test were significantly declined, and 5-HT in hippocampus was decreased in the D group (29.07±0.56 vs. 31.54±0.88 ng/ml, p<0.05). Compared to the D group, the score of activity tend (79.50±15.85, 59.50±8.24 vs. 43.00±16.56, p<0.05) in open-field test in DE group was higher than the others. 5-HT level in hippocampus were increased (31.29±1.45, 32.43±1.22 vs. 29.07±0.56, p<0.05) in the DE and DF groups, and there were no differences between the DE and DF groups (31.29±1.45 vs. 32.43±1.22, p>0.05). 5-HT level in brain raphe nucleus was significantly increased in DE group (37.22±0.26, 36.25±0.36 vs. 36.24±0.10, p<0.05).

**CONCLUSIONS:** The cognitive impairment and the lower level of 5-HT were observed in CUMS-induced depressive rats. Aerobic exercises have antidepressant effects in CUMS-induced depression by promoting the produce of 5-HT in brain raphe nucleus. Results indicated the mechanisms underlying the antidepressant effects of aerobic exercises and of fluoxetine may be different.

Supported by TSTC Grant, 10JCYBJC11800, 09ZCZDSF04600.

**2840 Board #112 June 1 9:30 AM - 11:00 AM**

**Type 1 Diabetes-associated Cognitive Decline: Nature And Magnitude - A Meta-analysis.**

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(No relationships reported)

**PURPOSE:** This meta-analysis was conducted to determine mechanisms and size of cognitive decline in patients with type 1 diabetes (T1D) and the potential associations with episodes of hypoglycemia (EoH), chronic hyperglycemia and early age of onset (EO).

**METHODS.** Pubmed and ISI Web of Knowledge were consulted to identify studies on cognitive function (CF) and on its possible determinants in T1D patients. Cohen's d statistics were used for calculating effect sizes (ES). Effect sizes (d) are defined as small = .3, medium = .5 and large = .8. Meta-analysis was performed where a minimum of 3 studies had assessed the same domain of CF.

**RESULTS.** According to the literature, mechanisms for cognitive decline are ascribed to EoH, chronic hyperglycemia and C-peptide/insulin deficiency. Results are shown in table 1. No significant differences were found between T1D children who did experience EoH vs. T1D children who did not experience EoH. There were insufficient studies on the association of CF with EoH or EO of diabetes in T1D adults, and with poor glycaemic control in T1D children to perform meta-analyses.

**CONCLUSION.** Cognitive decline seems to be related to an EO of diabetes and to high HbA<sub>1c</sub> levels. The magnitude of the cognitive decline is mild to moderate and is more severe in adults than in children; suggesting duration of diabetes and hyperglycaemia could have effects on CF. Considering its well-known positive effects on glycaemic control, physical activity could have beneficial effects for the CF.

Table 1: Estimates of the size of Cognitive decline in T1D.

| CF                 | T1D vs non-diabetic subjects |                   | EO (<4y) vs. late onset (>4y) of T1D |        | Poor controlled (HbA1c > 8%) vs. well-controlled T1D |                   |
|--------------------|------------------------------|-------------------|--------------------------------------|--------|--|-------------------|
|                    | Children                     | Adults            | Children                             | Adults | Children   | Adults            |
| Attention          | -.20 [-.11,-.29]*            | -.6 [-.8,-.40]*   | -.2 [-.19,-.44]*                     | /      | /  | -.4 [-.44,-.35]*  |
| Full IQ            | -.35 [-.26,-.45]*            | /                 | /                                    | /      | /  | /                 |
| Verbal IQ          | .07 [-.05, .19]              | /                 | -.26 [-.40,-.11]*                    | /      | /  | /                 |
| Memory             | -.12 [-.72, .48]             | -.56 [-.72,-.39]* | -.27 [-.37,-.18]*                    | /      | /  | -.26 [-.29,-.23]* |
| Executive Function | -.14 [-.59, .30]             | -.44 [-.59,-.28]* | /                                    | /      | -.12 [-.34, .10]                                     | -.21 [-.27,-.15]* |
| Motor Function     | .06 [-.05, .17]              | /                 | /                                    | /      | /  | -.20 [-.23,-.17]* |
| Spatial Memory     | -.20 [-.07,-.32]*            | /                 | -.41 [-.55,-.26]*                    | /      | /  | -.21 [-.25,-.17]  |

Data expressed as cohen's d [95% CI]. Values with \* = significant.

**2841 Board #113 June 1 9:30 AM - 11:00 AM**  
**Dual-task Performance Facilitation In Older Adults**

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 (No relationships reported)

The dual-task demands of motoric and cognitive processing have been of particular interest to gerontologists, who posit that age-related declines in sensorimotor processes increase the magnitude of task interference. Most studies show older adults' degradation in cognitive performance, which provides support for a "posture-first" hypothesis. The pattern of dual-task interference has not been consistent, however. Of particular interest are studies reporting improvements in cognitive performance during dual-task conditions compared to single-task conditions.

**PURPOSE:** To assess the influence of walking speed on young and older adults' cognitive test performance.

**METHODS:** 32 young adults (M age = 20.8 yr, range = 19-24 yr, 16 F) and 30 older adults (M age = 71.53 yr, range = 65-80 yr, 15 F) performed 3, 60-trial auditory switch tasks while standing, during a 5-min treadmill walk at a preferred speed, and during a 5-min treadmill walk at a speed 50% faster than preferred. The switch task measures the time required for an individual to inhibit an ongoing mental task and to initiate a different mental task, processes that are characteristic of executive function. Switch-task trials involved letter (vowel/consonant) or number (even/odd) discriminations to stimuli presented on headphones and recorded via two keys on a hand-held computer mouse.

**RESULTS:** A 2 X 3 mixed-model ANOVA was conducted with age (young, old), physical fitness level (high/low) as grouping factors and test condition (standing, walking preferred and walking fast) as a repeated measure factor. Separated analysis revealed Age x Condition interactions for local switch costs (F = 5.1, p < 0.01), mixed switch costs (F = 4.41, p < 0.05), and response time (F = 8.77, p < 0.001). Post-hoc analyses showed older adults' switch task performance was facilitated during both dual-task walking conditions compared to the single-task standing condition. Frequency of response errors for both young and old increased linearly across the three conditions (F = 11.32, p < 0.0001).

**CONCLUSIONS:** The dual-task facilitation of mental performance observed may be explained in terms of walking-induced arousal; alternatively, locomotion may provide a unique case for the study of dual-task interference.

Supported by Regional Council of Poitou-Charentes

**2842 Board #114 June 1 9:30 AM - 11:00 AM**  
**Physical Activity, Brain Function And Cognitive Performance In Young Adults - A Cross-sectional Study**

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 (No relationships reported)

There is growing interest in the study of exercise and cognition in both educational and health and care settings. In spite of mounting evidence that physical activity can induce a number of structural and functional changes in the brain and improves cognitive performance as well as neurocognitive health, so far most studies have focused either on children or the elderly population.

**PURPOSE:** To explore the association of physical (in-) activity, brain function and cognitive performance in young healthy university students in a prospective cross-sectional study.

**METHODS:** 154 young healthy participants (45 women, 109 men, 18 to 35 yrs) were tested for their endurance, strength and gross motor skills and grouped according to their performance. Event-related brain potentials and task performance were determined during a modified flanker task.

**RESULTS:** High fit subjects showed faster response times (423±35 vs. 441±44 ms, p<0.05), higher P3-amplitudes (6.4±2.2 vs. 5.2±1.9 µV, p<0.05), and shorter latencies (362±34 vs. 403±88 ms, p<0.05) than less fit subjects. Furthermore, endurance athletes showed larger P3-amplitudes than field athletes (3.7±1.5 vs. 2.7±1.1 µV, p<0.05). In addition, gross motor skills were positively associated with P3-amplitudes (2.7±1.2 vs. 3.7±1.8 µV, p<0.05), while strength was negatively related to P3-amplitude (6.3±1.5 vs. 5.1±2.0 µV, p<0.05).

**CONCLUSION:** Physical fitness may be beneficial to cognition and brain function in young healthy adults. Type of sport as well as type of physical performance may play a crucial role underlying this relationship. Endurance training as well as sports associated with high motor control might be particularly valuable in promoting cognition and brain health.

Supported by Young Investigator Grant "Brain Function, Cognitive Performance, and Physical Exercise" as part of the German Excellence Initiative.

**2843 Board #115 June 1 9:30 AM - 11:00 AM**  
**The Relationship Of Sub-concussive Impacts And Cognition**

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 (No relationships reported)

**PURPOSE:** Recently, the role of sub-concussive impacts on cognitive function has begun to garner attention. Emerging research has reported on the total number of impacts and cumulative linear (g's) and rotational acceleration (rads/s/s) sustained by athletes during a football season. How these impacts may influence cognitive functioning is not clear. The purpose of this investigation was to quantify the effect of sub-concussive impacts on neurocognitive function from a high school football season.

**METHODS:** During a three year investigation, 53 class 3A high school football players were fitted with the Head Impact Telemetry (HIT) System. Prior to each competitive season, each athlete completed a baseline assessment of cognitive function (ImPACT). The HIT System incorporates six single-axis accelerometers in a helmet and records linear and rotational acceleration. The ImPACT produces six subscores used to evaluate cognitive function following concussive events. Twelve athletes with diagnosed concussions were excluded from the analyses. Paired-sample t-Tests were used to analyze ImPACT scores between seasons. Pearson's Correlations were used to compare the HIT System data with the ImPACT data.

**RESULTS:** Participants reported significantly fewer concussion symptoms during the year two preseason assessment compared to year one ( $2.15 \pm 3.90$  vs  $3.39 \pm 3.38$   $p < .05$ ). No other ImPACT subscore produced significant paired-sample t-Test. No significant relationships were observed through Pearson's Correlations between cumulative HIT System data and ImPACT scores.

**CONCLUSIONS:** Other research has suggested there should be an age-related improvements on cognitive tests commonly used for concussion assessment. The athletes in this pilot study do not show the same improvements, but rather appear to have stunted cognitive function. While it is not entirely clear why, this may have been a result of cumulative sub-concussive impacts.

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**2844** Board #116 June 1 9:30 AM - 11:00 AM

**Positive Relationship between Fitness and Academic Proficiency in Elementary and Middle School Youth**

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(No relationships reported)

**PURPOSE:** Determine the extent of the association between school-based measures of physical fitness and state-wide, standardized assessments of reading and math.

**METHODS:** PE teachers were provided and trained to administer the Fitnessgram. Pacer (P) assessed aerobic fitness (AF), paced 90degree push-up (PU) and paced curl-up (CU) assessed muscular fitness (MF); a fitness composite score (P, PU, & CU) was calculated. Individual Reading and Math (adjusted) scores from the Ohio Achievement Assessment (OAA) was collected from participating school districts.

**RESULTS:** PF data on 5295 youth (50% male; 29%-4th, 24%-5th, 19%-6th, 15%-7th, 12%-8th) from 18/88 counties, 22 school districts and 5/7 school district typologies (DT), based on geography and household income levels was collected. P, PU, CU, and FC were significantly correlated with OAA-R and OAA-M, respectively (all  $p < 0.0001$ ). Multivariate ANOVA detected significant Sex (P, PU, CU, FC, & OAA-R;  $p < 0.0001$ ), however (OAA-M, BMI-Z, & BMI% did not differ by Sex) and Grade (P, PU, CU, FC, OAA-R, OAA-M, BMI-Z, & BMI%;  $p < 0.0001$ ) main effects and a significant Sex X Grade interaction. Multiple regression determined that P, CU, & Sex were significantly ( $p < 0.0001$ ) associated with OAA-R; P, CU & PU were significantly associated with OAA-M. Grade, BMI%, & DT were not associated with either academic measure.

**CONCLUSIONS:** AF, MF and Sex (Reading only) are associated with standardized Reading & Math assessments in 4th - 8th graders. Additionally, Grade, BMI% and DT are not associated with Reading and Math proficiency scores in youth. These findings suggest PA that leads to PF is important for increased academic proficiency regardless of school-related geographic and socio-economic indicators. Policy makers and other stakeholders should use this information to implement creative ways to increase PA and PF before, during, and after the school day as an additional mechanism to enhance academic proficiency in youth.

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**2845** Board #117 June 1 9:30 AM - 11:00 AM

**Associations Between Objectively Measured Physical Activity And Cognition In Adolescents: Evidence From The ALSPAC Cohort**

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(No relationships reported)

Emerging findings suggest that Physical Activity (PA) influences executive functioning (EF) however there are inconsistencies in the literature. The strongest associations have been found for tasks assessing planning though effect sizes are not consistent across other aspects (e.g. working memory and switching). Effect sizes are also related to the amount of PA performed; however a paucity of evidence from studies using objectively measured PA precludes firm conclusions being drawn.

**PURPOSE:** To examine the relationship between objectively measured levels of PA and EF in English adolescents.

**Method:** 5593 participants (47.6% male) from the Avon Longitudinal Study of Parents and Children (ALSPAC) had valid accelerometer measurements of PA (at least 10 hours a day on a minimum of three days) at 11 years of age. PA was recorded as average counts per minute (cpm) and as daily number of minutes spent in moderate to vigorous physical activity (MVPA). Participants completed three tasks of EF from the Test of Everyday Attention for Children (TEA-Ch) assessing attention, inhibition and working memory.

**RESULTS:** Mean cpm was 604 (SD = 178) and the mean number of minutes per day spent in MVPA was 23 (SD=15). Moderate gender differences in PA were observed for cpm (effect size = 0.66, 95% CI 0.60-0.71) and daily minutes in MVPA (effect size = 0.70, 95% CI 0.65-0.75). Small to medium effect sizes (ranging from 0.18-0.40) were found for gender on all tasks of executive function. While further analysis is currently underway, preliminary findings indicate that both total volume of physical activity (cpm) and MVPA are predictive of EF at 11 but that the amount of variance explained is small (ranging from 0.1% - 0.6%).

**CONCLUSIONS:** Findings suggest that while PA is predictive of EF task performance the effects are small. Further work is underway to explore potential confounders as well as mediators and moderators of this relationship. One possibility is that PA is predictive of specific aspects of EF but not others. In addition, the findings may reflect the low amounts of MVPA observed in the present sample. These findings will lead to a greater understanding of the impact of PA on cognitive development and will have implications for research and policy concerning PA and education.

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**2846** Board #118 June 1 9:30 AM - 11:00 AM

**Effects Of Physical Activity On The Aging Of Motor And Perceptual Inhibition**

Cedric T. Albinet<sup>1</sup>, Geoffroy Boucard<sup>1</sup>, Fabienne Collette<sup>2</sup>, Cedric A. Bouquet<sup>1</sup>, Michel Audiffren<sup>1</sup>. <sup>1</sup>University of Poitiers, Poitiers, France. <sup>2</sup>University of Liege, Liege, Belgium. (Sponsor: Phillip D. Tomporowski, FACSM)  
(No relationships reported)

Aging has a detrimental effect on behavioral inhibition (a core executive function), but physical activity (PA) appears to moderate this decline. However, different types of inhibition exist and for which the influence of aging and PA may differ.

**PURPOSE:** To evaluate the influence of age and regular PA on the performance of different cognitive tasks that separate perceptual and motor inhibition.

**METHODS:** Fifty adults participated in the study. Twenty-six young (Y, 20±2 yrs) and 24 older (O, 72±3 yrs) were classified as physically active (A) or sedentary (S), according to measures of past (Historical Leisure Activity Questionnaire, hours/week and METs-h/week) and present (Actigraph GT1M, steps/day and time spent/day in moderate to vigorous PA) PA. They performed the tasks developed by Nassauer and Halperin (2003), which assessed perceptual and motor inhibition. Performance in the inhibition tasks was assessed by Reaction Time (RT in ms) and response accuracy (% of correct responses) as a function of condition (no conflict vs. perceptual or motor conflict).

**RESULTS:** Overall, older were slower than young adults, and active people were faster than sedentary people. Preliminary results showed a differential effect of PA as a function of age and type of inhibition. Concerning motor inhibition, there was no effect of PA for the young groups ( $p > 0.05$ ). However, in the motor conflict condition, the OA group was significantly more accurate (95%) than the OS group (91%), although there was no significant RT difference ( $p = 0.09$ ) between the 2 groups (693±154 ms vs. 734±84 ms, for OA and OS respectively). Concerning perceptual inhibition, there was no effect of PA for the 2 groups of older ( $p > 0.05$ ). However, for the same accuracy level, YA were significantly ( $p < 0.05$ ) faster (485±64 ms) than YS (550±69 ms) in the perceptual conflict condition, although there was no RT difference in the no-conflict condition (350±24 ms vs. 357±26 ms, for the YA and YS respectively).

**CONCLUSION:** The effects of PA on inhibition appears to be moderated by both age and type of inhibition measured, deserving future research to understand the functionality of this dissociation.

Supported by a grant from Région Poitou-Charentes and FEDER.

2847 Board #119 June 1 9:30 AM - 11:00 AM

**Air Pollution Exposure During Aerobic Training: Effects On Inflammatory Markers, BDNF And Cognitive Performances.**

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(No relationships reported)

Exposure to Particulate Matter (PM) has been linked to inflammation and cognitive decline. It was shown that participation in an aerobic training program improves cognitive functions. Brain-Derived Neurotrophic Factor (BDNF) is a key mediator of the underlying mechanism. Recently, we found that the exercise-induced increase in BDNF serum level did not occur after cycling under high PM exposure.

**PURPOSE:** To investigate the effect of PM exposure during aerobic training on cognitive performances. The impact of PM exposure during the program is analyzed by white blood cell count (WBCC) and exhaled NO (eNO) as markers for respectively systemic and respiratory inflammation.

**METHODS:** 2 groups of inactive volunteers completed an aerobic training program of 12 weeks with 3 sessions/week, one group (n = 15) in the city of Brussels and the other group (n = 9) in the rural environment of Mol. Ultrafine Particle (UFP) concentration was measured during each training session. Before and after the program aerobic fitness (cooper test), white blood cell count (WBCC), exhaled NO (eNO), serum BDNF value and cognitive performances on the stroop test were analyzed.

**RESULTS:** UFP concentrations differed significantly with 7243.7 particles/cc in Brussels and 5625.2 particles/cc in Mol (p=0.003). Performances on the cooper test significantly improved (p<0.0001) with 15% in Brussels and 21% in Mol and did not differ between both groups (p=0.16). The group from Mol improved its performance on the stroop test, measured by stroop interference in the reaction time, with 69.3 ± 64.4 ms (p=0.023). In contrast, the group from Brussels did not improve its performance (7.4 ± 83.7 ms; p=0.74). Exhaled NO (+30%; p=0.006) and blood neutrophil concentration (+18%; p= 0.042) increased after the program in Brussels, whereas eNO (-3%; p = 0.80) and neutrophil concentration (-6%; p=0,65) did not differ after the program in Mol. No effects were found on serum BDNF value (p=0.96).

**CONCLUSIONS:** The results show that regular exercise in urban environment with high traffic - related air pollution increases markers of respiratory and systemic inflammation. In line with our previous findings where the exercise-induced increase in BDNF does not occur with exercise in polluted air, this study shows no improvements in cognitive performances with training in polluted air.

**E-25 Free Communication/Poster - Cold Stress**

JUNE 1, 2012 7:30 AM - 12:30 PM

ROOM: Exhibit Hall

2848 Board #120 June 1 11:00 AM - 12:30 PM

**Severe Drop in Body Core Temperature Following Four Cold Water Immersions**

Laura J. Palombo. Naval Health Research Center, San Diego, CA.

(No relationships reported)

**PURPOSE:** Previous studies have suggested that during severe cold water immersion, some subjects will reach a limit in thermal balance, as evidenced by the onset of a rapid drop in core temperature. Although the phenomenon is recognized, the percentage of the population that it occurs in has not been previously examined. The purpose of this study was to observe the minute by minute response of core temperature (T<sub>c</sub>) to multiple, consecutive cold water immersions.

**METHODS:** Nine male volunteers participated in this observational study. All subjects swallowed a core temperature monitoring pill (Mini Mitter) 7 hours prior to first immersion to ensure that the pill was properly located in the GI tract. Before entering the water, the volunteers underwent 60 min of intense physical training. At 1153 hours (air temp= 15°C, water temp = 15°C) subjects entered the ocean in cotton trousers, boots, and long-sleeved shirts, submersed up to the neck in the surf zone. Waves repeatedly washed over the head and neck during all immersions. The first immersion lasted 21 min. Subjects then stepped out of the ocean and stood on the beach for 4 minutes. Three subsequent re-immersions of 11, 10, and 4 min in duration followed, each separated by 4 min of standing on the beach. T<sub>c</sub> was recorded each minute of the 62-min protocol by monitors that were placed in waterproof packaging and worn on each subject's hip.

**RESULTS:** All 9 subjects completed the 62-min training evolution, and all were able to maintain their T<sub>c</sub> through the 3rd immersion. However, during the 4th immersion, 3 of the subjects had extremely rapid and large drops in T<sub>c</sub>. Specifically the rate of drop in T<sub>c</sub> during the 4th immersion was significantly (p < 0.05) greater (0.83 vs. 0.13°C·min<sup>-1</sup>), and the ending T<sub>c</sub> was significantly lower (34.13 vs. 37.17°C) in 3 of the subjects compared with the other 6. Furthermore, the mean % body fat, as determined by bioelectrical impedance, of the 3 subjects who demonstrated the rapid drop in core temperature was significantly less (15 vs. 18%) than in the other 6 subjects.

**CONCLUSIONS:** The results of the current study showed that one third of the subjects demonstrated a rapid and large drop in T<sub>c</sub> during the final stages of maximum tolerable cold water immersion. The physiological mechanisms responsible are unknown but may involve body fat insulation and/or shivering fatigue.

2849 Board #121 June 1 11:00 AM - 12:30 PM

**Thermoregulatory and Cardiovascular Responses During 60-minute Lower Body Cold Water Immersion**

Yongsuk Seo, Matthew D. Muller, Chul-Ho Kim, Edward J. Ryan, Ellen L. Glickman, FACSM. Kent State University, Kent, OH.

(No relationships reported)

**PURPOSE:** Lower body water immersion is used in athletics to improve endurance performance, but the effect of immersion duration on physiological responses is not known. The purpose of the current study was to compare the thermoregulatory and cardiovascular effects of 60 minute lower body water immersion (neutral versus cold).

**METHODS:** Nine healthy men (179.4±6.0 cm, 82.8±12.3 kg, 22.8±2.0 yrs, 8.4±4.8 % body fat) participated and were randomly assigned to both neutral (34.8±0.9°C) and cold (13.0±0.9°C) water immersion on separate mornings. In each session, participants rested in neutral air for 30 min followed by water immersion to the iliac crest for 60 min, then recovery for 15 min in neutral air. Rectal and mean skin temperatures were continuously monitored and recorded. Heart rate and stroke volume were measured every 10 min by impedance cardiography; brachial artery blood pressure was determined by automated sphygmomanometry.

**RESULTS:** A repeated measures ANOVA revealed a trial (Cold, Neutral) by time interaction for rectal temperature, mean skin temperature and mean arterial pressure (p<0.05). As shown in the table below, cold water immersion caused a significant stress to the body.

|                               |         | BASE     | 30 min Immersion | 60 min Immersion |
|-------------------------------|---------|----------|------------------|------------------|
| Rectal temperature (°C)       | NEUTRAL | 37.4±0.6 | 37.4±0.5         | 37.4±0.5         |
|                               | COLD    | 37.3±0.3 | 37.3±0.4         | 36.9±0.4*        |
| Mean skin temperature (°C)    | NEUTRAL | 32.1±1.0 | 34.1±0.8         | 33.8±0.6         |
|                               | COLD    | 32.4±0.4 | 27.4±0.5*        | 26.6±0.5*        |
| Mean arterial pressure (mmHg) | NEUTRAL | 83±10    | 73±8             | 76±4.6           |
|                               | COLD    | 82±8     | 81±11*           | 86±8*            |

Values are mean ± SD. \*Significant difference from neutral water immersion, P < 0.05.

**CONCLUSION:** These data suggest that longer than 30 minutes of lower body cold water immersion may be beneficial for endurance performance by reducing baseline core temperature. This study was funded by aZakelj Consulting & Design LLC.

**2850 Board #122 June 1 11:00 AM - 12:30 PM**  
**Thermoregulation during Lower Body Negative Pressure During the Cold.**

Ellen L. Glickman, FACSM, David J. Kean, Gabriel Sanders, Corey Peacock, Jacob Barkley, Matthew Muller. *Kent State University, Kent, OH.*  
(No relationships reported)

**PURPOSE:** To determine the effects cold has on thermoregulation during exposure to lower body negative pressure (LBNP).

**METHODS:** Eleven college aged men participated in two trials. Subjects were supine on a gurney with their lower extremities inserted into a LBNP pressure box up to the level of the anterior superior iliac spine. Each trial consisted of a control period of 100 min followed by application of LBNP for 20 min and concluded with a 15 min recovery period. Both trials were carried out in the environmental chamber; the cold trial was performed at 10°C (cold) and the ambient trial was performed at 23°C (ambient). The order of trials was counterbalanced. Mean skin temperature and rectal temperature was measured via skin thermistors. A repeated measures analysis of variance was used to compare trials across time. VO<sub>2</sub> was measured using a Parvo metabolic cart.

**RESULTS:** Mean skin temperature (T<sub>sk</sub>) was significant for time (p<0.001), condition (p<0.001) and there was an interaction (p<0.001). The interaction was due to a greater reduction in T<sub>sk</sub> from pre-LBNP (T<sub>sk</sub> ambient = 33.0±0.4°C vs. cold = 31.0±1°C) to recovery in the ambient condition vs the cold condition (T<sub>sk</sub> ambient = 33.7±0.9°C vs. cold = 28.9±2.0°C). Rectal temperature (T<sub>re</sub>) was significant for time (p<0.001) and there was an interaction (p=0.002). The interaction was due to a greater reduction in T<sub>re</sub> from pre-LBNP (T<sub>re</sub> ambient = 37.5±0.4°C vs. cold = 37.06±.2°C) to recovery in the ambient condition vs the cold condition (T<sub>re</sub> ambient = 37.2±0.2°C vs. cold = 36.9±0.3°C). VO<sub>2</sub> was significant for condition (p=0.028) only.

|                             | Pre-LBNP           | LBNP               | Recovery           |
|-----------------------------|--------------------|--------------------|--------------------|
|                             | Ambient Cold       | Ambient Cold       | Ambient Cold       |
| Mean skin temperature (°C)  | 33.9±0.7 9.3±1.3*  | 33.4±0.9 28.5±1.9* | 33.7±0.9 28.9±2*   |
| Rectal temperature (°C)     | 37.1±0.2 37.1±0.2* | 37.1±0.2 37.0±0.3* | 37.2±0.2 36.9±0.3* |
| VO <sub>2</sub> (ml/kg/min) | 4.9±1.1 6.3±1.6*   | 5.1±1.3 6.2±1.2*   | 5 ± 0.9 6.8±1*     |

**CONCLUSIONS:** Based on these data during cold exposure and orthostatic stress homeostasis is maintained due to adjustments in metabolism.

**2851 Board #123 June 1 11:00 AM - 12:30 PM**  
**Effect Of Microenvironment Temperature On Thermoregulatory And Perceptual Responses During Exercise In The Cold**

Colin R. Carriker<sup>1</sup>, Stephanie Campbell<sup>2</sup>, Adrienne Barr<sup>2</sup>, Lauren Stark<sup>2</sup>, Robert C. Pritchett<sup>2</sup>. <sup>1</sup>University of New Mexico, Albuquerque, NM. <sup>2</sup>Central Washington University, Ellensburg, WA.  
(No relationships reported)

In the cold, clothing may be necessary to ameliorate thermal insulation and reduce heat loss. Outer-garments in the present study were constructed of material marketed as windproof and intended to preserve the clothing microenvironment temperature (CME<sub>T</sub>) by preventing disruption of the inner air layer by cold ambient air.

**PURPOSE:** To investigate the effect of CME<sub>T</sub> on thermoregulatory and perceptual responses during moderate intensity exercise (~50% VO<sub>2max</sub>; 45 min) in a cold ambient temperature, T<sub>a</sub> (2±1°C; 66±6% humidity).

**METHODS:** A randomized crossover design was employed for 3 treatment garments of different thickness: Light (CL): 20 Denier, Medium (CM): 40 Denier, Heavy (CH): 70 Denier. Nine men (23.33±2.35 yr, 11.72±5.95 %Fat, VO<sub>2max</sub> 49.83±3.23 ml/kg/min) wore a treatment garment and baselayer pant/long sleeve shirt (100% polyester) composing a 2-layer ensemble. No hat/gloves were permitted. Trials were scheduled >2 days apart at the same time of day, 2 hr post-prandial. Testing occurred during winter/early spring months. Exercise consisted of 3 consecutive series of the following: 10 min treadmill walking at 10% grade and 5 min bench stepping (height at distal patella) with simulated wind (~1.5 m/s). Pace and cadence determined by ACSM walking/step equations at ~50% VO<sub>2max</sub>. A four site mean skin temperature (T<sub>sk</sub>) was employed (Hardy and Dubois 1938). Core temperature (T<sub>re</sub>) measured using a rectal thermistor probe. Thermal sensation, TS, ranged from -7 unbearably cold to +7 unbearably hot.

**RESULTS:** CME<sub>T</sub> and T<sub>sk</sub> were similar (p=0.108 and p=0.297 respectively) for CL, CM, CH over 45 min. CME<sub>T</sub> (17.34±2.61°C) was greater than T<sub>a</sub> (p<0.05). T<sub>re</sub> increased similarly (p=0.924) for CL, CM, CH over 45 min (1.23±0.31, 1.15±0.13 and 1.12°C±0.25; respectively) and was greater than rest after 15 min (p≤0.05) for all conditions. CH CME<sub>T</sub> declined the most over 45 min compared to CL and CM (-6.30±1.87, -6.21±1.53 and -3.67±1.82°C; respectively). A low correlation was seen between CME<sub>T</sub> and TS (r = -.03, p>0.05) and CME<sub>T</sub> and T<sub>re</sub> (r = -0.34, p<0.05). A moderate correlation was seen between T<sub>re</sub> and TS (r=0.53, p<0.05).

**CONCLUSION:** CME<sub>T</sub> declined over 45 min while both T<sub>re</sub> and TS increased. T<sub>re</sub> is more affected by work load in the cold than CME<sub>T</sub>. A windproof outer-garment preserved CME<sub>T</sub> above the ambient temperature but did not effect T<sub>re</sub> or TS.

**2852 Board #124 June 1 11:00 AM - 12:30 PM**  
**Effect Of Caffeine Gum And Exercise On Cold Induced Vasodilation In Human Finger**

Byeong Jo Kim, Dae Taek Lee. *Kookmin Univ., Seoul, Korea, Republic of.*  
(No relationships reported)

**PURPOSE:** This study examined whether chewing caffeine gum in conjunction with exercise would modify the cold induced vasodilation (CIVD) in human fingers.

**METHODS:** Two (no-caffeine; NC or caffeine intake; CI) by three (no-exercise; NE, 70% of VO<sub>2max</sub>; 70E, or all-out; AO) study design was employed. Ten non-cold acclimated healthy men (24.7±2.2 yrs, 175.0±5.1 cm, 71.3±7.4 kg, 16.0±6.3% body fat, 56.4±2.8 ml/kg/min VO<sub>2max</sub>) randomly participated in all six testings. In each session, subjects immersed their middle finger at 43°C water for 5 min followed by resting at ambient air for 10 min. During the resting, they either chewed caffeine gum (300 mg) or simply took a rest. Then they underwent one of three activity phases; NE for 20 min, 70E on a treadmill for 20 min, or AO with incremental exercise intensity. Upon completion of the activity phase, they immersed the middle finger at 5°C water for 20 min. And a blood sample was taken from antecubital veins. During testing, finger temperature from middle finger nail bed was measured. The lowest (T<sub>fmin</sub>) and the highest (T<sub>fmax</sub>) finger temperatures were recorded and the difference between T<sub>fmin</sub> and T<sub>fmax</sub> (T<sub>fdiff</sub>) were calculated. Time variable of CIVD such as the time period between min 0 and time at T<sub>fmin</sub> (Δtonset), time between at T<sub>fmin</sub> and at T<sub>fmax</sub> (Δtpeak), and Δtonset plus Δtpeak (Δtmax) were calculated.

**RESULTS:** Although main effects of caffeine and exercise were noticed, no interactions were found in T<sub>fmin</sub> and T<sub>fmax</sub>. T<sub>fdiff</sub> in NC-NE (6.9±1.6°C) was higher than CI-NE (4.8±1.2°C) (p<0.05). T<sub>fdiff</sub> in NC-AO (1.9±0.5°C) was lower than NC-NE and NC-70E (3.2±1.2°C) (p<0.05), and that in CI-AO (1.6±0.6°C) was lower than CI-NE (p<0.05). Caffeine did not impact on Δtonset, Δtpeak, and Δtmax but both 70E and AO shortened all time variables. No interactions were noticed in time variables of CIVD. Epinephrine level was higher in CI (291-400 pg/ml) than NC (106-362 pg/ml) (p<0.05) as well as in AO (362-400 pg/ml) than NE (106-291 pg/ml) and 70E (200-278 pg/ml).

**CONCLUSIONS:** The oral caffeine intake and exercise induced a small difference between the lowest and the highest finger temperatures. It appeared that exercise stimulus was stronger in modifying CIVD. Caffeine did not affect time variables of CIVD.



**2853** Board #125 June 1 11:00 AM - 12:30 PM  
**An Experimental Study of Practical Field Methods for Cold Casualty Protection**

Jennifer L. Brierley, Alberto Dolci, Neil P. Walsh, Samuel J. Oliver. *Bangor University, Bangor, United Kingdom.*  
(No relationships reported)

Hypothermia, particularly when combined with traumatic injury, is a significant contributor to fatalities in remote environments. It is therefore important to develop field methods to protect casualties from the cold whilst they await evacuation to more sophisticated medical facilities.

**PURPOSE:** To examine the thermoregulatory responses of men to four field methods following pre-cooling.

**METHODS:** Seven healthy males completed five trials in a randomised order. These included a thermo-neutral control trial (TC), where participants remained seated and fully clothed, and four cold trials. On each cold trial, dressed in shorts only, participants were cooled to 36°C core temperature in 13°C water after which they completed a 3-hour cold air test (CAT, 0°C) in one of four field methods, these included; 1. a polythene survival bag (PB), 2. PB with 70°C hot drink (PB+HD), 3. a triple-layered metallized sheeting Blizzard survival bag (BB), and 4. BB with chemical heat pads - Blizzard Heat (BB+HP). During each CAT drinks were consumed hourly equal to 6 ml·kg<sup>-1</sup> body mass. Non PB+HD trial drinks were served at 36°C. Core and mean weighted skin temperature, metabolic heat production and thermal comfort were assessed.

**RESULTS:** Prior to the CAT, time to reach 36°C was not different (31 ± 15 min,  $P = 0.50$ ). During the CAT, initial rewarming rate, afterdrop parameters (i.e. magnitude, time to nadir and return to 36°C) and core temperature were not different between the four field methods. However, compared with PB and PB+HD, skin temperature was greater (PB 25 ± 1, PB+HD 25 ± 1, BB 27 ± 2, BB+HP 28 ± 2, TC 32 ± 1 °C,  $P < 0.01$ ) and metabolic heat production was lower during BB and BB+HP (PB 133 ± 73, PB+HD 149 ± 74, BB 112 ± 73, BB+HP 96 ± 62, TC 57 ± 16 W·m<sup>-2</sup>,  $P < 0.01$ ). Indeed, metabolic heat production was similar to TC on BB and BB+HP by 30 min into CAT. Thermal comfort was also higher on BB+HP compared with PB+HD ( $P < 0.05$ ) but not different between other field methods.

**CONCLUSION:** Despite cold exposure, the four field methods supported re-warming to near resting core temperatures in shivering cold-casualties. However, less metabolic heat production was required to maintain core temperature in triple-layered metallized survival bags compared with polythene survival bags. Hot drinks had no measured thermoregulatory or perceptual benefit. Supported by ESF.

**2854** Board #126 June 1 11:00 AM - 12:30 PM  
**53 Hrs Of Sleep Deprivation On Oxygen Consumption (VO<sub>2</sub>) During Multiple Stages Of Acute Cold Exposure**

Katherine E. Pierce-Clark<sup>1</sup>, Tiffany A. Esmat<sup>2</sup>, Edward J. Ryan<sup>3</sup>, Ellen L. Glickman, FACSM<sup>3</sup>. <sup>1</sup>University of Mount Union, Alliance, OH. <sup>2</sup>Kennesaw State University, Kennesaw, GA. <sup>3</sup>Kent State University, Kent, OH.  
(No relationships reported)

**BACKGROUND:** It is well established that acute exposure to a cold environment elicits an increase in shivering thermogenesis and that oxygen consumption (VO<sub>2</sub>) must also increase to meet these demands. The impact of an additional stressor such as sleep deprivation, in conjunction with acute cold exposure, on VO<sub>2</sub> has yet to be extensively evaluated.

**PURPOSE:** To evaluate the effects of 53-hrs of sleep deprivation on VO<sub>2</sub> of young adult Caucasian males during multiple bouts of acute cold exposure.

**METHODS:** Eight males (22.8±1.7y) underwent two conditions [control (CON) or sleep deprivation (SDEP)] during which they were exposed to cold air (10°C) for 120-min, once per day, for 3 consecutive days (Stages 1, 2, and 3) beginning at 0600-hrs. Rectal temperature (T<sub>re</sub>), mean skin temperature (T<sub>sk</sub>), and oxygen consumption (VO<sub>2</sub>) were collected at baseline (BASE) and 5-, 15- and every 15-min thereafter for the duration of the 120-min trial (for 120-min).

**RESULTS:** VO<sub>2</sub> demonstrated a main effect across time for both conditions ( $p < 0.001$ ). During the CON trial, VO<sub>2</sub> (ml·kg<sup>-1</sup>·min<sup>-1</sup>) increased from 3.99±0.53 to 7.35±0.86, 3.76±0.57 to 6.83±1.15, and 3.54±0.45 to 7.87±2.00, for ACE stages 1, 2, and 3, respectively. During the SDEP trial, VO<sub>2</sub> (ml·kg<sup>-1</sup>·min<sup>-1</sup>) increased from 3.81±0.95 to 6.52±1.68, 3.58±0.97 to 6.59±2.38, and 3.93±0.55 to 7.46±0.7, for ACE stages 1, 2, and 3, respectively. A stage x time repeated measures ANOVA revealed a significant interaction ( $p = 0.05$ ). This interaction may be attributed to a differential increase in VO<sub>2</sub> during each ACE stage. Two additional separate two-way (stage x time) ANOVAs were conducted to determine whether the interaction was due to the SDEP or CON trial, but there were no significant interactions as BASE VO<sub>2</sub> did not significantly change during SDEP (3.81±0.95 vs. 3.58±0.97 vs. 3.93±0.55,  $p = 0.60$ ) or CON (3.99±0.53 vs. 3.76±0.57 vs. 3.54±0.45,  $p = 0.76$ ).

**CONCLUSION:** These data suggest that SDEP does not appear to affect an individual's metabolic response to acute cold exposure. Although VO<sub>2</sub> increased during each ACE there was no significant increase from ACE stage 1 to ACE stage 3.

**2855** Board #127 June 1 11:00 AM - 12:30 PM  
**Effect Of Clothing On Validity Of Devices Used To Estimate Core Temperature In Cold Environments**

Jason Ng<sup>1</sup>, Andrea M. DuBois<sup>1</sup>, Nicole E. Moyon<sup>1</sup>, Jeremy G. Tan<sup>1</sup>, Michelle R. Villa<sup>1</sup>, Lee E. Brown, FACSM<sup>1</sup>, Jared W. Coburn, FACSM<sup>1</sup>, Douglas J. Casa, FACSM<sup>2</sup>, Daniel A. Judelson, FACSM<sup>1</sup>. <sup>1</sup>California State University, Fullerton, Fullerton, CA. <sup>2</sup>University of Connecticut, Storrs, CT.  
(No relationships reported)

Many devices invalidly estimate core temperature in cold environments. Work showing this typically minimized subject clothing to maximize cold stress, substantially reducing external validity and questioning whether the devices might validly estimate core temperature when coupled with temperature-appropriate clothing.

**PURPOSE:** To investigate the effect of clothing on the validity of devices used to estimate core temperature in cold environments.

**METHODS:** Twelve healthy males (age=23±2 y, height=178.7±8.2 cm, mass=87.8±10.7 kg) completed two trials in cold conditions (6±1 °C, 64±10% RH), wearing either environmentally-appropriate (AC) or minimal clothing (MC). Subjects wore gloves, underwear, socks, and shoes in both trials. AC also included a headband, long-sleeved moisture-wicking shirt, and running pants, while MC was limited to athletic shorts. Each trial was comprised of 30 min resting equilibration, 90 min cycling at 60-70% of age-predicted maximum heart rate, and 30 min rest. Investigators measured rectal (T<sub>REC</sub>), aurial (T<sub>AUR</sub>), expensive axillary (T<sub>AXLE</sub>), inexpensive axillary (T<sub>AXLI</sub>), forehead sticker (T<sub>FOR</sub>), gastrointestinal (T<sub>GI</sub>), expensive oral (T<sub>ORLE</sub>), inexpensive oral (T<sub>ORLI</sub>), and temporal (T<sub>TEM</sub>) temperatures every 15 min. A mean bias of ±0.27 °C from T<sub>REC</sub> acted as the validity criterion.

**RESULTS:** Mean biases for T<sub>AUR</sub>, T<sub>FOR</sub>, and T<sub>TEM</sub> during AC significantly exceeded MC but never achieved the validity criterion. No significant differences existed in mean biases between AC and MC trials for T<sub>AXLE</sub>, T<sub>AXLI</sub>, T<sub>GI</sub>, T<sub>ORLE</sub>, and T<sub>ORLI</sub>. Only T<sub>GI</sub> achieved the validity criterion (AC mean bias=0.08±0.09 °C, MC mean bias=0.14±0.19 °C).

**CONCLUSIONS:** Clothing improved measurements covered by a snug headband (T<sub>AUR</sub>, T<sub>FOR</sub>, and T<sub>TEM</sub>) but not other sites (T<sub>AXLE</sub>, T<sub>AXLI</sub>, T<sub>ORLE</sub>, and T<sub>ORLI</sub>). Only T<sub>GI</sub> validly estimated core temperature. Even while wearing appropriate clothing, only a rectal thermometer or gastrointestinal pill should assess core body temperature in the cold.

**2856** Board #128 June 1 11:00 AM - 12:30 PM  
**Patterns Of Injury, Mood And Sleep Patterns Of Athletes Participating In An Arctic Ultra Marathon**

Scott M. Graham<sup>1</sup>, Chris Connaboy<sup>2</sup>, Colin Brow<sup>1</sup>, Mairi McKinley<sup>3</sup>. <sup>1</sup>UWS, Glasgow, United Kingdom. <sup>2</sup>Edinburgh Napier, Edinburgh, United Kingdom. <sup>3</sup>University of Abertay, Dundee, Dundee, United Kingdom.  
(No relationships reported)

**INTRODUCTION:** The 6633 was an ultra marathon held in the Canadian Arctic, 2009. Participants ran a 100 mile continuous stage over a period of 72 hours. Temperatures averaged -14oc day, -20oc night, low of -32oc (-42oc with wind chill). Type of injury, mood and sleep was assessed and documented throughout the race. Previous work has shown mood states to vary, and to be correlated to sleep patterns, in a cold environment. (Pedlar et al., Wild. and Environ. Med 18, 127-132. 2007).

**PURPOSE:** To document injuries, self reported sleep and profile mood states during an endurance race in an Arctic environment

**METHODS:** Eight male competitors (mean BMI 23 ± 12, Age: 31 ± 9.1 yrs) completed a 100 miles endurance running stage. Injuries were clinically assessed and recorded during each 24 hour period of exercise. Mood was assessed using the Brunel Mood Scale (BRUMS) (Terry et al., J. Sports Sci. 17, 861-872. 1999). A full self assessment sleep log was completed. Descriptive statistics and data analysis were performed using SPSS. Friedman's nonparametric test was used to compare differences specific psychological mood states, between and within groups.

Pearson's correlation coefficient analysis was used to investigate the degree of linear relationship between sleep patterns and recorded mood states (Anger, Confusion, Depression, Fatigue, Tension and Vigor). Differences were considered statistically significant at the  $p < 0.05$  level

**RESULTS:** All athletes presented with skin abrasion injuries, cold

condition injuries, dehydration and environmental related stress. Four subjects presented with soft tissue injuries. Vigour decreased continuously from the first 24 hours ( $p < 0.05$ ) whilst fatigue increased ( $p < 0.05$ ). This trend continued from start with values not recovering until recovery period post race. Continued activity resulted in increased levels of depression ( $p < 0.05$ ), tension ( $p < 0.05$ ) and confusion ( $p < 0.05$ ) which peaked at the 60 hour mark and decreased to the 72 hour mark. Mean sleep duration over the race period was 4:45 ± 00:12 hr: min.

**CONCLUSION:** Injury types and patterns documented were similar to those reported in other adventure and ultra distance events held in extreme environments. Consistent with previous work, data shows increased fatigue and reduced vigour in response to reduced sleep.

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## E-26 Free Communication/Poster - Endocrine

JUNE 1, 2012 7:30 AM - 12:30 PM

ROOM: Exhibit Hall

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### 2857 Board #129 June 1 9:30 AM - 11:00 AM

#### Salivary Cortisol Production during the Ride Across America (RAAM): A Case Study and Exploratory Analysis

Matthew A. Stults-Kolehmainen<sup>1</sup>, Chuck J. Abolt<sup>2</sup>, Craig E. Broeder, FACSM<sup>3</sup>, Amy M. Flewelling<sup>1</sup>, Amanda J. Salacinski<sup>1</sup>. <sup>1</sup>Northern Illinois University, DeKalb, IL. <sup>2</sup>Duke University, Durham, NC. <sup>3</sup>Exercising Nutritionally Clinical Research Partners, Naperville, IL.

(No relationships reported)

**PURPOSE:** The aim of this study was to investigate the variation in salivary cortisol during the Ride Across America.

**METHODS:** A 51 year old elite endurance cyclist competed in the RAAM ride. Descriptives are provided in Salacinski et al. (2011, MSSE, vol 43, p 536). Saliva was collected with oral swabs throughout two different time periods: 21 awakening and before sleep samples at baseline (4 weeks before race) and 23 samples during the event and before/after periods of rest. Salivary cortisol was analyzed with a Salimetrics immuno-assay and a Biotek plate reader.

**RESULTS:** The subject completed 6 days, 11 hours and 19 minutes of the race before discontinuing. His average speed, including rest stops, was 10.3 mph. His mean power was 199.5 W for days 1&2 and 124 W for days 4&5. The mean cortisol concentration for 7 baseline awakening samples was .71 µg/dL (SD = .09) and before bed was .15 µg/dL (SD = .07). Seven samples were discarded for possible blood and/or sports drink contamination, leaving 16 samples (awakening: M = .35 µg/dL, SD = .23; during-race: M = .64 µg/dL, SD = .16; before bed: M = .51 µg/dL, SD = .05). Saliva pH increased from baseline (M = 7.14, SD = .74) to race time (M = 8.38, SD = .60), while 2.54 kg of fat mass was lost from pre to post race.

**CONCLUSION:** The subject displayed a normal cortisol production rhythm at baseline; however, race values demonstrate a state of hyper-activation, catabolism, and dysregulation.

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### 2858 Board #130 June 1 9:30 AM - 11:00 AM

#### Effects of Varying Type of Physical Exercise on Children's Salivary Cortisol

Maria Chiara Gallotta, Emanuele Franciosi, Gian Pietro Emerenziani, Valerio Bonavolontà, Marco Meucci, Luigi di Luigi, Laura Guidetti, Carlo Baldari, FACSM. University of Rome, Rome, Italy.

(No relationships reported)

**PURPOSE:** Aim of this study was to investigate whether different physical exercise conditions could induce different exercise-related changes on children's salivary cortisol.

**METHODS:** Saliva collection of 48 children (8-11 years of age) took place before (Pre) and after (Post) 50 min of a traditional physical education (TPE) and of a coordinative physical education (CPE) lesson, respectively. Physical education (PE) sessions occurred at the same time (in the morning) of the same school day over 2 weeks. The school day was planned to have the same schedule every day during the experimental intervention with PE lessons preceded by academic classes. During the TPE lesson, children were instructed to exercise at a moderate to vigorous physical activity (MVPA corresponding to HR > 139 bpm) intensity without any specification on motor coordination. The CPE lesson, conducted at the same exercise intensity, was characterized by a high variability of motor coordination and skill learning demands.

**RESULTS:** Results showed that participants' salivary cortisol was significantly affected by Time (Pre vs Post) ( $5.51 \pm 4.50$  nmol/L vs  $4.01 \pm 2.70$  nmol/L,  $F = 5.74$ ;  $p = 0.02$ ), indicating a reduction of salivary cortisol after the two PE lessons independently of their content ( $F = 1.01$ ;  $p = 0.32$ ).

**CONCLUSION:** We found that varying types of physical exercise did not differentially affect children's salivary cortisol concentration. Moreover, a significant decrease of the cortisol concentrations occurred from pre- to post-exercise. Our findings suggest that physical education could act as a distractor, leading to a reduction of school stress. These activities were probably enjoyable and relaxing for children and in turn cortisol decreased.

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### 2859 Board #131 June 1 9:30 AM - 11:00 AM

#### Stress Hormone Biomarker Response in Fit and Unfit Premenopausal Women to One-Hour Aerobic Run

Lee Berk, FACSM, Paula Cavalcanti, Janhavi Soni, Shreenath Varadarajan. Loma Linda University, Loma Linda, CA.

(No relationships reported)

Exercise modulates the release of stress hormones and other biomarkers relative to fitness level. Various cohort studies have shown differential modulation of cortisol (CORT), HGH, TSH, FT4, insulin (INS) and iron-oxygen-binding protein myoglobin (MYO) with different exercise modalities. However, few studies have examined the differential response to aerobic exercise in fit and unfit premenopausal women.

**PURPOSE:** To compare low vs. high fitness premenopausal women for stress hormones and MYO blood biomarkers levels at rest and in response to a 1-hr aerobic exercise.

**METHODS:** 21 fit and 14 unfit premenopausal women ages 20-50 years, mean  $\text{VO}_2 \text{ Max}$   $42.2 \pm 5.3$  and  $27.9 \pm 3.3$  mL/kg/min respectively, performed a 1-hr exercise 70-80% of max HR. Blood levels were determined at pre-exercise (Pr-E), immediate post-exercise (IPo-E) and 30 min post-exercise (30Po-E) for TSH, HGH, INS, FT4, CORT, 17β-Estradiol (17β-E) and MYO and adjusted for plasma volume shifts.

**RESULTS:** The proportion of menstrual states was similar in the two groups. 17β-E was not different between the fit and unfit group ( $94.6 \pm 54.6$  vs.  $90.7 \pm 66.8$  pg/mL respectively,  $p > .05$ ). A 2x3 Mix Factorial ANOVA showed significant differences between groups in mean TSH ( $F = 7.92$ ;  $p = .002$ ; mean ± SE was  $1.61 \pm .26$  for fit and  $2.42 \pm .31$  for unfit), HGH ( $F = 19.50$ ;  $p = .002$ ;  $5.71 \pm .69$  for fit and  $5.01 \pm .82$  for unfit), MYO ( $F = 96.26$ ;  $p < .001$ ;  $1.76 \pm .06$  for fit and  $1.76 \pm .67$  for unfit). Differences were found between Pr-E and 30min post exercise for TSH ( $p = .003$ ), HGH ( $p < .001$ ), MYO ( $p < .001$ ); Pr-E and IPo-E for MYO ( $p < .001$ ); and IPo-E and 30Po-E for TSH ( $p < .001$ ), HGH ( $p < .001$ ). One-way Repeated Measures showed difference in CORT levels over time in the fit group ( $F = 47.14$ ;  $p < .001$ ) and unfit group ( $F = 18.84$ ;  $p < .001$ ). The differences were between Pr-E and IPo-E (fit:  $p < .001$ ; unfit:  $p = .005$ ); also, between Pr-E and 30Po-E (fit:  $p = .007$ ; unfit:  $p < .001$ ), and between IPo-E and 30Po-E (fit:  $p < .001$ ; unfit:  $p = .001$ ). ANCOVA showed no difference between groups for INS ( $F = .26$ ;  $p = .873$ ) and FT4 at Pr-E ( $F = .49$ ;  $p = .489$ ).

**CONCLUSION:** Stress hormones CORT, HGH, TSH and MYO are differentially modulated in fit versus unfit premenopausal women. Further study is needed to elaborate the significance of these physiological differential responses, mechanisms and resultant stress implications in premenopausal women.

2860 Board #132 June 1 9:30 AM - 11:00 AM

**Capillary but Salivary Cortisol Samples Accurately Reflects Venous Cortisol Following Intense Exercise**

lee stoner<sup>1</sup>, Simon Fryer<sup>2</sup>, Tabitha Dickson<sup>2</sup>, Stephen Hillier<sup>3</sup>, Nick Draper<sup>2</sup>. <sup>1</sup>Massey University, Wellington, New Zealand. <sup>2</sup>University of Canterbury, Christchurch, New Zealand. <sup>3</sup>Tauranga Hospital, Tauranga, New Zealand. (Sponsor: Kevin K. McCully, FACSM)  
(No relationships reported)

**PURPOSE:** To determine whether capillary and salivary cortisol samples accurately reflect venous blood cortisol during intense exercise. Venepuncture is the establish "gold standard" for sampling cortisol, but is expensive, highly invasive and impractical for many experimental and clinical settings. Salivary free cortisol is a non-invasive and practical alternative; however, when cortisol concentrations exceed 500 nmol/l there is a lack of agreement between salivary and venous blood cortisol. No known research has assessed whether capillary cortisol accurately reflects venous blood cortisol across a range of concentrations.

**METHODS:** Eleven healthy male subjects (26.1 ± 5.0yrs) were recruited. Capillary, salivary and venous blood samples were collected pre and post (immediately post and post 5, 10, 15 and 20 minutes) a treadmill VO<sub>2</sub> max test.

**RESULTS:** A strong relationship was found between capillary and venous cortisol samples ( $r = 0.899$ ,  $P = <0.001$ ). Bland-Altman analysis revealed a small but random bias for lower cortisol concentrations with capillary versus venous cortisol sampling. Two-way repeated measures ANOVA revealed a non-significant ( $P = 0.340$ ) interaction between stage (time post-stress test) and sampling site. There was a moderate relationship between salivary and venous cortisol samples ( $r = 0.565$ ,  $p = 483.14.3$ ).

**CONCLUSIONS:** Capillary but not salivary is a valid technique for measuring whole bound cortisol following intense exercise.

2861 Board #133 June 1 9:30 AM - 11:00 AM

**Changes in Selected Blood, Endocrine, and Myocardial Markers Measured During 24-hour Continuous Cycling**

Serge P. von Duvillard, FACSM<sup>1</sup>, Rainer Hochgatterer<sup>2</sup>, Helmuth Ocenasek<sup>2</sup>, Martin Michl<sup>3</sup>, Karin Vonbank<sup>4</sup>, Sabine Würth<sup>1</sup>, Peter Hofmann, FACSM<sup>5</sup>, Gerhard Smekal<sup>1</sup>, Robert Berent<sup>6</sup>, Manfred Wonsch, FACSM<sup>7</sup>, Rochus Pokan, FACSM<sup>3</sup>. <sup>1</sup>University of Salzburg, Salzburg, Austria. <sup>2</sup>Hospital Linz, Linz, Austria. <sup>3</sup>University of Vienna, Vienna, Austria. <sup>4</sup>Medical University of Vienna, Vienna, Austria. <sup>5</sup>University and Medical University of Graz, Graz, Austria. <sup>6</sup>Centers for Cardiac Rehabilitation, Bad Schallerbach, Austria. <sup>7</sup>Centers for Cardiac Rehabilitation, St. Radegund, Austria.  
(No relationships reported)

**PURPOSE:** We measured changes in selected blood, endocrine, and myocardial markers during 24h continuous non-stop cycling in 8 highly endurance trained male cyclist (mean±SD: age: 39.4±7.9 yrs; Wt: 77.4±6.4 kg; Ht: 179.3±6.6 cm; BMI: 24.0±0.7). The mean power for 24h cycling expressed in Watts (W) was 162.8±24.9 and the mean relative oxygen consumption over 24h was 34.3±4.0 ml.kg<sup>-1</sup>.min<sup>-1</sup>.

**METHODS:** All tests were conducted on an electronically braked cycle ergometer (Excalibur-Sport, Lode, Groningen, The Netherlands). Blood samples were collected in the beginning and every 6h of the 24h in EDTA tubes and as serum. Each test started at 10:00 AM and concluded at 10:00 AM next day. Blood samples in the amount of 5x18 ml were collected from antecubital vein every 6h during each 24h test. In addition to numerous other variables we assessed changes in selected blood variables as follows: %hematocrit (%Hct), creatine kinase (CK), creatine kinase myocardial marker (CK-MB), insulin, N-terminal brain natriuretic peptide (NT-proBNP), somatotrophic hormone (STH), testosterone, and cortisol.

**RESULTS:** Statistical analysis revealed statistically significant differences from start to the end of 24h cycling for NT-proBNP (27.1±9.8 to 567.9±359.8), CK (181.4±60.2 to 860.1±528.4), decrease in %Hct (44.2±2.3 to 40.9±1.1) and a decrease in testosterone (3.8±0.6 to 1.2±0.7) all  $P < 0.001$ . CK-MB (24.0±0.0 to 30.3±8.3) increased significantly ( $P < 0.02$ ) at the end of 24h cycling; however, there were no significant difference for cortisol, STH or insulin responses ( $P > 0.05$ ).

**CONCLUSION:** The results of our study suggest that 24h non-stop cycling at an average workload of approximately 160 W alter the concentration of several blood markers. NT-proBNP concentration at the end of 24h cycle ergometry was pathologically high. The CK was expected to increase and so was a decrease in %Hct. Statistically significant increase in CK-MB may reflect the duration of exercise more than the workload. Almost all selected endocrine constituents (cortisol, STH, and insulin) remained largely unaltered suggesting that body can regulate hormonal and metabolic response very well. Blood testosterone decreased significantly after 24h of non-stop cycling; however, the exact mechanism as to why testosterone declined by 68% at the end of 24h cycling is not known.

2862 Board #134 June 1 9:30 AM - 11:00 AM

**Urinary Androgens Changes In Pre And Postmenopausal Women After 6 Months Of Aerobic Training**

M. Concepción Robles<sup>1</sup>, Javier Brazo<sup>1</sup>, Guillermo Olcina<sup>1</sup>, Antonio F. Toribio<sup>2</sup>, Carmen Crespo<sup>1</sup>, Rafael Timón<sup>1</sup>, Marcos Maynar<sup>1</sup>. <sup>1</sup>University of Extremadura, Cáceres, Spain. <sup>2</sup>University of Extremadura, Badajoz, Spain.  
(No relationships reported)

The postmenopausal period is associated with an estrogen and androgens deficiency. These hormonal alterations could be responsible for the increased morbidity. Physical activity could have an important regulating effect on female hormonal metabolism, although not necessarily the same in pre or postmenopausal women.

**PURPOSE:** To evaluate the effect of 6 months of aerobic exercise on urinary excretion of androgens in pre and postmenopausal women and to determine the basal urinary steroid profile.

**METHOD:** 20 premenopausal (PRE) (45.56 ± 4.06 years) and 20 postmenopausal (POST) (52.27 ± 3.80 years) women, all sedentary, were studied before and after a supervised 6 months exercise training program based on aerobic dance (60-70% maximal heart rate, 60 min/day, 3 days/week). Before and after the program, anthropometric data and VO<sub>2</sub> max were measured and overnight fasting urines samples were collected and analyzed by gas chromatography / mass spectrometry (GC/QMS). Steroids values were expressed as ng steroid / mg creatinine (cr). The data was analyzed by one-way ANOVA and by repeated measures, using a general linear model.

**RESULTS:** Both groups improved their VO<sub>2</sub> max after the aerobic exercise program (32.59±6.0 before vs 37.60±8.2 ml/min/kg after exercise in PRE  $p < 0.01$ ; 31.84±6.0 before vs 36.94±6.3 ml/min/kg after exercise in POST  $p < 0.01$ ). Important differences were observed between urinary androgens in both groups in basal values. Urinary testosterone (26.32±14.62 ng/mg cr PRE vs 20.50±13.18 ng/mg cr POST,  $p < 0.05$ ), DHEA (48.02±57.91 ng/mg cr PRE vs 11.38±11.21 ng/mg cr POST,  $p < 0.05$ ) and androstenedione levels (72.14±49.72 ng/mg cr PRE vs 45.44±31.71 ng/mg cr POST,  $p < 0.05$ ) were affected by menopause. After the exercise program, no changes in urinary androgens levels were observed in premenopausal women. However, the aerobic exercise caused an increase in urinary excretion of DHEA (11.38±11.21 ng/mg cr before vs 55.13±57.17 ng/mg cr after exercise  $p < 0.05$ ) in postmenopausal women.

**CONCLUSION:** Pre and postmenopausal women presented important differences in the basal levels of androgens. In postmenopausal women, moderate physical activity could raise levels of DHEA, probably due to an activation of the suprarenal gland. This elevation of androgens levels could bring health benefits for postmenopausal women.

2863 Board #135 June 1 9:30 AM - 11:00 AM

**Vitamin D Supplementation and Physical Performance in Adolescent Swimmers**

Naama W. Constantini, FACSM<sup>1</sup>, Netachen Livne<sup>2</sup>, Daniel Moran, FACSM<sup>3</sup>, Raanan Raz<sup>4</sup>, Gal Dubnov-Raz<sup>5</sup>. <sup>1</sup>Hadassah- Hebrew University Medical Center, Jerusalem, Israel. <sup>2</sup>Hebrew University, Rehovot, Israel. <sup>3</sup>Ariel University Center of Samaria, Tel Aviv, Israel. <sup>4</sup>Tel Aviv University, Tel Aviv, Israel. <sup>5</sup>The Edmond and Lily Safra Children's Hospital, Tel Hashomer, Israel.  
(No relationships reported)

Serum vitamin D levels have been shown to correlate with several physical functions, such as muscle power, velocity and balance, mostly in the elderly and in sedentary populations. Vitamin D insufficiency is extremely prevalent in the general population, including athletes, yet its effect on performance is unknown.

**PURPOSE:** To evaluate the effect of vitamin D supplementation on swimming performance, power and balance of young swimmers with vitamin D insufficiency.

**METHODS:** 54 competitive adolescent swimmers (age 13.8±1.5 yrs, 63% males) with serum vitamin D levels (25(OH)D) below 30 ng/mL were randomized to two groups. The supplementation group received 2,000 IU/d of vitamin D3 drops for 12 weeks during a winter training season, and the control group received placebo drops identical in appearance and flavor. Freestyle swimming performance was assessed by a modification of the Mader test: 400m at V2-3 (below anaerobic threshold), 400m at V3-4 (above anaerobic threshold), and 4X50m all-out

sprints. Swimming time and post-swim heart rate were measured for each stage of the test. Arm grip strength was measured using a dynamometer; balance was measured using the uni-pedaled stance test twice (eyes open/closed). All measures were taken pre- and post- intervention, and changes were calculated to serve as endpoints.

**RESULTS:** Mean serum 25(OH)D levels increased in the supplementation group (from 24.6±5.2 to 29.6±6.5 ng/ml,  $p<0.001$ ) and decreased in the control group (from 24.6±4.9 to 20.3±4.3 ng/ml,  $p<0.001$ ) during the study period. There were no significant between-group differences in swimming time, heart rate, strength, or balance changes post-supplementation. No significant correlations were found between age-adjusted vitamin D change in the whole study cohort, and changes in the measures of physical performance.

**CONCLUSION:** Vitamin D supplementation for 12 weeks to adolescent swimmers with vitamin D insufficiency did not affect swimming performance, power and balance, more than placebo. Despite the widespread concern that vitamin D insufficiency might influence sport performance, there is currently no evidence that improving vitamin D status would benefit these athletes. Additional studies in vitamin D deficient athletes and in other sport types are warranted.

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**2864** Board #136 June 1 9:30 AM - 11:00 AM

**Adiponectin is Negatively Correlated with Testosterone in Male and Female Rats**

Luke A. Beggs<sup>1</sup>, Joshua F. Yarrow<sup>2</sup>, Sean C. McCoy<sup>2</sup>, Christine F. Conover<sup>2</sup>, Stephen E. Borst<sup>2</sup>. <sup>1</sup>University of Florida, Gainesville, FL. <sup>2</sup>VA Medical Center, Gainesville, FL.

(No relationships reported)

Adiponectin is an adipokine that is typically secreted in an inverse manner to adiposity, low concentrations of which are an independent risk factor for several metabolic disorders. The loss of endogenous sex-hormones increases adiposity in both males (M) and females (F) and has also been linked to a number of metabolic disorders including metabolic syndrome. Conversely, testosterone (T) administration generally reduces body fat. However, the influence of T on adiponectin requires further elucidation.

**PURPOSE:** To evaluate the effects of gonadectomy (GX) and supraphysiologic testosterone-enanthate (TE) administration on serum adiponectin in young M and F rats.

**METHODS:** Animals underwent GX or sham surgery and received either vehicle or TE (7.0 mg/wk, i.m.) for 28 days. Blood was collected at sacrifice for analysis.

**RESULTS:** Serum T was 3.3 ± 1.0 (SHAM-M), 0.1 ± 0.04 (GX-M), 41.5 ± 3.1 (GX+TE-M), 0.5 ± 0.1 (SHAM-F), 0.2 ± 0.04 (GX-F), and 46.7 ± 4.1 ng/mL (GX+TE-F). Serum estradiol (E<sub>2</sub>) was 4.6 ± 0.8 (SHAM-M), 3.0 ± 0.4 (GX-M), 6.4 ± 0.6 (GX+TE-M), 8.8 ± 0.7 (SHAM-F), 3.6 ± 0.4 (GX-F), and 5.3 ± 0.6 pg/ml (GX+TE-F). Serum adiponectin concentrations were 5760 ± 561 (SHAM-M), 7418 ± 429 (GX-M), 3132 ± 179 (GX+TE-M), 6348 ± 840 (SHAM-F), 10228 ± 589 (GX-F), and 3738 ± 255 ng/ml (GX+TE-F). Compared to SHAM, GX elevated adiponectin 29% (M;  $p<0.001$ ) and 34% (F;  $p<0.01$ ), while TE administration reduced adiponectin 58% (M) and 65% (F) compared to GX ( $p<0.001$ ) and by 46% (M) and 53% (F) compared to SHAM ( $p<0.001$ ). Strong negative correlations were present between T and adiponectin in both M ( $r=-0.747$ ,  $p<0.001$ ) and F ( $r=-.742$ ,  $p<0.001$ ). Conversely, E<sub>2</sub> was not significantly associated with adiponectin in either sex.

**CONCLUSIONS:** T, but not E<sub>2</sub>, was inversely associated with adiponectin in both M and F. This is despite the fact that we have previously reported that T administration in rats reduces retroperitoneal fat pad mass 45% below GX animals, and that adiponectin is typically inversely related to fat mass. This suggests that adiponectin is regulated not only by adiposity, but also by T. The metabolic consequences associated with an elevated adiponectin following GX and a reduced adiponectin following supraphysiologic T administration remain to be identified.

Supported by a VA Merit Award to S.E. Borst

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**2865** Board #137 June 1 9:30 AM - 11:00 AM

**Systemic PGF<sub>2α</sub> Metabolite Response to Resistance Exercise and Naproxen Sodium**

Christi Brewer, Mark Loftin, FACSM, John Garner, John Bentley, Elaine Day, Dwight Waddell. University of MS, University, MS.

(No relationships reported)

Prostaglandin F<sub>2α</sub> (PGF<sub>2α</sub>) is an endogenously produced growth factor that mediates satellite cell activity and protein incorporation into existing musculature after exercise-induced muscle injury. Accordingly, non-steroidal anti-inflammatory drugs, which inhibit prostaglandin production, have been shown to interfere with these cellular processes integral to adaptation and regeneration. Previous human research that has reported negative effects of drug-induced inhibition of PGF<sub>2α</sub>-mediated anabolic processes has limited its measurement to acute exercise, preventing decisive conclusions concerning concurrent use of analgesics with repeated resistance exercise.

**PURPOSE:** To determine if chronic consumption of naproxen sodium (440mg) inhibits adaptation to exercise using systemic sources of PGF<sub>2α</sub> metabolites.

**METHODS:** 23 recreationally-trained college-aged males were randomly assigned to receive either placebo (n=11) or naproxen sodium (n=12). Treatments were prophylactically administered in double-blind fashion with supervised upper body resistance exercise performed twice per week for 6 weeks. Venous blood (6ml) was sampled pre- and post-workouts 1, 7, and 11 and analyzed for PGF<sub>2α</sub> metabolites using enzymeimmunoassay. Factorial mixed design ANOVA was employed to determine acute and chronic differences in systemic plasma PGF<sub>2α</sub> metabolites (pg/ml).

**RESULTS:** Factorial analysis of metabolite concentrations (pg/ml) revealed significant effects of time ( $p<.005$ ) and acute exercise ( $p=.015$ ), with average systemic metabolite increases of 13.5±11.3 pg/ml in placebo-treated participants versus 2.7±24.2 pg/ml in naproxen-treated. Analysis of the acute metabolic response, expressed as a percent change pre- to post-exercise, revealed significant treatment effects, with naproxen sodium inhibiting the typical increase in PGF<sub>2α</sub> after resistance exercise nearly two-fold. Naproxen sodium was not found to inhibit the rate of strength or size development.

**CONCLUSIONS:** While functional outcomes of strength and size showed no significant treatment effects over 6 weeks, continued inhibition of the hormonal response to resistance exercise may delay attainment of muscular fitness goals.

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**2866** Board #138 June 1 9:30 AM - 11:00 AM

**Effects Of Exercise Training On Insulin And Igf-1 Concentrations In Cerebellum Of Diabetic Rats**

Luciana Arantes, Natalia Bertolini, Rodrigo Moura, Maria Alice Rostom de Mello, Eliete Luciano. Sao Paulo State University, Rio Claro, Brazil.

(No relationships reported)

Physical activity has proven effective increase in metabolic control in diabetic rats, and is an important component in treatment of diabetes, but less is known concerning any effects of aerobic training on insulin and IGF-1 concentrations in cerebellum of diabetic rats.

**PURPOSE:** The present study investigated the role of swimming training on cerebral metabolism of insulin and IGF-1 concentrations in cerebellum of diabetic rats.

**METHODS:** Forty Wistar rats were divided in four groups: sedentary control (SC), trained control (TC), sedentary diabetic (SD), and trained diabetic (TD). Diabetes was induced by Alloxan (35 mg/kg b.w.), single dose injection. The mean blood glucose of diabetic groups was 367±40 mg/dl. Training program consisted in swimming 5 days/week, 1 h/day, 8 weeks, supporting a workload corresponding to 90% of maximal lactate steady state (MLSS). For MLSS determination, rats were submitted to three sessions of 25-min, in alternate days, supporting loads of 4, 5, or 6% of body wt. Blood samples were collected every 5 min for lactate determination. All dependent variables were analyzed by one-way analysis of variance (ANOVA) and a significance level of  $P < 0.05$  was used for all comparisons. At the end of the training period, rats were killed by decapitation and cerebellum was extracted. Insulin and IGF-1 contents determination was done by radioimmunoassay and ELISA commercial kit, respectively.

**RESULTS:** There was no difference between groups for cerebellum IGF-1 content (SC = 5.58±0.37 ng/mL/mg of wt; TC = 4.78±0.21 ng/mL/mg of wt; SD = 4.5±0.5 ng/mL/mg of wt; TD = 5.71±0.44 ng/mL/mg of wt). Insulin concentrations were not different between groups (SC = 8.8±1.3 uIU/mL/g; TC = 9.2±2.6 uIU/mL/g; SD = 9.3±2.4 uIU/mL/g; TD = 11±1.4 uIU/mL/g).

**CONCLUSION:** It was concluded that in diabetic rats, aerobic training does not induce alterations on cerebellum insulin and IGF-1 contents.

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## E-27 Free Communication/Poster - Endocrine - Reproductive

JUNE 1, 2012 7:30 AM - 12:30 PM  
ROOM: Exhibit Hall

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2867 Board #139 June 1 11:00 AM - 12:30 PM

### Effect of Voluntary Wheel Running on the Sex-hormone of High-fat Feeding Impuberism Male Sd Rats

Yi Yan, XIE Minhao, SUN Jingquan, ZHAO Yan, LIU Junshi. *Beijing Sport University, Beijing, China.* (Sponsor: Tongjian You, FACSM)  
(No relationships reported)

The sex hormone imbalance and sexual development delay of obese boy are associated with the nutritional obesity of high-fat and high-energy diet. However, the effect of exercise on obesity-related sex hormone imbalance is still not well known.

**PURPOSE:** To compare the sex hormone level of high-fat feeding and normal diet SD rats in response to voluntary wheel running.

**METHODS:** 3-weeks newly weaned SD rats were randomly assigned to normal diet and high-fat diet group (normal diet sedentary: NS, n=8, normal diet exercise: NE, n=8, high-fat diet sedentary: FS, n=8, high-fat diet exercise: FE, n=8) groups. After one-week adaptive feeding and one-week adaptive training, rats of SE and FE group were individually placed into the wheel-cage to do voluntary wheel running 1 hour each half day, 5 days per week for 6 weeks. Food intake and running distance were monitored daily and body weight weekly. The testicle weight, testicle testosterone, estradiol; and serum testosterone, estradiol, luteinizing hormone and follicle-stimulating hormone were measured.

**RESULTS:** There were significant main negative effects of high-fat diet on bodyweight, testicle weight, serum estradiol (all  $p < 0.01$ ) and testicle testosterone ( $p < 0.05$ ). The 6-weeks voluntary wheel running had no significant effect on the bodyweight, testicle weight and sex hormone (all  $p > 0.05$ ) of NS and FS. Compared to NS, FS had not only lower level of bodyweight ( $129.69 \pm 17.16$  vs.  $336.67 \pm 29.32$  g,  $p < 0.01$ ), testicle weight ( $2.03 \pm 0.83$  vs.  $3.18 \pm 0.22$  g,  $p < 0.01$ ), but also lower serum testosterone detectable rate (37.5% vs 87.5%). The detected serum testosterone of FS was lower ( $49.17 \pm 32.20$  vs  $91.51 \pm 86.35$  ng/l) too. In addition, FS had higher level of serum estradiol ( $129.04 \pm 40.55$  vs.  $52.66 \pm 16.29$  g,  $p < 0.01$ ) than NS. There were no significant difference between NS and NE, FS and FE.

**CONCLUSIONS:** Long term high-fat diet will inhibit the growing development of newly weaned SD rats, and induce the imbalance of sex hormone. 6-weeks voluntary wheel running of two times per day can not potentially improve the growth of high-fat diet newly weaned SD rats. The effective exercise load needs to be further detected.

Supported by NSFC of China with No. of 30800541.

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2868 Board #140 June 1 11:00 AM - 12:30 PM

### Aerobic Exercise Training During Pregnancy Improves Mitochondrial Function In Human Placenta

Juanita Bustamante, Ph.D<sup>1</sup>, Robinson Ramirez-Velez, Ph.D<sup>2</sup>, Ana C. de Plata Aguilar, MS.c<sup>2</sup>, Analia Czerniczyniec, Ph.D<sup>1</sup>, Silvia Lores-Amaiz, Ph.D<sup>1</sup>. <sup>1</sup>University of Buenos Aires, Buenos Aires Argentina, Argentina. <sup>2</sup>University of Valle, Cali, Colombia.  
(No relationships reported)

**INTRODUCTION:** Aerobic exercise enhances mitochondrial biogenesis and performance, favoring tighter coupling between  $\beta$ -oxidation and trichloroacetic acid cycle, and may concomitantly improve mitochondrial function in skeletal muscle. In other tissues, aerobic exercise in non-pregnant women affects mitochondrial function however; it is not known whether exercise produces the same effect in human placental mitochondria.

**OBJECTIVES:** To determine the effects of aerobic exercise training in the second half of pregnancy on mitochondrial function from human placenta.

**METHODS:** This was a randomized, double-blinded, controlled clinical trial of 20 healthy primigravid women between 16 and 20 weeks' gestation. The training group (n=10) took part in aerobic exercise at an intensity of 50-65% of their maximum heart rate for 60 min, three times a week for 16 weeks. The control group (n=10) undertook their usual physical activity. Oxygen consumption, enzyme activity of respiratory complexes, and hydrogen peroxide production were measured as mitochondrial function parameters.

**RESULTS:** Oxygen consumption was not significantly affected by training. Activity of complex I-III of the mitochondrial respiratory chain was increased by 29% in human placental mitochondria from exercised women, as compared with control subjects ( $p < 0.05$ ). Also, significant increases of 45% and 27%, ( $p < 0.05$ ) were observed in complexes II-III and in complex IV respectively in placental mitochondria from exercised women, as compared with the controls. Mitochondrial H<sub>2</sub>O<sub>2</sub> production rate was decreased by 27% in placental mitochondria from exercised women, as compared with control subjects ( $p < 0.05$ ).

**CONCLUSION:** Aerobic training improves mitochondrial function in human placenta by increasing mitochondrial respiratory complexes activity and decreasing H<sub>2</sub>O<sub>2</sub> production. This intervention favors fetal oxygenation and substrate delivery and could help protection on gestational disorders associated to impaired mitochondrial function. Trial registration. NCT00741312.

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2869 Board #141 June 1 11:00 AM - 12:30 PM

### Effect Of Endurance Training On Nitric Oxide Synthase Activity And Expression In Human Placenta

Silvia Lores-Amaiz<sup>1</sup>, Robinson Ramirez-Velez<sup>2</sup>, Ana C. de Plata Aguilar<sup>2</sup>, Analia Czerniczyniec<sup>1</sup>, Juanita Bustamante<sup>1</sup>. <sup>1</sup>University of Buenos Aires, Buenos Aires Argentina, Argentina. <sup>2</sup>University of Valle, Cali, Colombia.  
(No relationships reported)

**INTRODUCTION:** Many studies have documented that placental development is altered by a variety of environmental factors such as aerobic exercise training which alter placental bed blood flow and/or oxygen delivery. The placenta lacks innervation, thus vascular tone regulation depends on endothelial release of vasoactive molecules such as nitric oxide (NO). Although exercise-induced increases in blood flow and in endothelial nitric oxide synthase (eNOS) expression have been reported; it is not known if exercise produces the same effect in human placenta. Objectives: To determine the effects of aerobic exercise training in the second half of pregnancy on eNOS expression and on NO production in human placenta.

**METHODS:** This was a randomized, double-blinded, controlled clinical trial of 20 healthy primigravid women between 16 and 20 weeks' gestation. The training group (n=10) took part in aerobic exercise at an intensity of 50-65% of their maximum heart rate for 60 min, three times a week for 16 weeks. The control group (n=10) undertook their usual physical activity. A spectrophotometric assay was used to measure NOS activity in cytosolic samples from placental tissue and Western Blot technique was used to determine endothelial NOS expression.

**RESULTS:** The ratio eNOS/ $\beta$  actin expression was 4-fold increased in cytosolic samples from exercised women. A 2-fold increase in NOS activity was observed in cytosolic samples from exercised women.

**CONCLUSION:** Training during pregnancy leads to an increase in eNOS expression and in total NO production in placental cytosol. Greater eNOS expression may also underlie the effects of exercise in the protection of gestational disorders associated to endothelial dysfunction. Trial registration. NCT00741312.

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2870 Board #142 June 1 11:00 AM - 12:30 PM

**Effects of Chronic Exercise on DNA Methyltransferase Expression in Mouse Testes**

Michael P. Marini, Lisa M. Guth, Andrew C. Venezia, Estefan P. Beltran, Espen E. Spangenburg, Stephen M. Roth, FACSM. *University of Maryland, College Park, MD.*

(No relationships reported)

**PURPOSE:** To examine the role of physical activity as represented by voluntary wheel running on the expression of DNA methyltransferases (DNMTs) in mouse testes.

**METHODS:** Male C57BL/6mice were randomly assigned to cages with exposure to an exercise running wheel (EX, n = 8), or cages without running wheels (SED, n = 10 from age 8 weeks to 28 weeks, at which point they were sacrificed and testes were extracted. Isoform-specific mRNA expression of isoforms of several genes that govern *de novo* attachment of DNA methylation marks (*Dnmt3a1*, *Dnmt3a2*, *Dnmt3b2/3*) were measured in testes and compared to a housekeeping gene (18s).

**RESULTS:** EX males ran an average of 3610 ± 581 m/24hrs over the 20-week intervention. There was no significant difference (p>0.05) in average testicular weight between EX (101.4 ± 3.9 mg) and SED(106.6 ± 2.6 mg) cohorts. Expression levels for *Dnmt3a1*, *Dnmt3a2* and *Dnmt3b2/3* showed no significant differences between EX and SED cohorts after 20 weeks of exercise intervention.

**CONCLUSIONS:** These preliminary findings indicate that physical activity as represented by voluntary wheel running does not affect expression of genes that govern *de novo* DNA methylation in mouse testes.

This work was supported by NIH grant HD062868.

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**E-28 Free Communication/Poster - Environmental Stress**

JUNE 1, 2012 7:30 AM - 12:30 PM

ROOM: Exhibit Hall

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2871 Board #143 June 1 9:30 AM - 11:00 AM

**Cardiovascular Time Courses During Prolonged Dry Apnea in Exercising Divers**

Renza Perini, Michela Capogrosso, Sabrina Donati, Andrea Sivieri, Guido Ferretti. *Università di Brescia, Brescia, Italy.*

(No relationships reported)

In static apnea, cardiovascular readjustments are such that, after an initial decrease in Heart Rate (HR) and increase in Blood Pressure (BP) (ph I, ~30 s duration), there are ~2 min of steady values (phII). Then HR and BP again decreases and increases, respectively, up to the end of apnea (ph III), possibly due to chemoreflex activation. We hypothesize that the end of ph II corresponds to physiological apnea breaking point. This being so, in case of increased metabolic rate (M'), duration of ph II would be shorter.

**PURPOSE:** to study the effect of increased M' on cardiovascular time courses during apnea.

**METHODS:** 8 divers (age 36±7 yrs) performed voluntary maximal apnea: A) sitting at rest; B) pedaling at 30 W on a cycle ergometer. BP (finger photo-plethysmography) and arterial O<sub>2</sub> saturation (SaO<sub>2</sub>, infrared spectroscopy) were continuously recorded before, during and after apnea. M' was measured before and after apnea by a metabolic cart. Beat to beat HR, systolic (Ps) and diastolic (Pd) pressures were obtained.

**RESULTS:** A) apnea lasted 227±62 s. In ph I (29±3 s), HR decreased from 98±11 b/min to 82±13 b/min, returning to control values (ctrl), Ps remained equal to ctrl (140±11 mmHg), Pd increased by 14 mmHg above ctrl (70±8 mmHg, p<0.05). In ph II (102±32 s), all parameters were stable, then HR fell to 57±5 b/min, while Ps and Pd increased, respectively, to 215±23 mmHg and 105±16 mmHg after 110±35 s (ph III). SaO<sub>2</sub> was 91±5 % at the end of ph II (p<0.05) and 75±13% at the end of apnea. B) apnea lasted 88±21 s, M' was twice as at rest. During the first 24±7 s (ph a), cardiovascular parameters remained unchanged. HR (112±9 b/min) was 15±10 b/min above exercise steady state values. Ps was 167±15 mmHg and Pd 81±15 mmHg. In the following 64±22 s (ph b), a continuous fall of HR and increase in Ps and Pd occurred. At the end of apnea, HR was 55±10 b/min, Ps 244±24 mmHg and Pd 112±13 mmHg. SaO<sub>2</sub> started to drop after ~30 s of apnea to 76±11% at the end.

**CONCLUSIONS:** apnea at exercise, with higher M', showed different cardiovascular trends from static apnea. The lack of stable cardiovascular values after the first phase a and the steep decrease in SaO<sub>2</sub> suggest early chemoreflex activation, inducing progressive bradycardia and hypertension. The absence of initial HR drop indicates that the level of autonomic activity affects the cardiac response to breath-holding.

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2872 Board #144 June 1 9:30 AM - 11:00 AM

**Effects of Repeated 6-hour 100% Oxygen Dry Chamber Dives on Diver Performance and Orthostatic Tolerance**

John P. Florian, Erin E. Simmons, Barbara E. Shykoff. *Navy Experimental Diving Unit, Panama City, FL.*

(No relationships reported)

Shallow-water diving operations may require personnel to be immersed for extended periods of time, breathing either compressed air or 100% O<sub>2</sub>. Our lab recently documented the differential effects on physiological function of breathing air vs. oxygen during repeated 6-hr dives. While dynamic exercise performance (EP) and isometric strength are reduced more following O<sub>2</sub> dives than air dives, orthostatic tolerance is diminished more following air dives than O<sub>2</sub> dives. However, information regarding the effect of repeated exposures to hyperbaric O<sub>2</sub>, independent of water immersion, is limited.

**PURPOSE:** To characterize postdive performance and orthostatic tolerance following repeated 100% O<sub>2</sub> dry chamber dives.

**METHODS:** Twelve healthy men (27±1 yrs; VO<sub>2max</sub>: 51±2 ml/kg/min; mean±SEM) completed a single 6-hr dive (SD) and a dive week (DW: 5 consecutive 6-hr dives with 18-hr surface intervals) in a hyperbaric chamber while resting and breathing 100% O<sub>2</sub> at 1.35 ata. Dynamic EP (time-to-fatigue on treadmill at 85% of VO<sub>2max</sub>) was measured before and the day immediately after SD and DW. Isometric strength (maximal handgrip strength [MHS], time-to-fatigue at 40% of MHS) and orthostatic tolerance (70° head-up tilt [HUT] testing; endpoint: presyncope or censored at 15 min) were measured before and after each dive.

**RESULTS:** Dynamic EP decreased more after DW than SD (-38% vs +6%, p<0.01), a change comparable to previous O<sub>2</sub> dives in water. Handgrip time-to-fatigue was not affected by a single dive (p>0.8) or repeated dives (p>0.6). Average predive MHS tended to be lower than postdive MHS (p=0.06), but no changes in MHS across dive days were noted (p>0.09). Average HUT time was not affected by diving; however, the O<sub>2</sub> dives improved HUT time for one diver who was predisposed to orthostatic intolerance (DW predive vs. postdive: 9.5±1.6 vs. 14.0±0.7 min, p<0.04). These results also agree with our previous water immersion study showing that, although O<sub>2</sub> dives and air dives adversely affected hemodynamic stability during HUT, tilt time was reduced following air dives only.

**CONCLUSION:** Repeated exposure to hyperbaric O<sub>2</sub>, independent of water immersion, adversely affects dynamic EP, but not isometric strength. Breathing 100% O<sub>2</sub> during repeated dives may protect against diving-induced orthostatic intolerance.

Support: NAVSEA DSBDDP and ONR

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2873 Board #145 June 1 9:30 AM - 11:00 AM

**Acute Short Term Dim Light Exposure Can Lower Muscle Strength Endurance.**

Arnold G. Nelson, FACSM<sup>1</sup>, Joke Kokkonen<sup>2</sup>, Megan Mickenberg<sup>2</sup>. <sup>1</sup>LSU, Baton Rouge, LA. <sup>2</sup>BYU-H, Laie, HI.

(No relationships reported)

Since it has been shown that spending 18 hours under dim light conditions can result in reduced handgrip endurance, it was wonder if a shorter exposure to dim light (i.e. 1 hour) would have similar influence upon muscular strength endurance.

**PURPOSE:** This study compared the number of weighted knee extension lifts that could be done after spending 1 hour in either dim or bright light.

**METHOD:** Participants (6 women, 12 men, college students 19-26 years) performed knee extension lifts to exhaustion with a load approximating 40% of their body weight. Performances were done immediately following 1 hour of exposure to each of the following 3 conditions: dim light (<500 lx) (DL) and bright light (>40000 lx) (BL) and bright light plus 6 mg melatonin (BLM). A minimum of 48 hours separated each condition, and all participants started the exposures in a rested fed condition.

**RESULTS:** Average ( $\pm$  standard deviation) number of knee extension lifts for DL ( $51.4 \pm 14.7$ ) was significantly ( $p < 0.05$ ) lower than either BL ( $62.0 \pm 22.0$ ) or BLM ( $57.8 \pm 22.9$ ).

**CONCLUSION:** Exposure to one hour of dim light immediately prior to activity can result in a reduction in thigh muscle strength endurance. The decline in performance to short-term dim light exposure was similar to that found following longer-term exposure. Thus, it appears that light intensity can influence muscle endurance, however, at this time this effect cannot be related to endogenous melatonin production.

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2874 Board #146 June 1 9:30 AM - 11:00 AM

**Comparison Of Serum Toxic Metals Concentrations Between Athletes And Sedentary People**

Guillermo Olcina<sup>1</sup>, Carmen Crespo<sup>1</sup>, Francisco Llerena<sup>2</sup>, Javier Brazo<sup>1</sup>, Concepción Robles<sup>1</sup>, Marcos Maynar<sup>1</sup>, M<sup>a</sup> Jesús Caballero<sup>2</sup>. <sup>1</sup>Sport Sciences Faculty, University of Extremadura, Cáceres, Spain. <sup>2</sup>Faculty of Medicine, University of Extremadura, Badajoz, Spain.

(No relationships reported)

Toxic trace elements are present in human environment and they accumulate in the human body over lifetime. Research has shown how physical activity may influence in the metabolism of some minerals. However, there are not many studies about the effect of physical activity over toxic trace elements levels in biological tissues.

**PURPOSE:** The aim of this study was to compare the level of toxic elements: lead (Pb), cadmium (Cd), beryllium (Be), tellurium (Te), tungsten (W), rhenium (Re) and thallium (Tl) in serum samples between athletes and sedentary subjects living in the same geographical area.

**METHODS:** A Middle-distance male runners group ( $n=21$ ) (age,  $21.62 \pm 4.3$  yr; BMI,  $18.25 \pm 1.73$ ) and a sedentary men group ( $n=21$ ) (age,  $22.65 \pm 3.6$  yr; BMI,  $21.81 \pm 3.14$ ) belonging to the region of Extremadura (Spain) participated in this study. Morning midstream serum samples were collected in all participants in 10 ml polyethylene containers with EDTA as anticoagulant. Pb, Cd, Be, Te, W, Re and Tl were determined by ICP-MS (model NexION 300D). This model has a triple quadrupole mass detector, and a reaction cell / collision that allow operation in three modes STD (no reaction gas), KED or kinetic energy discrimination (with helium as collision gas) and DRC or reaction (with ammonia as reaction gas). Data between groups were compared. The Mann-Whitney test was performed for statistical analysis. A  $p$  value of  $<0.05$  was used to determine statistical significance.

**RESULTS:** Concentrations of toxic elements in serum from athletes versus sedentary subjects on  $\mu\text{g/L}$  were as follows: Pb ( $1.635 \pm 2.199$  vs  $0.162 \pm 0.271$   $p < 0.01$ ); Cd ( $0.083 \pm 0.0047$  vs  $0.046 \pm 0.027$ ,  $p < 0.01$ ); Be ( $0.062 \pm 0.036$  vs  $0.043 \pm 0.019$ ,  $p < 0.01$ ); Te ( $0.117 \pm 0.220$  vs  $0.118 \pm 0.188$ , ns); W ( $0.200 \pm 0.099$  vs  $0.116 \pm 0.117$ ,  $p < 0.01$ ); Re ( $0.087 \pm 0.085$  vs  $0.035 \pm 0.066$ ,  $p < 0.01$ ); Tl ( $0.139 \pm 0.062$  vs  $0.014 \pm 0.043$ ,  $p < 0.01$ ).

**CONCLUSIONS:** With the exception of Te, serum toxic metal concentrations from athletes were higher than from sedentary. This fact suggests that athletic training may increase the level of ingestion of these toxic metals from the environment (water, air) or their accumulation inside the body.

Supported by Government of Extremadura grant PRI08B130

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2875 Board #147 June 1 9:30 AM - 11:00 AM

**The Acute Effects of Flotation R.E.S.T. (Restricted Environmental Stimulation Technique) Following Maximal Eccentric Exercise**

Paul M. Morgan, Amanda J. Salacinski, Matthew Stults-Kolehmainen. Northern Illinois University, DeKalb, IL.

(No relationships reported)

Flotation REST involves compromising senses of sound, sight, and touch by creating a quiet, dark environment. The individual lies supine in a tank of Epsom salt and water heated to roughly skin temperature (34-35°C). Use of Flotation REST has been primarily for hospital patients resulting in decrements of stress, pain, blood pressure, and anxiety. Reductions appear to stem from the lack of proprioceptive stimuli resulting in decreased arousal of the sympathetic nervous system. Usefulness of flotation REST for recovery from exercise is unclear.

**PURPOSE:** To determine acute effects of flotation REST following maximal eccentric knee extensions and flexions.

**METHODS:** A randomized crossover study of twenty-four ( $N=24$ ) untrained male subjects ( $23.29 \pm 2.1$  yr,  $184.17 \pm 6.85$  cm,  $85.16 \pm 11.54$  kg) participated over a 14 day period. Subjects performed 50 maximal eccentric repetitions of knee extension and flexion on two occasions separated by one week. Either one hour flotation R.E.S.T. (FLOAT) or one hour seated control (SEAT) followed exercise. Blood lactate, glucose, and heart rate were measured pre and post exercise, and after FLOAT and SEAT. Torque was assessed prior to exercise, post FLOAT and SEAT, and over next two days. Omni-rating of perceived exertion (RPE) and pain of the knee extensors and flexors were recorded during torque measures. Visual analogue scale was used to measure delayed onset muscle soreness (DOMS) for six days following maximal eccentric exercise. Blood lactate and glucose, heart rate, RPE, pain, and torque analyzed with MANCOVA with baseline measures as covariates. DOMS comparisons made using MANOVA.

**RESULTS:** Mean blood lactate lower following FLOAT ( $1.11 \pm .27$  vs  $1.77 \pm .98$ ,  $p < 0.05$ ) as was mean pain of knee extensors ( $.67 \pm 1.03$  vs  $.99 \pm 1.26$ ,  $p < 0.05$ ). Mean torque (N-M) of knee extensors greater following SEAT ( $242.12 \pm 65.46$  vs  $223 \pm 58.03$ ,  $p < 0.05$ ). No significance observed in knee flexors, heart rate, glucose, RPE, pain of knee flexors, DOMS ( $p > .05$ ).

**CONCLUSION:** Flotation REST lowers blood lactate following a one hour flotation R.E.S.T. session, while alleviating pain in the knee extensors. Flotation REST appears to hinder ability to produce torque as proprioception is compromised. Therefore, flotation REST may help with recovery, but may also cause torque decrement in the following hour.

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2876 Board #148 June 1 9:30 AM - 11:00 AM

**Comparison Of The Effects Of Cold Air (-110°C) And Water (8°C) Cryotherapy On Intramuscular Temperature**

Joseph T. Costello<sup>1</sup>, Kevin Culligan<sup>1</sup>, James Selfe<sup>2</sup>, Gráinne M. Hayes<sup>1</sup>, Ciarán D. McInerney<sup>3</sup>, Alan E. Donnelly<sup>1</sup>. <sup>1</sup>University of Limerick, Limerick, Ireland.

<sup>2</sup>University of Central Lancashire, Preston, United Kingdom. <sup>3</sup>Sheffield Hallam University, Sheffield, United Kingdom.

(No relationships reported)

Whole Body Cryotherapy (WBC) is a treatment growing in popularity with individual athletes and in team sports. Most WBC protocols involve repeatedly exposing minimally dressed individuals to extremely cold dry air (-110 to -140°C) for a short duration of time (2-4 min). A range of claims are made regarding WBC, though the evidence base for these is currently limited. The effects of WBC on intramuscular temperature (IM) may be central to some of the proposed benefits of WBC.

**PURPOSE:** To compare the effects of two modalities of cryotherapy, -110°C WBC and 8°C Cold Water Immersion (CWI) on IM.

**METHODS:** With ethical approval and written informed consent 10 healthy active male participants ( $23.6 \pm 2.7$  yr,  $180.9 \pm 5.8$  cm,  $87.2 \pm 17.8$  kg,  $26.5 \pm 4.3$  kg/m<sup>2</sup>,  $23.4 \pm 8.7\%$  body fat, measured via DXA,  $10.5 \pm 5.9$  mm thigh skin fold; mean  $\pm$  SD) participated in the study. Volunteers completed two treatment sessions, one CWI and one WBC a minimum of 7 days apart, with the treatment order randomised. IM was recorded 3cm below the subcutaneous fat layer in the right vastus lateralis using a flexible temperature probe, which was inserted through an indwelling

flexible cannula. Recordings were made every minute for 60 min before and after each of the treatments. During WBC participants stood in a chamber (-60±3°C) for 20 sec before entering the main chamber (-110°C±3°C) where they remained for 3 min and 40 sec. For CWI participants were seated in a tank filled with cold water (8±0.3°C) and immersed to the level of the sternum for 4 min. Absolute change in temperature from baseline every 10 min after treatment were analysed using a two-way ANOVA with repeated measures. The  $\alpha$ -level was set at 0.05.

**RESULTS:** Muscle temperature was significantly reduced at 20, 30, 40, 50 and 60 min after both cooling modalities ( $p<0.01$ ). A maximum reduction of 1.6 and 1.7°C, after WBC and CWI respectively, was recorded 60 min after treatment. However there was no significant difference between treatments ( $p=0.29$ ).

**CONCLUSIONS:** These results suggest that WBC is effective in producing a delayed reduction in IM that is similar to that experienced after CWI.

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**2877** Board #149 June 1 9:30 AM - 11:00 AM

**Compare Manual-Wheelchair Driving Performance in Virtual and Real Environment**

Yu-Chun Liao<sup>1</sup>, Kai-Jie Sie<sup>2</sup>, Jiun-Ren Hwang<sup>3</sup>, Wen-Hsu Sung<sup>1</sup>, Tien-Yow Chuang<sup>4</sup>. <sup>1</sup>National Yang-Ming University, Taipei, Taiwan. <sup>2</sup>National Central University, Taipei, Taiwan. <sup>3</sup>National Central University, Taipei, Taiwan. <sup>4</sup>Taipei Veterans General Hospital, Taipei, Taiwan.

(No relationships reported)

People with physical disability usually need delivery aids to be independent in activities of daily life, and manual-wheelchair (MW) is one of the common delivery aids. Ability of MW driving is usually evaluated by therapists subjectively, partly underestimated and partly overestimated; whereas it is sometimes evaluated by clients' self-administered questionnaire, and is easily overestimated. We tried to develop a virtual reality MW driving system for evaluating the driving performance objectively.

**PURPOSE** Compare MW driving performance in virtual environment (VE) and real environment (RE).

**METHODS** Thirteen healthy adults were recruited to drive a modified MW in both VE and RE. The modified MW was equipped with sensors to measure the subject's driving actions. All subjects executed three tasks: 1.straight forward (SF), 2.straight backward (SB), and 3.S-type forward (STF) in both VE and RE. In VE-tests, visual image was displayed in head mounted display (HMD). Task Complete Time (TCT) and driving path Boundary Collision Times (BCT) were used to evaluate driving performance. Measured data was analyzed with paired sample t-test and the level of .05 was set for statistical significance.

**RESULTS** The average and standard deviations (SD) of BCT of SF, SB, and STF in VE were 0.07(±0.00), 0.38(±1.12) and 2.07(±1.32) respectively; and the values in RE were 0.00(±0.00), 0.15(±0.37) and 0.07(±0.27) respectively. Significant differences of BCT were found in the SF and STF test ( $p=0.00$ ). The average and SD of TCT (in seconds) of SF, SB, and STF in VE were 17.7(±7.5), 18.3(±11.0), and 33.4(±13.2) respectively, and the values in RE were 10.9(±4.1), 15.6(±7.8), and 20.5(±6.4) respectively. Significant difference of TCT was found in the STF test ( $p=0.00$ ). All of the average and SD in VE tests was greater than the relative values in RE, showing that driving performance was worse and varies greatly in VE. It may mainly result from the visual field limitation of HMD (field of view=40 degrees in diagonal). The limited visual field increased the difficulty of the tasks in VE.

**CONCLUSION** The MW driving performance in VE was worse than it in RE, and we found that it may result from the visual field limit of HMD. In the future, we expect that, after modifying the limited HMD visual field, we may use these tasks in VE to evaluate MW driving performance in RE.

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**2878** Board #150 June 1 9:30 AM - 11:00 AM

**Does Cardiovascular Health/Fitness Protect Hearing Acuity in College Students Who Use Earbud Headphones?**

Helaine M. Alessio, FACSM, Ian Cramer, Lisa Treadway, Kendra Marchiondo, Sarah Stephenson, Sarah Wagner, Kathleen Hutchinson. *Miami University, Oxford, OH.*

(No relationships reported)

Although hearing loss has been associated with advanced age, two other factors have been shown to significantly impact hearing sensitivity: (1) use of earbud headphones when listening to personal listening devices (PLD) due to the way they funnel sounds into the ear canal and fail to block out ambient noises, and (2) cardiovascular (CV) health, due to the importance of circulation to and oxygen utilization in muscles and bones of the inner ear.

**PURPOSE:** Investigate factors that affect hearing acuity in college students who listen to PLDs.

**METHODS:** Hearing sensitivity, earbud use, CV health and other audiological, behavioral, and health-related variables were measured in a sample of college students (N=140). Hearing sensitivity was assessed in all subjects at multiple frequencies to determine normal and abnormal hearing levels across a normal spectra of listening frequencies. Volume and duration of actual listening when using PLDs were directly measured. Maximum oxygen consumption (VO<sub>2</sub>max), body mass index, daily physical activity (PA), and blood lipid levels (total cholesterol/high density lipoprotein {TC/HDL}) were assessed.

**RESULTS:** The majority of students listened within relatively safe decibel ranges, although standards for PLD's do not exist. The following trends were observed in this sample: hearing acuity was best in students who had rarely used PLDs (mean=4+/-2 vs. 8+/-2 dB), ( $p<.05$ ). There was no clear evidence for cardiovascular health/fitness as indicated by VO<sub>2</sub>max, BMI, TC/HDL, and PA providing protection against hearing loss in college students (Mean Right Ear High Frequency Pure Tone Threshold and Mean VO<sub>2</sub>max:  $r = 0.25$ , BMI:  $r = 0.06$ , daily PA:  $r = 0.00$ , and TC/HDL:  $r = 0.00$ ).

**CONCLUSION:** Using earbud headphones to listen to PLD's negatively impacts hearing acuity in college-aged students. There is no trend for high levels of cardiovascular health or fitness protecting hearing acuity compared with medium fit college aged students, regardless of listening habits.

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**2879** Board #151 June 1 9:30 AM - 11:00 AM

**Mild Dehydration Decreases Repeated Hill Cycling Performance In The Heat**

Costas N. Bardis, Stavros A. Kavouras, FACSM, Giannis Arnaoutis, Marietta Markousi, Lena Kosti, Labros S. Sidossis. *Harokopio University, Athens, Greece.*

(No relationships reported)

Dehydration greater than 2% of body weight, decreases exercise performance. However, the effect of mild dehydration (<2%) is not clear.

**PURPOSE:** The purpose of this study was to determine the effect of mild dehydration on repeated hill cycling performance in a warm environment (32.5±0.2 °C).

**METHODS:** A randomized crossover design was used. Ten endurance cyclists (age: 29±6 years, weight: 75.5±6.9 kg, height: 1.78±0.07 m, VO<sub>2</sub>max: 52.4±3.3 ml·min<sup>-1</sup>·kg<sup>-1</sup> and Powermax: 358±18 W) completed on two separate trials a performance test consisted of three bouts of 5 km race pace hill cycling, followed by 5 km at 50% of max power output, in a laboratory ergometer. Before the performance test subjects cycled for an hour with or without water drinking, to ensure that subjects started the performance test euhydrated (EUH) or dehydrated (DEH) by 0±0% & -0.98±0.1%, respectively. After each 5 km cycling bout body weight was taken and subjects were rehydrated with water to avoid greater dehydration. Dehydration at the end of the test was for the EUH and DEH trials -0.55±0.1% and -1.7±0.1%, respectively.

**RESULTS:** Time to completion of the 1st, 2nd and 3rd 5km hilly cycling was faster in EUH trail (10.8±1.3 min, 11.0±1.3 min, 11.3±1.7 min) than the DEH trail (11.3±1.3 min, 11.7±1.8 min, 11.8±1.9 min); ( $P<0.05$ ). As a result, mean power output was significantly greater during EUH 268±56 W than DEH 254±58 W. Core temperature at the end of the performance test was greater in DEH 38.2±0.2 °C than EUH 37.9±0.3 °C; ( $P<0.05$ ). No significant differences were found between conditions for heart rate and lactic acid.

**CONCLUSION:** It was concluded that mild dehydration decreased cycling performance in a hot environment, possibly by inducing greater thermal load.



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## E-29 Free Communication/Poster - Exercise Physiology - Cancer (Clinical Exercise Physiology Association)

JUNE 1, 2012 7:30 AM - 12:30 PM  
ROOM: Exhibit Hall

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**2880** Board #152 June 1 11:00 AM - 12:30 PM  
**Aerobic Fitness in Breast Cancer Survivors and High-Risk Control Group**

Dave Burnett, Jennifer Klomp, Patty Kluding, Charles Porter, Carol Fabian. *Kansas University Medical Center, Kansas City, KS.*  
(No relationships reported)

Breast cancer (BrCa) survivors are at increased risk of experiencing late and long-term effects of their treatment. Risk for recurrence of BrCa and cardiovascular disease (CVD) increases in long-term BrCa survivors largely because of the indirect effects of their diagnosis, including inactivity and weight gain. In addition, increased weight and inactivity are associated with primary BrCa. Inactivity can lead to low cardiorespiratory (CR) fitness level, which has been associated with CVD, BrCa, and all-cause mortality.

**PURPOSE:** Describe and compare CR fitness, measured as  $VO_{2\text{ peak}}$ , in BrCa survivors and women at high-risk for developing BrCa.

**METHODS:** Thirty BrCa survivors and 21 controls were matched by age and CVD risk. Breast cancer survivors were 50.5  $\pm$  5.6 years old and approximately 4.5 years from initial treatment. All BrCa survivors were treated with chemotherapy and/or left chest radiation and had at least 2 CVD risk factors. High-risk controls were 49.1  $\pm$  6.5 years old, had at least 2 CVD risk factors, and high-risk for BrCa. High-risk for BrCa included a family history of BrCa and multiple (> 1) breast biopsies, but had never been exposed to anti-hormonal therapy for BrCa prevention. All participants performed a graded maximal cardiopulmonary exercise test using indirect calorimetry while walking on a treadmill.

**RESULTS:**  $VO_{2\text{ peak}}$  mean values (+/- S.D.) for BrCa survivors resulted in 25.4 +/- 5.3 ml/kg/min compared to 26.3 +/- 4.5 ml/kg/min for high-risk controls. Comparison between BrCa survivors and high-risk controls was done using a Student's *t*-test, showing no significant difference in  $VO_{2\text{ peak}}$  ( $p = 0.52$ ). Twenty six of 30 BrCa survivors and all 21 high-risk controls tested below the 20th percentile based on their age group and gender for aerobic fitness as established by the American College of Sports Medicine.

**CONCLUSION:** Breast cancer survivors and high-risk controls in this study had a marked decrease in  $VO_{2\text{ peak}}$ , putting them at a higher risk for CVD, BrCa, and all cause mortality. Strategies to improve CR fitness should be targeted in future primary prevention and survivorship trials.

Supported by Back in the Swing and NIH BIRCWH K12 Grant.

University of Kansas Medical Center's CTSA, NIH/NCRR Grant Number UL1RR033179.

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**2881** Board #153 June 1 11:00 AM - 12:30 PM  
**Cardiorespiratory And Neuromuscular Deconditioning In Fatigued And Non-fatigued Breast Cancer Survivors**

Sarah E. Neil<sup>1</sup>, Riggs J. Klika, FACSM<sup>2</sup>, S Jayne Garland<sup>1</sup>, Donald C. McKenzie<sup>1</sup>, Kristin L. Campbell<sup>1</sup>. <sup>1</sup>*University of British Columbia, Vancouver, BC, Canada.*  
<sup>2</sup>*Cancer Survivor Center for Health and Wellbeing, Aspen, CO.*  
(No relationships reported)

**PURPOSE:** Fatigue is one of the most commonly reported side effects during treatment for breast cancer, and for some fatigue can continue for an extended period following treatment completion. Cancer-related fatigue is multi-factorial in nature, and one hypothesized mechanism of both development and persistence of cancer-related fatigue following treatment is cardiorespiratory and neuromuscular deconditioning. The purpose of this study is to compare measures of cardiorespiratory and neuromuscular deconditioning in breast cancer survivors who meet the ICD-10 criteria for cancer-related fatigue with breast cancer survivors who report no fatigue.

**METHODS:** Participants performed a graded incremental exercise test on a cycle ergometer for determination of power output at lactate threshold, lactate threshold as a percentage of peak power output, and absolute and relative  $VO_{2\text{ peak}}$ . Central and peripheral causes of muscle fatigue were assessed following a sustained contraction of the right quadriceps using the twitch interpolation technique and voluntary activation, peak force of the electrically-evoked twitch and the maximum voluntary contraction, and endurance time were measured.

**RESULTS:** The fatigue group reached lactate threshold at a lower power output than the control group (61.9 16.5 vs. 78.2 25.2 W,  $p=0.05$ ), but there were no differences between groups for lactate threshold as a percentage of peak power output (46.7 8.2 vs. 55.4 14.7%,  $p=0.10$ ), peak power output (134.4 36.2 vs. 146.8 49.4 W,  $p=0.46$ ), absolute  $VO_{2\text{ peak}}$  (1.53 0.37 vs. 1.79 0.36 L/min,  $p=0.08$ ), or relative  $VO_{2\text{ peak}}$  (22.9 4.7 vs. 25.2 7.5 ml/kg/min,  $p=0.33$ ). When adjusted for age, the fatigue group had a lower power output at lactate threshold (60.5  $\pm$  5.0 vs. CG 80.2  $\pm$  6.1 W,  $p=0.02$ ) and absolute  $VO_{2\text{ peak}}$  (1.50  $\pm$  0.09 vs. 1.83  $\pm$  0.11 L/min,  $p=0.03$ ). There were no significant differences in any of the neuromuscular parameters between groups.

**CONCLUSION:** These findings support the hypothesis that cardiorespiratory deconditioning may play a role in the development and persistence of cancer-related fatigue following treatment. Future research into the use of exercise training as a tool to improve cardiorespiratory deconditioning and thereby reduce this proposed aspect of cancer-related fatigue is warranted.

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**2882** Board #154 June 1 11:00 AM - 12:30 PM  
**Effects Of Resistance Training On Muscular Strength, Body Composition And Functionality In Breast Cancer Survivors**

Takudzwa A. Madzima, Emily Simonavice, Pei-Yang Liu, Jasminka Z. Ilich, Jeong-Su Kim, Bahram H. Arjmandi, Lynn B. Panton, FACSM. *Florida State University, Tallahassee, FL.*  
(No relationships reported)

In addition to normal age-related changes, breast cancer survivors (BCS) encounter many side effects from cancer treatments that negatively affect muscular strength, body composition, and functionality. Studies have shown that resistance training (RT) in older adults can improve strength, body composition and functionality.

**PURPOSE:** To evaluate the efficacy of a RT intervention to modulate muscular strength, body composition, and functionality in BCS over a six-month period.

**METHODS:** Twenty-seven BCS (age: 64  $\pm$  7 yrs; BMI: 27.7  $\pm$  5.5 kg/m<sup>2</sup>) were measured pre and post training for the following variables: muscular strength (chest press and leg extension) via one-repetition maximums (1-RM), body composition (lean mass, fat mass, lean to fat mass ratio) via dual energy X-ray absorptiometry and functionality via the continuous scale physical functional performance (CS-PFP) test. RT consisted of two days/week of ten exercises including two sets of 8-12 repetitions at ~60-80% of 1-RM. Data were analyzed using one way analysis of variances. Significance was accepted at  $p < 0.05$ .

**RESULTS:** BCS significantly increased upper (70  $\pm$  22 to 88  $\pm$  22 kg) and lower body (71  $\pm$  23 to 89  $\pm$  30 kg) strength. There were no changes in lean mass (39.9  $\pm$  6.3 to 40.3  $\pm$  6.3 kg), fat mass (30.7  $\pm$  9.2 to 30.9  $\pm$  9.3 kg), percent body fat (43.0  $\pm$  5.2 to 42.8  $\pm$  5.1%), or the lean to fat mass ratio (1.36  $\pm$  0.31 to 1.37  $\pm$  0.30) over the 6 months of training. Total functionality significantly increased (66  $\pm$  12 to 74  $\pm$  12 units) along with the functionality subscales of upper body strength (64  $\pm$  16 to 71  $\pm$  17 units), lower body strength (59  $\pm$  15 to 69  $\pm$  16 units), balance and coordination (67  $\pm$  12 to 75  $\pm$  12 units), and endurance (67  $\pm$  12 to 75  $\pm$  12 units).

**CONCLUSIONS:** Six months of moderate RT significantly improved strength and functionality in BCS. Although, RT did not significantly alter body composition measures of lean and fat mass it did offset the negative decrements (loss of muscle, increase in adiposity) that usually occur as a result of cancer related treatments and aging. Funded in part by the California Dried Plum Board

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2883 Board #155 June 1 11:00 AM - 12:30 PM

**The Effect Prior Physical Activity has on Physiological and Psychological Outcomes in Cancer Survivors**

Andrew R. Smith<sup>1</sup>, Trent L. Lalonde<sup>1</sup>, Brent M. Peterson<sup>1</sup>, Jessica M. Brown<sup>1</sup>, Kurt Dallow, FACSM<sup>2</sup>, Reid Hayward<sup>1</sup>, Carole M. Schneider, FACSM<sup>1</sup>. <sup>1</sup>Rocky Mtn Cancer Rehab, Univ Northern Colorado, Greeley, CO. <sup>2</sup>North Colorado Family Medicine, Greeley, CO.  
(No relationships reported)

Cancer survivors are impacted by physical and emotional responses associated with diagnosis and treatment. Current research shows that exercise provides a positive effect in cancer survivors at various stages in their recovery.

**PURPOSE:** To investigate the effect physical activity level prior to beginning a cancer rehabilitation program has on physiological and psychological outcomes in cancer survivors following a supervised 3-month exercise intervention.

**METHODS:** Two hundred forty-seven cancer survivors participated in initial fitness assessments examining heart rate (HR), systolic (SBP) and diastolic blood pressure (DBP), cardiorespiratory fitness ( $VO_{2peak}$ ), and abdominal strength (crunches). In addition, subjects completed inventories assessing fatigue and depression. Subjects were divided into three groups based on self-reported physical activity prior to the initial assessment; none (no prior physical activity), low (< 150 minutes of prior physical activity per week), and moderate ( $\geq$  150 minutes of prior physical activity per week) according to ACSM guidelines. Subjects were given an individualized exercise prescription and participated in 3 months of supervised exercise. Subjects were reassessed following the 3-month intervention.

**RESULTS:** No significant differences ( $p>.05$ ) were found between prior physical activity and any of the physiological or psychological variables assessed following the 3-month intervention. However, significant improvements ( $p<.01$ ) were found when comparing percent change pre to post 3-month exercise in all physiological and psychological variables [HR (-2.56%), SBP (-1.45%), DBP (-1.20%),  $VO_{2peak}$  (+17.51%), crunches (+60.53%), fatigue (-2.13%), and depression (-2.24%).]

**CONCLUSION:** The results of this study suggest that cancer survivors demonstrate improved physiological and psychological outcomes following a supervised three-month exercise intervention regardless of their physical activity level prior to entering a cancer rehabilitation program.

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2884 Board #156 June 1 11:00 AM - 12:30 PM

**Initial Physiological and Psychological Measures in Cancer Survivors During Treatment Versus Following Treatment**

Colin J. Quinn<sup>1</sup>, Jessica M. Brown<sup>1</sup>, Trent L. Lalonde<sup>1</sup>, Kurt Dallow, FACSM<sup>2</sup>, Reid Hayward<sup>1</sup>, Carole M. Schneider, FACSM<sup>1</sup>. <sup>1</sup>Rocky Mtn Cancer Rehab, Univ Northern Colorado, Greeley, CO. <sup>2</sup>North Colorado Family Medicine, Greeley, CO.  
(No relationships reported)

There have been suggestions that once cancer survivors complete treatment that exercise interventions can be similar to the apparently healthy population. This implies that the negative effects of cancer treatments occur during treatment with no lingering side-effects once treatment is completed.

**PURPOSE:** To compare cancer survivors' initial physiological and psychological assessment values during treatment to the initial values of cancer survivors' following treatment.

**METHODS:** Five hundred eighty-one cancer survivors participated in initial fitness assessments examining pulmonary function, cardiorespiratory fitness ( $VO_{2peak}$ ), muscular strength, resting heart rate and blood pressure. Additionally, participants completed inventories of depression, fatigue, and quality of life. Participants were separated into two groups, those who were in treatment ( $n=99$ ) and those who had completed treatment ( $n=482$ ).

**RESULTS:** Significant differences were found on the initial assessment values between groups for  $VO_{2peak}$  ( $p<.05$ ). Cancer survivors in treatment exhibited higher  $VO_{2peak}$  scores ( $24.06 \pm 7.6$  ml/kg/min) on the initial assessment compared to cancer survivors who had completed treatment ( $21.97 \pm 3.33$  ml/kg/min). No significant differences were found in measures of pulmonary function, muscular strength, resting heart rate and blood pressure. Initial psychological parameters (depression, fatigue, quality of life) were not significantly different between groups.

**CONCLUSION:** The higher initial  $VO_{2peak}$  values for cancer survivors during treatment suggest that the cumulative negative effects of cancer treatments occur throughout the treatment regimen. Cancer survivors following treatment have cumulative negative side-effects and therefore need to participate in an exercise intervention designed specifically for cancer survivors.

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2885 Board #157 June 1 11:00 AM - 12:30 PM

**Validation of the Rocky Mountain Cancer Rehabilitation Institute Multistage Treadmill Protocol for Cancer Survivors**

Daniel Y.K. Shackelford, Jessica M. Brown, Trent L. Lalonde, David S. Hydock, Carole M. Schneider, FACSM. Rocky Mtn Cancer Rehab, Univ Northern Colorado, Greeley, CO.  
(No relationships reported)

Currently there is not a multistage treadmill protocol for cancer survivors. Most protocols have stages that are either too high in intensity or too long in duration and are highly stressful for cancer survivors. The Rocky Mountain Cancer Rehabilitation Institute (RMCRI) developed a treadmill protocol designed specifically for cancer survivors to address this issue.

**PURPOSE:** To validate the RMCRI multistage treadmill protocol for cancer survivors.

**METHODS:** Fifteen cancer survivors completed a randomized double validation study to compare oxygen consumption ( $VO_{2peak}$ ) between two protocols. The RMCRI treadmill protocol, using gas analysis to determine  $VO_{2peak}$ , was validated against the Bruce protocol. Participants completed the randomized trials one week apart in random order. The Bruce protocol  $VO_{2peak}$  was then compared with the  $VO_{2peak}$  recorded from the gas analysis for the RMCRI treadmill protocol. Additionally, ACSM's predicted  $VO_{2peak}$  equations were validated against the RMCRI protocol using gas analysis.

**RESULTS:** No significant differences ( $p=.98$ ) in  $VO_{2peak}$  were found between the RMCRI protocol and the Bruce protocol and these values were significantly correlated with the RMCRI gas analysis test ( $R^2=.712$ ,  $p=.003$ ). The  $VO_{2peak}$  achieved using RMCRI gas analysis compared to ACSM's predicted  $VO_{2peak}$  equations showed no significant difference ( $p=.72$ ). The  $VO_{2peak}$  values obtained with ACSM's predicted  $VO_{2peak}$  equations were significantly correlated with the  $VO_{2peak}$  values from the RMCRI protocol gas analysis ( $R^2=.830$ ,  $p<.001$ ). This suggests ACSM's predicted equations may be used in place of gas analysis for the RMCRI protocol.

**CONCLUSION:** The RMCRI multistage treadmill protocol which has shorter stages and lower intensities was better tolerated and less stressful for cancer survivors. Given the validity and strong correlations to other treadmill protocols, the RMCRI cancer specific protocol should be the standard for the determination of functional capacity ( $VO_{2peak}$ ) in cancer survivors.

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2886 Board #158 June 1 11:00 AM - 12:30 PM

**Evaluation of Two Common Field Tests as Surrogate Measures of Strength in Breast Cancer Survivors**

Melissa J. Benton, FACSM, Maura C. Schlairet, David R. Gibson. Valdosta State University, Valdosta, GA.  
(No relationships reported)

Valid field measures of strength are potentially useful for clinical assessment of breast cancer survivors who are at risk for loss of strength, especially of the upper body, secondary to surgical mastectomy.

**PURPOSE:** To evaluate the relationship between two common field tests and two traditional laboratory measures of upper and lower body strength.

**METHODS:** Before and after 8 weeks of resistance training (RT), 20 female breast cancer survivors (42-80 years old) completed field testing using the Arm Curl test for upper body and Chair Stand test for lower body, followed by laboratory strength measurement using seated Chest Press for upper body and seated Leg Press for lower body. A minimum of 24 hours rest was insured between field and laboratory measurement sessions. The number of repetitions achieved in 30 seconds for the Arm Curl and Chair Stand tests was evaluated against the greatest weight pressed ten times (10RM) for the Chest Press and one time (1RM) for the Leg Press.

**RESULTS:** After 8 weeks of RT, upper and lower body strength increased significantly (Arm Curl =  $16.8 \pm 0.8$  to  $21.3 \pm 0.8$  repetitions; Chair Stand =  $14.4 \pm 1.3$  to  $17.1 \pm 1.2$  repetitions; Chest Press =  $14.2 \pm 1.1$  to  $26.5 \pm 1.4$  kg; Leg Press =  $61.6 \pm 2.9$  to  $82.6 \pm 6.1$  kg;  $p < 0.001$ ). Neither upper nor lower body strength, measured either by field or laboratory tests, was

significantly related to participant age, time since diagnosis, or mastectomy status. There was strong intraclass agreement between pre- and post-RT values for each laboratory and field test (ICC = 0.74-0.96). Pearson correlation analysis identified strong, positive relationships between all pre- and post-RT field tests ( $r = 0.60-0.81$ ,  $p < 0.01$ ), and between all pre- and post-RT laboratory tests ( $r = 0.56-0.88$ ,  $p < 0.05$ ). However, no relationship was found between upper or lower body field and laboratory tests ( $p > 0.05$ ), either before or after RT.

**CONCLUSIONS:** For clinical assessment of breast cancer survivors, use of either field or laboratory tests can provide reliable measures of change over time. However, based on our findings, field tests cannot be considered valid surrogates for actual laboratory measurement of either upper or lower body strength. Moreover, increased familiarity with laboratory tests based on training status does not affect these findings.

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## E-30 Free Communication/Poster - Fitness and Performance Testing IV

JUNE 1, 2012 7:30 AM - 12:30 PM

ROOM: Exhibit Hall

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### 2887 Board #159 June 1 9:30 AM - 11:00 AM

#### Assessment Of Field-attainable Variables For Use In The Quantification Of Physiological Load

Robert W. Wilson, II, Thomas S. Goepfinger, Bruce A. Wade, Ann C. Snyder, FACSM. *University of Wisconsin - Milwaukee, Milwaukee, WI.*

(No relationships reported)

The attainment of peak performance has led coaches to plan practice sessions, with the goal of either increasing or maintaining performance capabilities. Periodization advocates that this is accomplished by adjusting the training load through changing the volume and/or the intensity of the physical work performed. The periodized plan is a prescription of load; as such it does not provide a measure of each individual's internal physiological load (PL). Several methods have been proposed to calculate the individual PL in a field setting using heart rate (HR). Recent technological advances now allow for additional objective variables, such as respiration rate (RR), activity (ACT), percent of maximal HR (%HRmax), body posture (BP), skin temperature (ST), and peak acceleration (PA) data, which could enhance the assessment of PL, to be obtained.

**PURPOSE:** The purpose of the study was to determine if these additional variables enhance the assessment of PL. We hypothesize that a multiple variable equation will produce a better fit regression equation. We further hypothesize that using the Karvonen percent of maximal heart rate (%HRmaxK) with RR and/ or ACT will produce a better fit equation than using %HRmax alone.

**METHODS:** Twenty-two female NCAA DI soccer players completed sub-maximal and maximal effort tests while wearing a physiological monitor which collected HR, RR, ACT, %HRmax, BP, ST, and PA data at 1 second intervals, and a heart rate monitor which collected HR data averaged over five second epochs. %HRmaxK was also calculated using the Karvonen method. Blood was sampled at the end of each submaximal stage and the end of the maximal test for the determination of blood lactate concentration ([HLA]). Multivariate and uni-variate regression analyses were conducted.

**RESULTS:** Of the 538 regression analyses that were run, the best equation was cubic and included only the %HRmaxK variable ( $r=0.88$ ,  $R^2=77.9\%$ ,  $p<0.001$ ).

**CONCLUSION:** The best fit equation utilized only %HRmaxK not RR or ACT contrary to our hypotheses. This is due to the high variability of the RR data and the low variability of the ACT data. Therefore, this analysis indicates that HR expressed as %HRmaxK is the best variable for assessing PL. The cubic regression line is very similar to an expected lactate curve with a low slope at low intensities and a fast rise toward the end.

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### 2888 Board #160 June 1 9:30 AM - 11:00 AM

#### Cross-validation Of The 20-meter Multiple Shuttle Test For Predicting Vo2max In Basketball And Soccer Players

Barbara E. Bloomquist, Michael R. Esco, Aindrea N. McHugh, Henry N. Williford, FACSM. *Auburn University Montgomery, Montgomery, AL*

(No relationships reported)

The 20-meter shuttle run test (MST) has been shown to be an accurate field parameter for predicting maximal oxygen consumption ( $VO_{2max}$ ) in field settings and is commonly used in aerobically trained individuals, such as soccer athletes. However, research examining the accuracy of the MST in athletes whose sport involves a mixed metabolic contribution from aerobic and anaerobic energy systems, such as basketball, has not been fully explored.

**PURPOSE:** The purpose of this study was to cross-validate the MST for predicting  $VO_{2max}$  between soccer and basketball collegiate male athletes.

**METHODS:** College-age male athletes (age range = 18 to 24 years) from the university's soccer ( $n = 49$ ) and basketball ( $n = 62$ ) teams were evaluated for  $VO_{2max}$  via open circuit spirometry and maximal graded treadmill testing (TMT). The athletes performed the MST and predicted  $VO_{2max}$  was calculated from the following regression equation:  $VO_{2max} = -27.4 + 6.0 * \text{maximal running speed}$  (Leger et al, 1989; Mercier et al., 1983).

**RESULTS:** The following cross-validation statistics were computed:  $r = 0.79$  ( $p < 0.01$ ),  $SEE = 4.01 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$  and  $r = 0.82$  ( $p < 0.01$ ),  $SEE = 2.42 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$  for the soccer and basketball athletes, respectively. The mean ( $\pm$  SD) values for  $VO_{2max}$  via TMT and MST were  $56.04 (\pm 6.54) \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$  and  $55.56 (\pm 5.36) \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ , respectively, for the soccer athletes and  $51.60 (\pm 4.24) \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$  and  $53.60 (\pm 3.84) \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ , respectively, for the basketball athletes. A paired  $t$ -test indicated that these values were not significantly different for the soccer ( $p > 0.05$ ) but were for the basketball ( $p < 0.05$ ) group. Bland-Altman Plots showed that the 1.96 SD of the bias ranged from  $-8.28 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$  to  $7.32 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$  in the soccer athletes and from  $-2.76 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$  to  $6.76 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$  for the basketball athletes.

**CONCLUSIONS:** The results of this investigation indicate that the MST is a moderate field predictor of  $VO_{2max}$  in collegiate soccer and basketball players. However, predicted  $VO_{2max}$  may be slightly higher than actual  $VO_{2max}$  in male basketball players.

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### 2889 Board #161 June 1 9:30 AM - 11:00 AM

#### Cross-validation Of The 20-meter Shuttle Test For Predicting Vo2max In Male And Female Soccer Players

Aindrea N. McHugh<sup>1</sup>, Michael S. Green<sup>2</sup>, Michael R. Esco<sup>1</sup>, Henry N. Williford, FACSM<sup>1</sup>, Tyler D. Martin<sup>2</sup>, Barbara E. Bloomquist<sup>1</sup>, Robert Pritchett<sup>3</sup>. <sup>1</sup>*Auburn University Montgomery, Montgomery, AL* <sup>2</sup>*Troy University, Troy, AL* <sup>3</sup>*Central Washington University, Ellensburg, WA.*

(No relationships reported)

The 20-meter shuttle run (MST) has been shown to be an accurate test for predicting maximal oxygen consumption ( $VO_{2max}$ ) in field settings and is commonly used in soccer players. However, it is not fully known if the precision of the MST for predicting  $VO_{2max}$  in soccer athletes is sex-specific.

**PURPOSE:** The purpose of this study was to cross-validate the MST for predicting  $VO_{2max}$  between male and female collegiate soccer players.

**METHODS:** Eighty-nine male ( $n = 49$ ) and female ( $n = 40$ ) college soccer players (age range = 18 - 24 years) were evaluated for  $VO_{2max}$  using open circuit spirometry and maximal graded treadmill testing (GXT). Athletes performed the MST and predicted  $VO_{2max}$  was calculated from the following regression equation:  $VO_{2max} = -27.4 + 6.0 * \text{maximal running speed}$  (Leger et al., 1989).

**RESULTS:** The following cross-validation statistics were computed:  $r = 0.78$  ( $p < 0.01$ ),  $SEE = 4.14 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$  and  $r = 0.49$  ( $p < 0.01$ ),  $SEE = 2.87 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$  for the male and female subjects, respectively. Mean ( $\pm$  SD) values for  $VO_{2max}$  via GXT and MST were  $56.04 (\pm 6.54) \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$  and  $57.00 (\pm 5.51) \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ , respectively, for the men and  $44.20 (\pm 3.25) \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$  and  $45.73 (\pm 3.75) \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ , respectively, for the women. A paired  $t$ -test indicated these values were not significantly different for the men ( $p > 0.05$ ) but were for the women ( $p < 0.05$ ). Bland-Altman Plots showed that the 1.96 SD of the bias ranged from  $-7.13 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$  to  $9.03 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$  in the men and from  $-5.40 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$  to  $8.56 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$  for the women.

**CONCLUSIONS:** The results of this investigation indicate that the MST is a moderate field predictor of  $VO_{2max}$  in collegiate soccer players. However, MST may be slightly more accurate in a group of male compared to a group of female athletes. The mean value for predicted  $VO_{2max}$  was slightly higher ( $\sim 1.53 \text{ ml}$ ) than actual  $VO_{2max}$  in the female subjects.

2890 Board #162 June 1 9:30 AM - 11:00 AM

**Prediction Of In-season Injuries Using A Preseason Functional Movement Screen In Collegiate Athletes**

Molly R. Winke<sup>1</sup>, Katie Dalton<sup>2</sup>, Jake Mendell<sup>2</sup>, Meghan Nicchi<sup>2</sup>. <sup>1</sup>East Stroudsburg University, East Stroudsburg, PA. <sup>2</sup>Skidmore College, Saratoga Springs, NY.  
(Sponsor: Patricia Fehling, FACSM)  
(No relationships reported)

**PURPOSE:** The Functional Movement Screen (FMS) is a tool to assess deficiencies in fundamental movement patterns such as balance, stability, and range of motion. Previous research has indicated that a low FMS score can be predictive of future athletic injury.

**PURPOSE:** To investigate the ability of the FMS to predict in-season injury rate among two groups of Division III collegiate athletes: those with a low composite score ( $\leq 14$ ) and those with a high composite score ( $>14$ ) on a pre-season FMS.

**METHODS:** At the start of their respective competitive seasons, FMS scores were obtained for 122 (97 men and 25 women) varsity collegiate athletes from seven sports. Injuries which required evaluation and treatment by certified athletic trainers were recorded using the SportsWare injury-tracking database. The primary hypothesis was assessed using a chi-square analysis. All other analyses were evaluated using an independent samples t-test.

**RESULTS:** A total of 84 injuries from 64 athletes were recorded during the course of the study. The injury rate for those with high ( $>14$ ) and low ( $\leq 14$ ) composite FMS score were not significantly different ( $p=0.15$ ). The mean FMS score from the injured group ( $15.4 \pm 2.3$ ) was only slightly lower than those in the uninjured group ( $16.4 \pm 2.8$ ) ( $p < 0.05$ ). The injury rate was not different between athletes with at least one asymmetry in any of the individual movements and athletes without asymmetry ( $p=0.62$ ). However, low scores on specific elements of the FMS (deep squat) were related to the occurrence of specific injuries (ankle sprain).

**CONCLUSIONS:** A low composite FMS score ( $<14$ ) did not predict injury in this group of Division III athletes. The small difference in mean FMS score between the injured and non-injured questions the utility of the composite score to identify those at risk of injury. Additional findings of this study suggest that individual scores from the seven movements that comprise the FMS, rather than the composite score, may be more predictive of who will sustain an injury and the type of injury sustained.

2891 Board #163 June 1 9:30 AM - 11:00 AM

**A Prediction Equation for Determining Maximal Oxygen Uptake in Competitive Cyclists**

Frank Wyatt. *Midwestern State University, Wichita Falls, TX.*  
(No relationships reported)

Prediction equations for determination of oxygen uptake ( $VO_{2max}$ ) are well established for the general population. However, these equations often underestimate  $VO_{2max}$  in the endurance performance athlete.

**PURPOSE:** the purpose of this study was to establish a prediction equation for  $VO_{2max}$  in high level, performance cyclists.

**METHODS:** Subjects were 56 (n=49 males, n=7 females) competitive cyclists. Prior to testing, all subjects signed an informed consent approved by the Institutional Review Board for humans as subjects at Midwestern State University. Each subject tested on a cycle ergometer utilizing a cycling protocol with a beginning workload at 150 watts (w) for 5 minutes followed by 25 w increases every minute until volitional fatigue. Collected expired gases and heart rate (HR) were breath-by-breath and beat-by-beat, respectively and averaged every 20 sec. Maximal values were recorded at the end of the test. A backward stepwise multiple regression analysis was utilized to establish a prediction equation for  $VO_{2max}$  incorporating the following variables: height, weight, age, maximal power, maximal HR and time to exhaustion (TE). Associated variables significant at  $p < 0.05$  were selected as independent variables in the equation for predicting the dependent variable,  $VO_{2max}$ . After establishing a regression equation, a dependent samples t-test was run between true  $VO_{2max}$  values and predicted  $VO_{2max}$  values established from the equation. Statistical significance was set a priori at  $p \leq 0.05$ .

**RESULTS:** Mean (SD) demographic values were the following: age 21.9(7.1) y; height 176.9(6.5) cm; weight 73.9(9.8) kg. Group means (SD) at maximal were the following:  $VO_{2max}$  63.1(10.3)  $ml \cdot kg^{-1} \cdot bw^{-1}$ ; heart rate 194.6 (9.9)  $b \cdot min^{-1}$ ; power 349.6 (55.9) w; time to exhaustion (TE) 13.9 (9.4) min. The following prediction equation was established utilizing the independent variables body weight (BW, kg) and maximal power (MP, w):  $VO_{2max} = 59.08 - (0.67 \cdot BW) + (0.15 \cdot MP)$ . Group mean (SD) Estimated  $VO_{2max}$  from the equation was 62.01 (9.4)  $ml \cdot kg^{-1} \cdot min^{-1}$ . The dependent samples t-test between true  $VO_{2max}$  and estimated  $VO_{2max}$  indicated no significant differences.

**CONCLUSION:** These findings indicate the established equation may be used for prediction of maximal oxygen uptake in competitive level cyclists.

2892 Board #164 June 1 9:30 AM - 11:00 AM

**Predictive Validity of Rating of Perceived Exertion: A Cross-culture Validation**

Li Peng<sup>1</sup>, Jiong Luo<sup>1</sup>, Jingcheng Wu<sup>1</sup>, Weimo Zhu<sup>2</sup>. <sup>1</sup>College of Physical Education, South-West University, Chongqing, China. <sup>2</sup>University of Illinois at Urbana and Champaign, Chongqing, IL. (Sponsor: Weimo Zhu, FACSM)  
(No relationships reported)

**PURPOSE:** To examine prediction accuracy of HR using the Borg Scale (RPE multiplied by 10) under different protocols and workout intensities with a Chinese sample.

**METHODS:** 7 healthy males (22.88±0.83 yr.) completed an incremental exercise (3 min at 50 Watts, followed by 50 Watt/3 min increases) to exhaustion on an electric braked bicycle, as well as each exercise at their 20, 40, 60, 80, and 100%  $VO_{2max}$  exercise intensities to steady state or exhaustion. HR and RPE by the Borg scale were measured at the end of each stage of incremental exercise and each steady exercise. The estimated HRs by Borg Scale (HR-e) were compared with the ones directly measured by Polar -RS400 using a correlated t-test.

**RESULTS:** Means and SDs of HR-e and HR-m are summarized below :

Comparison between HR-m and HR-e during incremental exercise

|    | 20% $VO_{2max}$    |       | 40% $VO_{2max}$    |        | 60% $VO_{2max}$    |        | 80% $VO_{2max}$   |        | 100% $VO_{2max}$   |        |
|----|--------------------|-------|--------------------|--------|--------------------|--------|-------------------|--------|--------------------|--------|
|    | HR-m               | HR-e  | HR-m               | HR-e   | HR-m               | HR-e   | HR-m              | HR-e   | HR-m               | HR-e   |
| X  | 103.48             | 78.57 | 122.76             | 120.00 | 147.14             | 141.43 | 171.76            | 161.43 | 182.71             | 197.14 |
| SD | 11.16              | 14.64 | 10.17              | 10.00  | 7.20               | 17.73  | 7.39              | 13.80  | 14.99              | 23.60  |
|    | t=-3.03,<br>p=0.36 |       | t=-0.49,<br>p=0.88 |        | t=-1.51,<br>p=0.00 |        | t=8.88,<br>p=0.00 |        | t=2.84,<br>p=0.015 |        |

Comparison between HR-m and HR-e during steady exercise

|    | 20% $VO_{2max}$    |       | 40% $VO_{2max}$    |        | 60% $VO_{2max}$    |        | 80% $VO_{2max}$    |        | 100% $VO_{2max}$   |        |
|----|--------------------|-------|--------------------|--------|--------------------|--------|--------------------|--------|--------------------|--------|
|    | HR-m               | HR-e  | HR-m               | HR-e   | HR-m               | HR-e   | HR-m               | HR-e   | HR-m               | HR-e   |
| X  | 89.36              | 76.75 | 118.68             | 112.91 | 155.81             | 128.57 | 176.95             | 155.71 | 192.02             | 182.76 |
| SD | 10.07              | 14.47 | 9.72               | 10.17  | 9.93               | 21.16  | 10.19              | 16.18  | 2.08               | 28.75  |
|    | t=-2.33,<br>p=0.41 |       | t=-0.45,<br>p=0.68 |        | t=-1.88,<br>p=0.27 |        | t=-2.44,<br>p=0.26 |        | t=-0.73,<br>p=0.63 |        |

**CONCLUSION:** The Borg scale could accurately predict subjects' actual body status during steady exercise and low intensity (20% and 40%  $VO_{2max}$ ) of incremental exercise for the Chinese young adults, but its predictive accuracy reduced at the high-intensity from 60%  $VO_{2max}$  during incremental exercise.

2893 Board #165 June 1 9:30 AM - 11:00 AM

**Effects of Training Status on Bench Press Prediction Accuracy from Repetitions and Lifting Load**

Brandon Skoff<sup>1</sup>, Paul Reneau<sup>1</sup>, Michael J. Ryan<sup>1</sup>, Jerry Mayhew<sup>2</sup>, William F. Brechue, FACSM<sup>3</sup>, Thomas J. Pujol, FACSM<sup>4</sup>. <sup>1</sup>Fairmont State University, Fairmont, WV. <sup>2</sup>Truman State University, Kirksville, MO. <sup>3</sup>United States Military Academy, West Point, NY. <sup>4</sup>Southeast Missouri State University, Cape Girardeau, MO.  
(No relationships reported)

Many persons use 1-RM bench press prediction equations to estimate 1-RM to save time and reduce the possibility of injury. However, little is known of how training status impacts the predictive accuracy of these equations.

**PURPOSE:** To investigate the effect of trained vs untrained status on the accuracy of 1-RM prediction equations.

**METHODS:** 40 male subjects, 20 trained (TR) and 20 untrained (UTR) (age=21.7 ± 2.3 yrs; height=179.9 ± 6.2 cm; weight= 86.2 ± 9.7 kg) served as subjects. All subjects were instructed on proper bench press technique prior to performing the 1-RM. Three to five days later an additional bench press test consisting of weight load x maximal repetitions to volitional fatigue was performed. The second test results were utilized to estimate 1-RM from ten prediction equations. Seven of the equations were taken from published material and three from the world wide web (W). Data were analyzed via a repeated measures ANOVA within the UTR and TR data with Tukey *post hoc* follow-up.

**RESULTS:** UT and TR performed between three and seven repetitions using loads equivalent to 80 to 97% 1-RM. Five of the prediction equations produced estimates that were not significantly different (p>.05) from the actual 1-RM, and five equations overestimated 1-RM performance in both UTR and TR. The difference between predicted and actual 1-RM values for the same equations produced overestimations ranging from 2-6% in UT and from 3-5% in TR.

**CONCLUSIONS:** Some prediction equations for estimating 1-RM appear to be accurate while others tend to overpredict 1-RM performance. Training status does not appear to be a major factor impacting the predictive accuracy for selected equations.

| Equation        | Untrained    | Trained       |
|-----------------|--------------|---------------|
| Brzycki         | 84.0 ± 11.9  | 108.3 ± 19.7  |
| Musclenet(W)    | 83.3 ± 11.7  | 108.3 ± 19.7  |
| NatPhys(W)      | 83.3 ± 11.7  | 108.5 ± 19.7  |
| O'Conner et al. | 83.6 ± 11.7  | 108.3 ± 19.8  |
| Lander          | 84.1 ± 12.0  | 109.5 ± 20.0  |
| Wathan          | 85.9 ± 7.4*  | 112.0 ± 20.5* |
| Musc&Str(W)     | 86.0 ± 12.0* | 112.1 ± 20.5* |
| Epley           | 86.3 ± 12.0* | 112.1 ± 20.5* |
| Lombardi        | 87.4 ± 12.6* | 112.9 ± 20.7* |
| Mayhew et al.   | 89.0 ± 12.9* | 114.6 ± 21.0* |
| 1-RM (kg)       | 84.0 ± 11.9  | 108.6 ± 19.5  |

2894 Board #166 June 1 9:30 AM - 11:00 AM

**Accuracy of 1-RM Bench Press Prediction Equations in College-Age Men**

Paul Reneau<sup>1</sup>, Brandon Skoff<sup>1</sup>, Jerry Mayhew<sup>2</sup>, Michael J. Ryan<sup>1</sup>, Thomas J. Pujol, FACSM<sup>3</sup>, William F. Brechue, FACSM<sup>4</sup>. <sup>1</sup>Fairmont State University, Fairmont, WV. <sup>2</sup>Truman State University, Kirksville, MO. <sup>3</sup>Southeast Missouri State University, Cape Girardeau, MO. <sup>4</sup>United States Military Academy, West Point, NY.  
(No relationships reported)

Maximum Bench Press (1-RM) performance is often used as a measure of strength. However, prediction equations from maximal repetitions and load lifted are frequently used to predict 1-RM to reduce the possible risk of injury involved with 1-RM testing.

**PURPOSE:** To determine the accuracy of ten prediction equations for estimating 1-RM from sub-maximal repetitions and load lifted.

**METHODS:** 235 subjects (age = 20.3 ± 1.8 yrs; height = 179.5 ± 7.4 cm; weight = 78.9 ± 12.8 kg) with various levels of training experience served as subjects. All subjects were instructed in proper bench press technique prior to determination of 1-RM. An additional bench press test consisting of maximal repetitions (range = 3 to 10) performed with submaximal loads until volitional fatigue was utilized to estimate 1-RM from the prediction equations. Seven of the equations were taken from published material and three from the world wide web (W). Data were analyzed via a repeated measures ANOVA with a Tukey's *post hoc* test performed as needed. Alpha was set at p<.05 *apriori*.

**RESULTS:** Two of the prediction equations for 1-RM were not significantly different from actual 1-RM (p>.05), four equations over predicted (1.2-2.4%) while four under predicted (1.3-3.4%).

**CONCLUSION:** Although the results indicate that many rep-max prediction equations present significantly different estimates of 1-RM bench press, prediction errors are relatively small, hence allowing reasonable estimates of maximal strength in young men.

| Equation        | Predicted 1RM |
|-----------------|---------------|
| O'Connor et al. | 84.8 ± 20.9*  |
| Musclenet (W)   | 86.2 ± 21.4*  |
| Brzycki         | 86.2 ± 21.5*  |
| NatPhys (W)     | 86.5 ± 21.5*  |
| Lander          | 87.0 ± 21.6   |
| Lombardi        | 87.7 ± 21.6   |
| Epley           | 88.4 ± 21.9*  |
| Musc&Str (W)    | 85.5 ± 20.9*  |
| Wathan          | 88.8 ± 22.1*  |
| Mayhew et al.   | 89.5 ± 22.1*  |
| 1-RM (kg)       | 87.4 ± 21.7   |
| *p<.05          |               |

2895 Board #167 June 1 9:30 AM - 11:00 AM

### Predictors Of 10 Km Performance

Ryan M. Broxterman, Carl J. Ade, Thomas J. Barstow, FACSM. *Kansas State University, Manhattan, KS.*

(No relationships reported)

**PURPOSE:** To determine the aerobic parameters that best predict 10 kilometer (km) running performance.

**METHODS:** On separate days 31 healthy subjects completed a maximal incremental test on a treadmill for determination of gas exchange threshold (GET) and maximal oxygen uptake ( $VO_{2max}$ ), and at least four constant speed tests to exhaustion on a treadmill for determination of the speed-duration relationship (critical speed (CS) and the finite distance that can be traversed above CS ( $D'$ )). On a different day each subject ran 10 km on an indoor 200 meter track.

**RESULTS:** While 10 km time was significantly inversely correlated with absolute GET ( $r^2 = 0.143$ ;  $p = 0.035$ ) and relative GET ( $r^2 = 0.224$ ;  $p = 0.007$ ), absolute  $VO_{2max}$  ( $r^2 = 0.231$ ;  $p = 0.006$ ) and relative  $VO_{2max}$  ( $r^2 = 0.558$ ;  $p < 0.0001$ ), it was best correlated with CS (hyperbolic CS,  $r^2 = 0.777$ ;  $p < 0.0001$ ; 1/time CS,  $r^2 = 0.847$ ;  $p < 0.0001$ ). 10km pace ( $10.4 \pm 1.9$  km·h<sup>-1</sup>) was significantly slower than the hyperbolic CS ( $11.7 \pm 2.0$  km·h<sup>-1</sup>) ( $p < 0.001$ ) and the 1/time CS ( $12.3 \pm 2.1$  km·h<sup>-1</sup>) ( $p < 0.001$ ), but was not significantly different from the speed at GET ( $9.6 \pm 2.1$  km·h<sup>-1</sup>) ( $p = 0.079$ ), despite the lack of significant correlation between these two measures ( $r^2 = 0.101$ ;  $p = 0.082$ ).

**CONCLUSION:** CS best predicts the average velocity and elapsed time for a 10 km running test.

2896 Board #168 June 1 9:30 AM - 11:00 AM

### Using High Resolution Accelerometers In Addition To Laboratory Measures Strongly Predicts 10k Running Performance

Lucas Wall<sup>1</sup>, Michael A. Busa<sup>1</sup>, Timothy Muth<sup>1</sup>, Joseph Hornyak<sup>2</sup>, Christopher Herman<sup>1</sup>, Erik Bolt<sup>3</sup>, Stephen J. McGregor<sup>1</sup>. <sup>1</sup>Eastern Michigan University, Ypsilanti, MI. <sup>2</sup>University of Michigan, Ann Arbor, MI. <sup>3</sup>Clarkson University, Potsdam, NY. (Sponsor: Andrew Coggan, FACSM)

(No relationships reported)

**PURPOSE:** The purpose of this study was to determine if high-resolution accelerometers (HRA) can be used with other laboratory measures ( $VO_2$  and lactate threshold) to predict performance in collegiate cross country runners.

**METHODS:** All subjects consented to procedures approved by EMU CHHS human subjects review committee. 7 NCAA Division 1 cross country runners ( $21.7 \pm 1.4$  yr,  $67.8 \pm 6.4$  kg,  $177.8 \pm 5.1$  cm,  $67.4 \pm 4.7$  ml/kg/min) completed 3,000m and 10,000m performance trials (3kTT and 10kTT), and 1 incremental trial on a treadmill, which included wearing an HRA (Microstrain, VT) superficial to the L3 vertebra at the approximate center of mass. Blood lactate levels (Lactate Pro, JP) and metabolic gases (Jaeger, CA) were measured to determine pace at LT (LTP),  $VO_{2max}$ , and speed at  $VO_{2max}$  (VmaxSpeed). Root-mean-square (RMS) of HRA signal was examined in three planes of motion (VT, ML, AP) and the Euclidian scalar (RES). The ratio of RMS of each axial acceleration to RES was determined ( $VT_{RA}$ ,  $ML_{RA}$ ,  $AP_{RA}$ ), as well as the axial and RES accelerations to speed ( $VT_{EC}$ ,  $ML_{EC}$ ,  $AP_{EC}$ ,  $RES_{EC}$ ). Laboratory measures and performance data were compared by correlation and stepwise regression using SPSS 19 (IBM, NY).

**RESULTS:** Relationships between measured variables and 3kTT are presented elsewhere. Mean 3kTT and 10kTT times were  $8.69 \pm 0.15$  and  $31.5 \pm 1.17$  min, respectively. LTP ( $19.77 \pm 0.90$ ) was correlated to 10kTT ( $r = -0.880$ ,  $p < 0.001$ ) and 3kTT was correlated with 10kTT ( $r = 0.698$ ,  $p < 0.001$ ). Linear stepwise regressions including LTP, 3kTT and other laboratory measures ( $VO_2$ ,  $VO_{2max}$ ) did not significantly improve relationships with 10kTT over LTP alone. When HRA parameters were added to LTP, 3kTT, and  $VO_{2max}$ , significant and substantially stronger relationships were obtained ( $r = 0.993$ ,  $p < 0.001$ ).

**CONCLUSION:** Adding HRA parameters to other laboratory or shorter performance measures improves performance predictions for the 10k in collegiate distance runners over standard laboratory measures or shorter performances alone. Further research is needed to determine if shorter performances can be used in the prediction (e.g. 1500m), or performance can be predicted in longer events (e.g. marathon) using this approach.

2897 Board #169 June 1 9:30 AM - 11:00 AM

### High Resolution Accelerometers In Conjunction With Laboratory And Performance Measures Accurately Predict Performance In 3000m

Aaron C. Stickel<sup>1</sup>, Michael A. Busa<sup>1</sup>, Lucas Wall<sup>1</sup>, Timothy Muth<sup>1</sup>, Joseph Hornyak<sup>2</sup>, Christopher Herman<sup>1</sup>, Erik Bolt<sup>3</sup>, Stephen J. McGregor<sup>1</sup>. <sup>1</sup>Eastern Michigan University, Ypsilanti, MI. <sup>2</sup>University of Michigan, Ann Arbor, MI. <sup>3</sup>Clarkson University, Potsdam, NY. (Sponsor: Andrew Coggan, PHD, FACSM)

(No relationships reported)

Previous attempts to predict running performance from laboratory measures, such as lactate threshold and  $VO_{2max}$ , have met with mixed success. Using high resolution accelerometers (HRA), we have previously demonstrated that differences in running economy can be explained, in part, by differences in acceleration profile.

**PURPOSE:** The purpose of this study was to determine if high-resolution accelerometers (HRA) could be used in conjunction with other laboratory measures ( $VO_2$  and lactate threshold) to accurately predict performance in the 3000m among collegiate distance runners.

**METHODS:** All subjects consented to procedures approved by EMU CHHS human subjects review committee. 7 NCAA Division 1 cross country runners ( $21.7 \pm 1.4$  yr,  $67.8 \pm 6.4$  kg,  $177.8 \pm 5.1$  cm,  $67.4 \pm 4.7$  ml/kg/min) completed 3,000m and 10,000m performance trials (3kTT and 10kTT), and 1 incremental trial on a treadmill, which included wearing an HRA (Microstrain, VT) superficial to the L3 vertebra at the approximate center of mass. Blood lactate levels (Lactate Pro, JP) and metabolic gases (Jaeger, CA) were measured to determine pace at LT (LTP),  $VO_{2max}$ , and speed at  $VO_{2max}$  (VmaxSpeed). Root-mean-square (RMS) of HRA signal was examined in three planes of motion (VT, ML, AP) and the Euclidian scalar (RES). The ratio of RMS of each axial acceleration to RES was determined ( $VT_{RA}$ ,  $ML_{RA}$ ,  $AP_{RA}$ ), as well as the axial and RES accelerations to speed ( $VT_{EC}$ ,  $ML_{EC}$ ,  $AP_{EC}$ ,  $RES_{EC}$ ). Laboratory measures and performance data were compared by correlation and stepwise regression using SPSS 19 (IBM, NY).

**RESULTS:** Relationships between measured variables and 10kTT are presented elsewhere. 3kTT was most strongly correlated with 10kTT ( $r = 0.69$ ;  $p < 0.001$ ), LTP ( $r = -0.67$ ;  $p < 0.001$ ) and  $VT_{RMS}$  ( $r = -0.65$ ;  $p < 0.001$ ), respectively. Linear stepwise regressions including 10kTT, LTP,  $VO_{2max}$  and HRA parameters resulted in a strong relationship with 3kTT ( $r = 0.97$ ,  $p < 0.001$ ). Variables such as VmaxSpeed and  $VO_2$  were excluded from the model.

**CONCLUSION:** Inclusion of HRA parameters with laboratory measures and 10kTT results in strong prediction of 3000m in collegiate distance runners. In particular, this approach is much stronger than speed at  $VO_{2max}$ , which has been suggested previously to accurately predict performance over various distances.

2898 Board #170 June 1 9:30 AM - 11:00 AM

### Prediction of Running Performances Utilizing the Running Energy Reserve Index

Govindasamy Balasekaran, FACSM<sup>1</sup>, Nidhi Gupta<sup>1</sup>, Visvasuresh Victor Govindaswamy<sup>2</sup>, Naveen Agrawal<sup>3</sup>. <sup>1</sup>Nanyang Technological University, Singapore, Singapore. <sup>2</sup>Texas A&M University at Texarkana, Texarkana, TX. <sup>3</sup>GE Water & Process Technologies, John F. Welch Technology Centre, Bangalore, India.

(No relationships reported)

Mathematical and physiological models to predict running performances are generally based on unverified assumptions which may reduce accuracy. Few models are able to predict for a wide range of distances.

**PURPOSE:** To predict all out 200m and 5000m track and treadmill running performances ranging from .19 s~ to 1339 s~ utilizing the running energy reserve index (RERI).

**METHODS:** 29 athletes [total: age:  $27.31 \pm 7.16$  yrs, BMI:  $22.04 \pm 1.95$  kg·m<sup>-2</sup>; endurance trained; ET = 9, sprinters; ST = 7 and middle distance; MD = 13] participated in this study. Additionally, 12 participated (age:  $24.45 \pm 6.44$  yrs, BMI:  $21.43 \pm 2.15$  kg·m<sup>-2</sup>) to calculate the value of c constant of the RERI model based on rational function. To determine maximal aerobic speed (MAS) athletes performed five-six laboratory sessions as follows: Astrand modified running maximal oxygen consumption test, submaximal discontinuous treadmill (SUBMAX) test,  $VO_2$  till exhaustion ( $T_{lim}$ ) tests at; velocity at  $VO_{2max}$  ( $vVO_{2max}$ ),  $v\Delta 50$  (median of  $vVO_{2max}$  and velocity at lactate threshold;  $vLT$ ) or  $v\Delta 50 + 5\% vVO_{2max}$ . Maximal anaerobic speed (MANs) was determined with a 50m sprint on the track. Also, athletes performed two all out 200m and 5000m track runs. The maximal aerobic energy ( $E_{MAS}$ ) and maximal anaerobic energy ( $E_{MANs}$ ) at corresponding speeds and estimated energy for 200m, 5000m and treadmill runs were established with submaximal efficiency equations. The RERI was computed with the ratio of  $E_{MANs}$  and  $E_{MAS}$ . Rational regression equation was fitted to the data of estimated energy at corresponding speeds of 200m, 5000m track runs and treadmill running trials as functions of run duration.

**RESULTS:** The measured value of c constant was .0185 with no significant differences between ET, ST and MD athletes. The predicted (P) and experimental (E) results for the total cohort had significant correlations from .96 to .99 ( $p \leq 0.01$ ): EMAnS ( $\text{ml} \cdot \text{kg}^{-1} \cdot \text{s}^{-1}$ ) [P(1.79  $\pm$  .24), E(1.78  $\pm$  .24)]; EMAS ( $\text{ml} \cdot \text{kg}^{-1} \cdot \text{s}^{-1}$ ) [P(0.80  $\pm$  .1), E(0.81  $\pm$  .11)] and RERIE [P(2.25  $\pm$  .36), E(2.25  $\pm$  .32)]. The RERI model predicted track and treadmill all out running performances to within an average of 2.26  $\pm$  1.89 % ( $R^2 = .99$ ) and 2.95  $\pm$  2.51 % ( $R^2 = .99$ ) respectively.

**CONCLUSION:** The RERI model may be accurate in predicting all out track and treadmill running performances for a wide range of distances from short, middle up to 5000m.

**2899** Board #171 June 1 9:30 AM - 11:00 AM

**Predicting Mets And Activity Type From Accelerometer Counts Using Different Machine Learning Tools**

Patty Freedson, FACSM<sup>1</sup>, Sarah Kozey-Keadle<sup>1</sup>, Kate Lyden<sup>2</sup>, John Staudenmayer<sup>1</sup>. <sup>1</sup>University of Massachusetts, Amherst, MA. <sup>2</sup>University of Massachusetts, Amherst, Amherst, MA.

(P. Freedson: Honoraria; Actigraph..)

There are numerous machine learning tools available for processing and interpreting accelerometer output to estimate METs and activity type. However, it is not known if certain machine learning tools are superior for translating accelerometer signals into MET estimates or for identifying activity type.

**PURPOSE:** To compare the accuracy and precision of 4 machine learning tools in estimating METs and detecting activity type from accelerometer counts.

**METHODS:** Four machine learning tools (neural network [NNET], classification/regression tree [CRT], support vector machine [SVM], and random forest [RF]) were used to estimate activity METs and activity type (household, locomotion and sport activity) in 277 adults using signal features from the GT1M Actigraph accelerometer counts (1 sec epoch). Hold-one-out cross-validation procedures were used to test the accuracy and precision of each of the models using measured METs and observed activity types as the criterion measures.

**RESULTS:** The table below presents the bias and rMSE for estimated METs, the correlations between measured and estimated METs and the accuracy of activity type classification.

|      | Bias   | rMSE  | r    | Classification accuracy |
|------|--------|-------|------|-------------------------|
| NNET | -0.003 | 1.44  | 0.81 | 96.5%                   |
| CRT  | -0.014 | 1.65* | 0.74 | 94.4%                   |
| RF   | 0.004  | 1.47  | 0.80 | 96.3%                   |
| SVM  | -0.001 | 1.50  | 0.79 | 96.4%                   |

\*significantly different than NNET, RF and SVM,  $p < 0.05$

**CONCLUSION:** The significantly higher rMSE for CRT is due to the less flexible nature of CRT. In general, all machine learning tools are accurate and precise in estimating METs and identifying activity type categories in a lab setting. Future investigations will apply these tools to free-living conditions.

Supported by NIH RO1 CA121005

**2900** Board #172 June 1 9:30 AM - 11:00 AM

**Estimated VO2max From The Rockport Walk Test On A Non-motorized Curved Treadmill**

Rhiannon M. Seneli, Ann C. Snyder, FACSM. University of Wisconsin - Milwaukee, Milwaukee, WI.

(No relationships reported)

The Rockport Walk Test (RWT) is a field test used to estimate maximal volume of oxygen uptake (VO2max). It consists of a one-mile walk on a measured track.

**PURPOSE:** To validate the Rockport Walk Test (RWT) on a non-motorized curved treadmill (CT).

**METHODS:** Twenty-three healthy adults (females = 10; 19-44 years old) who were sedentary to recreationally active volunteered for the study. One trial of the RWT was performed on a measured indoor track and another on the CT on different days at random. Subjects were instructed to walk one-mile at a brisk, steady pace. Heart rate (HR) and completion time were used to calculate VO2max using 6 different general and gender specific equations from previous research. Subjects also performed a treadmill graded exercise test (GXT) which was used as the criterion measure for VO2max measurements. Completion times and HR between the two RWT were compared using dependent t-tests. Estimated VO2max values were compared to results from the CT and overground as well as to observed values from the GXT through RM ANOVA, Pearson correlations (r), and Bland-Altman plots. The  $\alpha$  was set at .05.

**RESULTS:** There was no difference between completion times for the RWT in the overground and CT conditions but the CT produced significantly higher HR's. There was no difference between relative estimations of VO2max using the Kline et al. (1987) general and gender specific equations on the RWTC when compared to the Dolgener et al. (1994) equation on the RWTO ( $p = .561$  and  $.335$ ). There was no difference in the absolute estimations of VO2max for the RWTC with the Kline et al. (1987) general equation and the RWTO with the Dolgener et al. (1994) general equation ( $p = .204$ ). All VO2max estimations were significantly different from observed VO2max except for the estimation produced by the relative general Kline et al. (1987) equation on the RWTO. Despite high correlations ( $r = 0.75-0.91$ ) the RWTC underestimated VO2max.

**CONCLUSION:** The RWTC underestimates VO2max but may be beneficial if a new equation were created specifically for the CT.

**2901** Board #173 June 1 9:30 AM - 11:00 AM

**Predicting Twenty-Minute Power From Five Five-Minute Intervals in Competitive Cyclists**

Steven J. Albrechtsen, Jason R. Boynton. University of Wisconsin, Whitewater, WI.

(No relationships reported)

**PURPOSE:** The purpose of this research project was to compare the power achieved during five five-minute intervals and one twenty-minute effort. Five five-minute intervals is a commonly used workout for competitive cyclists who periodically replace a workout with one twenty-minute effort to obtain important information about power, but at the expense of a more productive workout.

**METHODS:** Nine cyclists competing at the category 3 level or above completed five five-minute intervals (5x5) separated by five minutes of recovery between intervals and one twenty-minute effort of continuous exercise (1x20) in separate exercise sessions in a random order on a Velotron computerized cyclist ergometer. Correlation coefficients and prediction equations were determined for the average 20 as a function of the average 5x5 in units of Watts and Watts/kg.

**RESULTS:** Correlating the average 5x5 (327.78 $\pm$ 31.70 W) with the average 1x20 (309.66 $\pm$ 30.28 W) in units of Watts resulted in a correlation coefficient of 0.9650 along with the following prediction equation: Average 1x20 (W) = 0.9218 [Average 5x5 (W)] + 7.5162. Correlating the average 5x5 (4.39 $\pm$ 0.47 W/kg) with the average 1x20 (4.16 $\pm$ 0.47 W/kg) in units of Watts/kg resulted in a correlation coefficient of 0.9747 along with the following prediction equation: Average 1x20 (W/kg) = 0.99868 [Average 5x5 (W/kg)] - 0.1721.

**CONCLUSION:** The results of this research project established the relationship between five five-minute intervals as a training technique to prepare for competition and one twenty-minute effort as a field test to evaluate training status with the intent of optimizing training to use five five-minute intervals as both a training technique and to evaluate training status without the need to interrupt the training schedule with one twenty-minute effort.

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2902 Board #174 June 1 9:30 AM - 11:00 AM

**A Retrospective Analysis Of Wellness And Fitness Assessments In College Freshman**

Amanda J. Peterson<sup>1</sup>, William F. Simpson, FACSM<sup>2</sup>, Glenn R. Carlson<sup>2</sup>. <sup>1</sup>Cooper Aerobics Center at Craig Ranch, McKinney, TX. <sup>2</sup>University of Wisconsin-Superior, Superior, WI.

(No relationships reported)

It is accepted that college students form their adult health behaviors during their college years. Educating first year students in respect to the importance of healthy behaviors can have a positive effect on their future.

**PURPOSE:** This investigation's purpose was to analyze 3 academic years worth [6 semesters] of fitness and wellness assessments completed by first year students during a health and wellness class at a small public liberal arts institution.

**METHODS:** As a portion of each student's course work, a wellness survey and fitness assessment was completed using a MicroFit computerized assessment package. A total of 332 males and 468 females were included in this cohort over the 6 semesters. Student who did not complete the entire assessment are not included in this analysis.

**RESULTS:** The wellness profile suggests that all students exercise 2-3 times per week, have fair eating habits, are not safety conscious and are exposed to moderate levels of stress. However, they are less likely to use tobacco products. The table illustrates fitness assessment data. Aside from the systolic reading for males, values are normal. Although BMI estimates are overweight for males, the corresponding % fat suggests a more active population. Est. max VO<sub>2</sub> values are skewed high. The YMCA protocol was used for prediction and may have overestimated.

**CONCLUSIONS:** This population reported low participation in exercise which one would anticipate a lower VO<sub>2</sub>. Based on these observations, first year students should be exposed to more educational and interventional programs involving exercise, proper nutrition and stress management programming. The Health and Wellness class addresses a variety of behaviors including the above.

|         | SBP/DBP             | BMI      | % Fat     | EST. VO <sub>2</sub> [mL/kg/min] |
|---------|---------------------|----------|-----------|----------------------------------|
| MALES   | 122.6±11.9/77.4±8.1 | 24.3±2.9 | 13.2±4.7  | 41.7±7.7                         |
| FEMALES | 112.1±10.9/74.8±6.1 | 25.8±6.2 | 24.06±6.2 | 37.6±8.9                         |

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**E-31 Free Communication/Poster - Genetics II**

JUNE 1, 2012 7:30 AM - 12:30 PM

ROOM: Exhibit Hall

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2903 Board #175 June 1 11:00 AM - 12:30 PM

**Two Dimensional Differential Gel Electrophoresis Analysis of the Nucleus accumbens in High and Low Active Mice.**

David P. Ferguson, Lawrence J. Dangott, J. Timothy Lightfoot, FACSM. Texas A&M University, College Station, TX.

(No relationships reported)

Current literature suggests that physical inactivity is one of the leading causes of death in the United States. With this understanding there is a growing interest in the mechanism responsible for the drive to be physically active.

**PURPOSE** While there have been several genomic and gene expression studies, there has been no data presented regarding differential protein expression between high and low active subjects.

**METHODS** Thus, we extracted proteins from nucleus accumbens of previously phenotyped high active male C57L/J mice (n=3), low active male C3H/HeJ mice (n=3), high active C3C5 F2 male mice (n=3), and low active C3C5 F2 male mice (n=3). The F2 cohort served as a control to aid in the identification of changes in proteins only related to physical activity. The differential expression of the extracted proteins was determined using 2D-DIGE and DeCyder software (p<0.05). Candidate proteins were digested with trypsin and the peptides were analyzed by mass spectrometry for protein identification.

**RESULTS** We identified four proteins that were expressed differently between the high active and low active mice: L-lactate dehydrogenase B, calcineurin subunit B type 1, and heat shock proteins HSP90-alpha and beta.

**CONCLUSION** These data provide a clearer framework to investigate the mechanism responsible for voluntary physical activity.

Supported by NIH RO1AR050085

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2904 Board #176 June 1 11:00 AM - 12:30 PM

**Effects of Physical Activity Ancestry on Aspects of Body Composition and Glucose Tolerance in Mice**

Lisa M. Guth, Andrew C. Venezia, Michael P. Marini, Estefan P. Beltran, Espen E. Spangenburg, Stephen M. Roth, FACSM. University of Maryland, College Park, MD.

(No relationships reported)

**PURPOSE:** To characterize the influence of a physical activity (PA) ancestry compared to a sedentary (SED) ancestry on aspects of body composition, glucose metabolism, and tissue characteristics in multiple generations of mouse offspring.

**METHODS:** 8-week old C57BL/6 mice (F<sub>0</sub>) were exposed to PA (computer-monitored voluntary wheel running, N=20) or a SED condition (no wheel access, N=20) for 12 weeks prior to breeding. PA males were bred with PA females and SED males were bred with SED females to obtain F<sub>1</sub> pups. F<sub>0</sub> PA animals had continued access to the running wheel during breeding, pregnancy, and weaning. F<sub>1</sub> pups were either sacrificed at 8 wk without exposure to PA (PA ancestry was the only distinguishing feature), or bred with like-ancestry F<sub>1</sub> animals to obtain the F<sub>2</sub> generation. Similarly, F<sub>2</sub> offspring were sacrificed at 8 wk without any PA exposure. Body, heart, liver, omental fat, and muscle (gastrocnemius, plantaris, soleus, TA, EDL) masses were recorded and intraperitoneal glucose tolerance (IPGTT) was measured in F<sub>1</sub> and F<sub>2</sub> offspring.

**RESULTS:** F<sub>0</sub> males and females ran an average of 4206 ± 634 and 5312 ± 637 meters/24 hours over the 12-wk pre-breeding period. In the F<sub>1</sub> generation, body mass tended to be higher in PA offspring (p = 0.05 and 0.06 for males and females). Liver mass was significantly higher in PA males (p < 0.05) and tended to be higher in PA females (p = 0.10). There were no differences in heart, omental fat, or muscle masses, though in the F<sub>2</sub> generation, average plantaris mass tended to be lower in SED males (p = 0.07). No other differences in body or tissue masses were observed. F<sub>2</sub> female mice with a PA ancestry had lower baseline blood glucose (p < 0.05) and tended to have lower IPGTT AUC (p = 0.06). No differences in blood glucose or glucose tolerance were observed in F<sub>2</sub> males or in the F<sub>1</sub> generation.

**CONCLUSION:** These findings suggest PA ancestry (independent of direct PA) has a limited influence on aspects of body composition and glucose metabolism in multiple generations of mouse offspring, but in a generation- and sex-specific manner.

This work was supported by NIH grants HD062868 and AG000268.



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**2905** Board #177 June 1 11:00 AM - 12:30 PM  
**A Quick One Tube Nested PCR-Protocol For Epo Transgene Detection**

Dirk A. Moser, Elmo E.W. Neuberger, Perikles Simon. *University of Mainz, Mainz, Germany.*  
(No relationships reported)

**PURPOSE:** Doping is particularly difficult to combat when it involves pharmaceuticals and therapeutic techniques that are still in development. With the very recent reports on successful gene therapies for several diseases, the likelihood for abuse of gene transfer techniques in elite sports is rapidly increasing. It is therefore very important to develop valid detection techniques for indicating the transfer of DNA (tDNA), with ultimate sensitivity and specificity.

**METHODS:** To date, three slightly different procedures have been developed, two using a real time PCR based approach and one using a primer-internal, intron-spanning PCR approach (spiPCR), each reported to reliably detect tDNA with high sensitivity. The specificity of these techniques, however, is still a matter of debate. Here we present a novel one-tube nested spiPCR approach that minimizes the chances for cross-contamination and shows increased sensitivity compared to non-nested PCR techniques. To further reduce the occurrence of false-positives based on cross-contamination, a multi-functional 19bp extended erythropoietin standard (EPO) was cloned which can be easily differentiated from EPO tDNA and can be used as an internal or external positive control.

**RESULTS:** The method described here combines the advantages of the three currently developed techniques for the detection of EPO gene doping in terms of sensitivity, specificity, the number of procedural steps and the chances for cross-contamination.

**CONCLUSIONS:** We hope that the sensitivity of the currently developed molecular biological detection techniques in combination with their ability to allow long-term detection will deter athletes from using gene transfer doping techniques.

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**2906** Board #178 June 1 11:00 AM - 12:30 PM  
**Effects of Resistance Training on Skeletal Muscle Gene Expression Profiling in Overweight, Sedentary Young Men.**

Brian H. Chen, Daniel M. Croymans, Christian K. Roberts, FACSM. *UCLA, Los Angeles, CA.*  
(No relationships reported)

Previously, we demonstrated that resistance training (RT) improved glucose tolerance, independent of changes in body weight. However, the biologic pathways leading to improvements in insulin sensitivity/glucose tolerance with RT remain largely unknown.

**PURPOSE:** To comprehensively identify changes in skeletal muscle gene expression networks and their associations with changes in measures of glucose tolerance and other metabolic traits before and after this 12-week RT intervention.

**METHODS:** 18 sedentary, overweight young adult men (age =  $21 \pm 2$  years, BMI =  $31 \pm 3$  kg/m<sup>2</sup>) completed 12 weeks of RT, 3x/week, and were assessed for changes in markers of metabolic health and underwent an oral glucose tolerance (OGTT). Skeletal muscle biopsies were collected from the vastus lateralis before and after the intervention. Global mRNA levels were measured using the Illumina HumanHT Expression BeadChip. Weighted Gene Co-expression Network Analysis (WGCNA) was used to construct gene networks (comprised of multiple clusters/modules of genes) based on their degree of co-expression. Correlations were based on change (post- minus pre-intervention) values.

**RESULTS:** We identified 3 distinct modules of genes by hierarchical clustering of gene co-expression values. Summary expression values based on the average change in expression of the component genes of each module were correlated with changes in several traits. One module showed positive correlations with oxidized LDL cholesterol ( $r=0.51$ ,  $p=0.04$ ), glucose area-under-the-curve (AUC) from OGTT ( $r=0.45$ ,  $p=0.07$ ), insulin AUC ( $r=0.52$ ,  $p=0.03$ ), and QUICKI ( $r=-0.62$ ,  $p=0.01$ ). Enrichment analysis using DAVID (<http://david.abcc.ncifcrf.gov>) indicated that this module was highly enriched for genes involved in cell signaling, extracellular matrix, and cell adhesion. Module genes with the strongest correlations with oxidized LDL levels included *RAB32* ( $r=0.73$ ), *ITGB5* ( $r=0.68$ ), *CTGF* ( $r=0.67$ ), and *CMTM3* ( $r=0.66$ ); for insulin AUC, *AEBP1* ( $r=0.74$ ), *EIF4A1* ( $r=0.70$ ), and *ANXA2* ( $r=0.66$ ); and for QUICKI, *WBP5* ( $r=-0.81$ ), *LIMA1* ( $r=-0.77$ ), *EBF1* ( $r=-0.76$ ), and *KCTD12* ( $r=-0.74$ ).

**CONCLUSION:** We identified a set of genes enriched for cell signaling/adhesion, whose expression levels were related to the effects of RT on glucose tolerance and insulin resistance traits.

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**2907** Board #179 June 1 11:00 AM - 12:30 PM  
**Potential Wash-out of Vmat2 Gene Silencing by Exercise Exposure.**

Emily E. Schmitt, David P. Ferguson, J Timothy Lightfoot, FACSM. *Texas A&M University, College Station, TX.*  
(No relationships reported)

**PURPOSE:** To investigate potential exercise-induced washout of vivo-morpholinos targeted toward vesicular monomine transporter type 2 (*Vmat2*).

**METHODS:** We randomly assigned 24, eight week old male C57Bl/6J inbred mice to one of two groups: one group had access to running wheels while the other group had locked running wheels. All animals received tail-vein injections (11 mg/kg) of *Vmat2*-targeted vivo-morpholinos for three consecutive days. Starting 24 hours after the first injection and continuing every 24 hours thereafter, we sacrificed one mouse from each group and determined the expression of *Vmat2* using Western Blotting to track efficacy of gene knock-down.

**RESULTS:** There was no significant difference between the wheel running and the locked-wheel group in *Vmat2* expression ( $p=0.45$ ) across the 11 day post-injection period. As compared to baseline *Vmat2* expression (optical density - OD = 21.3%), there was complete knock-down of *Vmat2* expression on days 1-8 post-injection (OD = 0.0% on all days). On day 9-11 post-injection, *Vmat2* expression gradually increased until on day 11, it was similar to baseline values (OD = 20.0%).

**CONCLUSIONS:** The use of vivo-morpholinos transiently silenced *Vmat2* with no difference between wheel running and locked wheel groups. This data suggests that wheel-running does not increase the clearance of vivo-morpholinos.

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**2908** Board #180 June 1 11:00 AM - 12:30 PM  
**High Fat Diet Enhances Tumorigenesis And Pro-tumoral Factors in the C3(1)SV40Tag Breast Cancer Mouse Model**

Jennifer Steiner<sup>1</sup>, J Mark Davis, FACSM<sup>1</sup>, Jamie McClellan<sup>1</sup>, Jeffrey Green<sup>2</sup>, E. Angela Murphy<sup>3</sup>. <sup>1</sup>University of South Carolina, Columbia, SC. <sup>2</sup>National Cancer Institute, Bethesda, MD. <sup>3</sup>University of South Carolina School of Medicine, Columbia, SC.  
(No relationships reported)

High fat diet (HFD) induced obesity increases the risk for breast cancer (BrCa); obese women have a greater risk of developing breast cancer and of dying from the disease than healthy women. However, few well supported mechanistic explanations in regards to the relationship between HFD induced obesity and BrCa exist.

**PURPOSE:** The purpose of this study was to determine the effects of HFD feedings on tumorigenesis in the C3(1)SV40Tag mouse model of BrCa and further to relate this to pro-tumoral factors expressed in the tumor microenvironment.

**METHODS:** Female C3(1)SV40Tag mice were assigned to a dietary treatment group (n=14-15), beginning at 4 wks of age: control (CON) diet (AIN76A), or high fat diet (HFD). The CON diet contained 11.5% kcal fat while the HFD diet had 41% kcal fat. All diets were identical in vitamin and mineral content. Body weight (BW) was measured weekly, and mice were examined bi-weekly for palpable tumors, from which tumor number and volume was recorded. At 18wks of age mice were sacrificed and all visible tumors were counted, measured, and excised. Tumor tissue was analyzed for pro-tumoral factors including mRNA gene expression of CD206 (a marker for pro-tumor M2 macrophage phenotype), VEGF (a mediator of angiogenesis) and TNF- $\alpha$  & IL-6 (pro-inflammatory cytokines) using RT-PCR. Tumor number and volume as well as BW were analyzed using a one-way repeated measures ANOVA and pro-tumoral factors were analyzed using Student's T-Tests. Significance was set at  $P<0.05$ .

**RESULTS:** HFD feedings significantly increased BW (wks 8-18), and body fat percentage (~70%) ( $P<0.05$ ). Tumorigenesis was greatly enhanced by HFD; tumor volume in HFD was ~50% greater than CON at 18wks ( $P<0.05$ ). HFD consumption increased tumor expression of CD206 (1.4 fold), VEGF (1.5 fold), IL-6 (~3 fold), and TNF- $\alpha$  (1.2 fold) compared to CON.

**CONCLUSIONS:** These data confirm the negative influence of HFD consumption on breast cancer in a transgenic mouse model and further provide evidence of a relationship between HFD and pro-tumoral factors related to tumor associated macrophages, angiogenesis and inflammation within the tumor microenvironment.

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2909 Board #181 June 1 11:00 AM - 12:30 PM

**Role of Ginseng extracts on Inflammatory Makers in the Adipose Tissue of Exhaustive Exercised Rats**

Yu-Yu Kao<sup>1</sup>, Hsien-Tang Lin<sup>1</sup>, Ming-Fen Hsu<sup>1</sup>, Feng-Chih Hsu<sup>2</sup>, Mallikarjuna Korivi<sup>1</sup>. <sup>1</sup>Taipei Physical Education College, Taipei, Taiwan. <sup>2</sup>National Taoyuan Agricultural & Industrial Vocational High School, Taoyuan, Taiwan. (Sponsor: Kuo Chia-Hua, FACSM)  
(No relationships reported)

**PURPOSE:** The present study was purposed to investigate the effect of ginseng extracts (Dammarane Oligo-Saponins, DS) against exhaustive exercise-induced changes in inflammatory markers in the adipose tissue of rat.

**METHODS:** Sprague Dawley rats (n=80) were divided into 4 groups: placebo (0.9% saline), DS (0.1 mg/kg bodyweight), DS20 (20 mg/kg b.w.), DS60 (60 mg/kg b.w.) and DS120 (120 mg/kg b.w.), and treated with respective doses of DS for 10 weeks. After the last dose half number of rats from each group (n=10) performed exhaustive exercise, and epididymal fat was collected immediately after exercise. mRNA levels of inflammatory makers including interleukin-1 $\beta$  (IL-1 $\beta$ ), IL-6, IL-10, tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ), leptin and adiponectin were analyzed.

**RESULTS:** Exhaustive exercise significantly increased the mRNA levels of IL-10, leptin and adiponectin in placebo group compared to non-exercise rats. In contrast, IL-1 $\beta$  and IL-6 mRNA expressions were down-regulated, while, TNF- $\alpha$  mRNA was not significantly changed after exhaustive exercise. Interestingly, exercise-induced elevated IL-10 mRNA expression was significantly decreased in DS-treated groups with all doses.

**CONCLUSIONS:** Findings from this study concludes that oral administration of DS (20 mg/kg) may control the exhaustive exercise-induced inflammation. This study also suggests that high dosage (120 mg/kg) may have negative impact on inflammatory system.

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**E-32 Free Communication/Poster - High Altitude/Hypoxia II**

JUNE 1, 2012 7:30 AM - 12:30 PM

ROOM: Exhibit Hall

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2910 Board #182 June 1 9:30 AM - 11:00 AM

**The Effect of Living High Training Low on Skeletal Muscular UPP and Protein Catabolism**

Ming Ye<sup>1</sup>, Junping Li<sup>2</sup>, Dongdong Li<sup>1</sup>, Zhen Ni<sup>2</sup>. <sup>1</sup>Capital University of Physical Education and Sports, Beijing, China. <sup>2</sup>Beijing Sports University, Beijing, China.  
(No relationships reported)

Previous researches showed that hypoxia can promote skeletal muscular protein degradation, the Ubiquitin-Proteasome Pathway (UPP) plays an important role in protein catabolism. Ubiquitin ligases Muscle ring finger 1 (Murf-1) and Muscle Atrophy F-box (MAFbx) can be regarded as markers of skeletal muscular protein degradation and UPP.

**PURPOSE:** To study the possible mechanism and influence of living high training low on skeletal muscular UPP and protein degradation.

**METHODS:** 160 Male SD rats were divided into 4 groups randomly: control group(C), normal exercise group(E), hypoxic group (H) and living high training low group(HiLo). Each group was divided into 1, 7, 14 and 28 days group. C group lived under normoxic circumstance; H group was exposed to normal pressure hypoxia for 10h/d, oxygen concentration was 13.6%; E group was performed treadmill exercise of 20m/min, 1h/d; the HiLo group's hypoxia exposure and exercise mode were as the same as H and E respectively. Murf-1 and MAFbx were tested by Q-T PCR, protein ubiquitination was tested by Western Blotting, 3-methylhistidine(3-MH) and corticosterone were tested by HPLC and ELISA respectively.

**RESULTS:** (1) Compared with C, Murf-1 mRNA of E, H and HiLo on the 1st day, Murf-1 mRNA of HiLo on the 7th day and Murf-1 mRNA of E, H and HiLo on the 14th and 28th day all increased (all P<0.05). (2) The change of skeletal muscular MAFbx mRNA was nearly the same as Murf-1 mRNA. (3) Protein ubiquitination of the E, H and HiLo at first increased and then decreased, and they increased on the 7th day, then decreased gradually, on the 14th day they declined as the same level of the 1st day. (4) Compared with C, 3-MH of H on the 14th day and 3-MH of E on the 28th day increased (all P<0.05), and 3-MH of HiLo on the 28th day increased (P<0.01). (5) Compared with C, the corticosterone of E, H and HiLo increased on the 1st day (all P<0.05), and they increased on the 7th, 14th, and 28th day too (all P<0.01).

**CONCLUSIONS:** Living high training low perhaps promotes the secretion of corticosterone significantly, which activates UPP and increases skeletal muscular protein ubiquitination, Murf-1 mRNA and MAFbx mRNA, which increase skeletal muscular protein degradation and 3-MH obviously. It shows that living high training low can activate UPP and enhance protein catabolism. Supported by KM200910029002.

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2911 Board #183 June 1 9:30 AM - 11:00 AM

**Heat and Hypoxia Cause Additive Increases in Heat Shock Protein 72 During Submaximal Exercise**

Douglas M. Jones<sup>1</sup>, Mia S. Green<sup>2</sup>, Jay H. Heaney<sup>1</sup>, Michael J. Buono, FACSM<sup>2</sup>. <sup>1</sup>Naval Health Research Center, San Diego, CA. <sup>2</sup>San Diego State University, San Diego, CA.  
(No relationships reported)

Individual stressors such as exercise, heat, and hypoxia have been shown to increase the plasma concentration of heat shock protein 72 (HSP 72). However, it is unclear how HSP 72 and other physiological markers of stress respond to the simultaneous combination of stressors.

**PURPOSE:** It has been proposed that both heat and hypoxia share the same induction pathway for HSP 72 expression. If this is true, then it could be hypothesized that combining both heat and hypoxia would have an additive effect on HSP 72 expression during submaximal exercise.

**METHODS:** Twelve healthy subjects completed 60-minute trials of moderate-intensity exercise (40% of maximal oxygen consumption) on a treadmill while exposed to four different environmental conditions: (1) 23°C, 20.9% O<sub>2</sub>, (2) 35°C, 20.9% O<sub>2</sub>, (3) 23°C, 16.5% O<sub>2</sub>, and (4) 35°C, 16.5% O<sub>2</sub>. Measurements of heart rate, core temperature, and perceived exertion were obtained throughout each trial. Postexercise blood samples were collected and analyzed for norepinephrine, epinephrine, and HSP 72.

**RESULTS:** Results showed that combining heat and hypoxia during submaximal exercise significantly increased systemic stress compared with similar intensity exercise in heat or hypoxia alone. This is evidenced by the fact that exercise in the combined heat and hypoxic environment caused significantly (P < 0.05) greater increases in heart rate, perceived exertion, and plasma norepinephrine concentration compared with exercise in heat or hypoxia alone. More importantly, combining the stressors of heat and hypoxia during submaximal exercise resulted in significantly (P < 0.05) greater plasma HSP 72 concentrations (17  $\pm$  6 ng/ml) compared with the other three trials, all of which had means of approximately 6  $\pm$  2 ng/ml.

**CONCLUSION:** Such data suggest that heat and hypoxia cause an additive increase in HSP 72 expression during submaximal exercise. By increasing HSP 72 using multiple stressors, the amount of cellular damage resulting from subsequent stressful environmental exposure may be reduced.

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2912 Board #184 June 1 9:30 AM - 11:00 AM

**Increases in Heart Rate and RPE Are Additive During Prolonged Exercise in Heat and Hypoxia**

Michael J. Buono, FACSM<sup>1</sup>, Mia Green<sup>1</sup>, Doug Jones<sup>1</sup>, Jay H. Heaney<sup>2</sup>. <sup>1</sup>San Diego State University, San Diego, CA. <sup>2</sup>Naval Health Research Center, San Diego, CA.  
(No relationships reported)

**PURPOSE:** To investigate the effects of a combined heat and hypoxic environment on HR and RPE during prolonged exercise.

**METHODS:** Twelve subjects completed 1 h trials of moderate-intensity exercise on a treadmill while exposed to four different environmental conditions: (1) 23°C, 20.9% O<sub>2</sub>, (2) 35°C, 20.9% O<sub>2</sub>, (3) 23°C, 16.5% O<sub>2</sub>, and (4) 35°C, 16.5% O<sub>2</sub>. HR, RPE, core temperature, and arterial oxygen saturation were measured every 5 minutes during the trials.

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**RESULTS:** The mean±SD end-exercise HR was 108±10, 125±19, 116±13, and 133±17 bpm for the four conditions. Thus, compared with the control condition (23°C, 20.9% O<sub>2</sub>) heat alone increased HR 17 bpm, hypoxia alone increased HR 8 bpm, while heat+hypoxia increased HR 25 bpm. Likewise, end-exercise RPE was 9.8±1.5, 10.8±2.0, 10.4±1.6, and 11.6±2.1 for the four conditions, respectively. Thus, compared with the control condition, heat alone increased RPE 1.0 units, hypoxia alone increased RPE 0.6 units, while heat+hypoxia increased RPE 1.8 units. The mean arterial oxygen saturation was 96% during the two normoxic trials and 93% ( $P < 0.05$ ) during the two hypoxic trials. The mean end-exercise core temperature ranged between 37.7 and 37.9°C and was not significantly different for the four trials.

**CONCLUSIONS:** The results of the current study strongly suggest that the separate heat- and hypoxia-induced augmentations in HR and RPE during prolonged exercise are additive when the two stressors are combined. The additive effects were apparent even though there was no difference in core body temperature between the four conditions, suggesting that hyperthermia was not the mediating factor. The heat stress and degree of hypoxia used in the study were moderate and equal to what many athletes and military personnel experience on a regular basis. Thus, the practical applications of the current findings are widespread.

This work was supported by the U.S. Navy Bureau of Medicine and Surgery under Work Unit No. 61033. The views expressed are those of the authors and do not reflect the official policy or position of the Department of the Navy, Department of Defense, or the U.S. Government. Approved for public release; distribution is unlimited. This research was conducted in compliance with all applicable federal regulations governing the protection of human subjects (SDSU IRB Protocol #536053).

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**2913** Board #185 June 1 9:30 AM - 11:00 AM  
**Impact Of Varying Levels Of Simulated Altitude On Balance**

James Schoffstall, Melissa Gogain, Taylor Clay. *Liberty University, Lynchburg, VA.* (Sponsor: Mel Williams, FACSM)  
(No relationships reported)

**PURPOSE:** The purpose of this study was to examine the effect of exposure to varying levels of simulated altitude on static and dynamic balance.

**METHODS:** Twenty subjects (9 males and 11 females; age: 21.2 ± .8 yrs) performed a static and dynamic balance test using a Biodex Balance System SD at various levels of simulated altitude [base 260 m (20.9% O<sub>2</sub>); 1500 m (17.2% O<sub>2</sub>); 3000 m (14.2% O<sub>2</sub>); 4500 m (11.8% O<sub>2</sub>); and 6000 m (9.8% O<sub>2</sub>)]. Altitude was simulated by creating a hypoxic environment using two Higher Peak hypoxic air generators feeding into a large 2-way valve attached to a V2 Mask. Statistical significance was determined through the use of repeated measures ANOVA, with post hoc pairwise comparisons.

**RESULTS:** The SpO<sub>2</sub> (%) levels were significantly different ( $p < 0.05$ ) among the assessed simulated altitudes: base (98%), 1500m (96%), 3000m (89%), 4500m (83%), and 6000m (75%). The subjects' HRs (bpm) were significantly different ( $p < 0.05$ ) among the assessed simulated altitudes: base (77 bpm), 1500m (84 bpm), 3000m (87bpm), 4500m (95 bpm), and 6000m (106 bpm). A significant difference ( $p < 0.05$ ) was noted in the static postural stability test between the 1500m level and the 6000m level for the overall score, and the anterior/posterior score. While significant differences were not observed between any of the other trials, the data demonstrated a trend for an increasingly poor balance score with higher altitudes. During the limits of stability dynamic balance test no significant differences were noted for either total time to completion or score. During the 6000m trial, 7 of the 20 subjects were unable to complete the testing due to abnormalities (headache, dizziness, nausea, or other signs of distress). A significant difference for SpO<sub>2</sub> existed between the subjects who were (77%) and were not (69%) able to complete the 6000m trial.

**CONCLUSIONS:** Based on the results of this study extreme simulated altitudes (6000m) can have a negative impact on static balance, which is not seen at lower simulated altitudes (1500 to 4500m).

This study was supported by funds from The Center for Research and Scholarship Fund of Liberty University.

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**2914** Board #186 June 1 9:30 AM - 11:00 AM  
**Impact of Hypoxia on Metabolic Gene Expression**

Dustin Slivka<sup>1</sup>, Matt Heesch<sup>1</sup>, Charles Dumke, FACSM<sup>2</sup>, John Cuddy<sup>2</sup>, Walter Hailes<sup>2</sup>, Brent Ruby, FACSM<sup>2</sup>. <sup>1</sup>University of Nebraska at Omaha, Omaha, NE. <sup>2</sup>University of Montana, Missoula, MT.  
(No relationships reported)

Hypoxia may be a potent stimulator for metabolic adaptation. However, the metabolic mechanism is not well characterized.

**PURPOSE:** To determine the impact of acute hypoxia on the expression of genes associated with anaerobic and aerobic metabolism after exercise.

**METHODS:** Twelve recreationally trained males (age 23.8 ± 3.8 y, mass 81.6 ± 11.6 kg, body fat 14.6 ± 7%, VO<sub>2</sub> peak 4.03 ± 0.60 L·min<sup>-1</sup>) exercised at an absolute workload associated with 60% VO<sub>2</sub> peak (158 ± 23 watts) in an altitude chamber that simulated the hypoxia associated with altitudes of 975 m (LOW) and 3000 m (HIGH) in a randomized order. Skeletal muscle biopsies were obtained from the vastus lateralis before exercise and after 4 hours of recovery. Gene expression was measured using real-time RT PCR and expressed using the  $\Delta\Delta$  CT method.

**RESULTS:** VO<sub>2</sub> was not different during exercise between LOW and HIGH (2.43 ± 0.56 L·min<sup>-1</sup> and 2.42 ± 0.35 L·min<sup>-1</sup>, respectively). Blood oxygen saturation was similar before each trial (LOW, 97.5 ± 0.9 %; HIGH, 97.7 ± 1.3 %) but was higher in LOW than HIGH during exercise ( $p < 0.05$ ; 97.0 ± 0.8 % and 91.1 ± 1.5 %, respectively) and recovery ( $p < 0.05$ ; 98.0 ± 0.5 % and 94.3 ± 1.4 %, respectively). Muscle glycogen reduced as a result of exercise ( $p < 0.05$ ) but was not different between trials. There were no differences between trials for COX, HIF, PGC1, FIS, MFN, OPA, HK or PFK ( $p > 0.05$ ) gene expression. However, COX, HIF, PGC1, FIS, MFN, HK and PFK increased as a result of exercise regardless of trial ( $p < 0.05$ ) while OPA did not.

**CONCLUSIONS:** These data indicate no differences in select metabolic gene expression between acute exercise at 975 m and 3000 m when absolute intensity is held constant despite differences in blood oxygen saturation.

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**2915** Board #187 June 1 9:30 AM - 11:00 AM  
**Effect Of 1-week Altitude Exposure On Circulating Stress Hormones In Male College Student**

Shu-Yun Lu<sup>1</sup>, Mei-Chih Chen<sup>2</sup>, Feng-Chih Hsu<sup>3</sup>, Ching-Hung Lin<sup>4</sup>. <sup>1</sup>National Tsing Hua University, Hsinchu, Taiwan. <sup>2</sup>Taipei Physical Education College, Taipei, Taiwan. <sup>3</sup>National Taoyuan Agricultural & Industrial Vocational High School, Taoyuan, Taiwan. <sup>4</sup>Yuan Ze university, Taoyuan, Taiwan. (Sponsor: Chia-Hua Kuo, FACSM)  
(No relationships reported)

**PURPOSE:** The purpose of this study was to investigate the effect of one week altitude physical activity on stress hormones in male subjects.

**METHODS:** Thirteen men (age: 17±1 years) were voluntarily participated in this study. All of the subjects lived at 1850 m high altitude level for one week. Circulating dehydroepiandrosterone sulfate (DHEA-S) testosterone, cortisol levels and white blood cell (WBC) were measured before, after and 1 week after altitude physical activity.

**RESULTS:** Our data shown the DHEA-S level was significantly increased 1-week after altitude exposure compared to before and after altitude physical activity. No significant difference in testosterone level was noticed before and after altitude physical activity. The cortisol level was significantly decreased after and 1-week later of altitude exposure compared to before altitude physical activity. We also found the number of WBC was significantly increased after and 1-week later altitude physical activity compared to baseline WBC count.

**CONCLUSIONS:** The results of the present study conclude that one week altitude physical activity can bring adaptation to stress and may improve health status by increasing the DHEA-S and decreasing the cortisol concentrations in men.

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**2916** Board #188 June 1 9:30 AM - 11:00 AM  
**Upland Indigenous in Taiwan may Have Better Anti-oxidative Capability in Response to Endurance Exercise at Altitude**

Jung-Chang Lin<sup>1</sup>, Sha Pu Lu Bi<sup>1</sup>, Chia-Chih Lin<sup>2</sup>, Yi-Ting Pan<sup>2</sup>, Yi-Tzu Lin<sup>2</sup>, Shih-Ling Chen<sup>3</sup>. <sup>1</sup>Chinese Culture University, Taipei, Taiwan. <sup>2</sup>National Dong Hwa University, Hualin, Taiwan. <sup>3</sup>Central Region Office, Ministry of Education, Taichung, Taiwan.  
(No relationships reported)

**PURPOSE:** To study anti-oxidative capability of upland indigenous (Atayal tribe) in Taiwan in response to endurance exercise at altitude.

**METHODS:** Fourteen (8 males and 6 females) Atayal tribe (ATA) and 18 (10 males and 8 females) Han race (HAN), who lived in sea level (age:  $19.8 \pm 1.2$  yrs vs.  $20.4 \pm 0.9$  yrs, height:  $168.9 \pm 8.8$  cm vs.  $163.4 \pm 6.4$  cm, weight:  $65.3 \pm 15.2$  kg vs.  $56.1 \pm 8.4$  kg,  $\text{VO}_2$  peak:  $36.7 \pm 8.4$  ml/min/kg vs.  $41.5 \pm 7.0$  ml/min/kg, peak power:  $180 \pm 56.7$  watts vs.  $172.1 \pm 26.2$  watts), were exposed to 2,400 m of altitude (ALT) or sea level (SEL), and stressed by ergometer exercise (70-75%  $\text{VO}_2$  peak 45 min + 90%  $\text{VO}_2$  peak to exhaustion). Plasma indicators showing oxidative damage in time courses (resting, immediately after, post 10 min, post 60 min, post 120 min and post 240 min of exercise) were analyzed. Repeated measures of ANOVA were used and the statistical significance was set at  $p < .05$ .

**RESULTS:** Main effects showed that significantly lower thiobarbituric acid reactive substance (TBARS) levels in ATA than in HAN in both environments (SEL: ATA vs. HAN  $7.68 \pm 0.67$   $\mu\text{M}$  vs.  $9.70 \pm 0.90$   $\mu\text{M}$ ; ALT: ATA vs. HAN  $8.31 \pm 0.89$   $\mu\text{M}$  vs.  $10.07 \pm 0.74$   $\mu\text{M}$ ,  $p < .05$ ), and so was glutathione peroxidase activity (SEL: ATA vs. HAN  $60.70 \pm 7.29$  U/mL vs.  $89.24 \pm 11.64$  U/mL; ALT: ATA vs. HAN  $57.98 \pm 6.59$  U/mL vs.  $79.35 \pm 10.67$  U/mL,  $p < .05$ ) and lactate values (SEL: ATA vs. HAN  $2.30 \pm 0.26$  mM vs.  $3.18 \pm 0.31$  mM; ALT: ATA vs. HAN  $2.74 \pm 0.27$  mM vs.  $3.48 \pm 0.29$  mM,  $p < .05$ ). However, TGS/GSSG values were higher in ATA than in HAN (SEL: ATA vs. HAN  $0.14 \pm 0.01$  vs.  $0.12 \pm 0.01$ ; ALT: ATA vs. HAN  $0.14 \pm 0.01$  vs.  $0.12 \pm 0.01$ ,  $p < .05$ ). There were no differences between ATA and HAN in other indicators including carbonyl proteins, superoxide dismutase and catalase activities, nitric oxide, creatine kinase activity.

**CONCLUSION:** Atayal tribe seems to have better capability of anti-lipid peroxidation in response to endurance exercise at altitude and may correlate with stronger non-enzymatic antioxidant capability.

Supported by Taiwan NSC grants 99-2410-H-034-055.

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**2917 Board #189 June 1 9:30 AM - 11:00 AM**  
**Contribution Of Oxygen Cost Of Breathing To Changes In Running Economy After Altitude Training**

Jonathon L. Stickford, Abigail S. Laymon, Daniel P. Wilhite, Joseph W. Duke, Robert F. Chapman, FACSM, *Indiana University, Bloomington, IN.*  
(No relationships reported)

Several studies have documented improvements in running economy following altitude training in elite runners, but the underlying mechanism remains elusive. It has been theorized that the hypoxic stimulus and resulting added ventilation encountered during chronic hypoxic exposure may improve the oxygen cost of breathing upon return to sea level.

**PURPOSE:** To examine the extent to which possible changes in running economy after altitude training can be explained by changes in respiratory muscle oxygen consumption.

**METHODS:** Six elite male distance runners completed a 28-d altitude training intervention at 2150m following a "Live High - Train Low" training model. Prior to altitude ascension, running economy was examined by measuring submaximal oxygen uptake ( $\text{VO}_2$ ) and ventilation ( $\text{V}_E$ ) while running at 16, 18, and 20  $\text{km}\cdot\text{h}^{-1}$  on a treadmill at sea level. The following day, runners performed a eucapnic voluntary hyperpnea test mimicking the same levels of  $\text{V}_E$ , breathing frequencies, and tidal volumes observed during the previous day's running economy test for the determination of respiratory muscle  $\text{VO}_2$  ( $\text{VO}_{2\text{RM}}$ ). The same tests were performed on days 1 and 2 following return from altitude.

**RESULTS:** Running  $\text{VO}_2$  decreased ( $p < .05$ ) at every speed upon return from altitude compared to pre-altitude levels. The change in  $\text{VO}_2$  from pre-to post-altitude was  $0.38 \pm 0.12$   $\text{L}\cdot\text{min}^{-1}$ ,  $0.38 \pm 0.12$   $\text{L}\cdot\text{min}^{-1}$ , and  $0.50 \pm 0.09$   $\text{L}\cdot\text{min}^{-1}$  at 16, 18, and 20  $\text{km}\cdot\text{h}^{-1}$ , respectively. The changes corresponded to a decrease of  $11.0 \pm 3.3\%$ ,  $9.9 \pm 3.0\%$ , and  $11.7 \pm 1.9\%$  from pre-altitude  $\text{VO}_2$  measurements at 16, 18, and 20  $\text{km}\cdot\text{h}^{-1}$ , respectively. No changes from pre- to post-altitude were observed in  $\text{V}_E$  at any speed. Though  $\text{VO}_{2\text{RM}}$  remained unchanged following the altitude training period, mean values trended lower post-altitude. The change in  $\text{VO}_{2\text{RM}}$  accounted for 23.4%, 25.0%, and 27.5% of the improvement in running economy at 16, 18, and 20  $\text{km}\cdot\text{h}^{-1}$ , respectively.

**CONCLUSIONS:** Decreases in the oxygen cost of breathing accounts for approximately one-quarter of the improvement in running economy in elite distance runners after altitude training. The data suggests that the added ventilation with chronic training at altitude acts as an additional training effect for the respiratory musculature, which may contribute to altitude training-mediated performance improvements.

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**2918 Board #190 June 1 9:30 AM - 11:00 AM**  
**Expiratory Flow Limitation Mitigates Increases In Exercise Ventilation In Elite Distance Runners After Altitude Training.**

Joseph W. Duke<sup>1</sup>, Jonathon L. Stickford<sup>1</sup>, Abigail S. Laymon<sup>1</sup>, Daniel P. Wilhite<sup>1</sup>, Timothy D. Mickleborough, FACSM<sup>1</sup>, Joel M. Stager<sup>1</sup>, James Stray-Gundersen, FACSM<sup>2</sup>, Benjamin D. Levine, FACSM<sup>2</sup>, Robert F. Chapman, FACSM<sup>1</sup>. <sup>1</sup>*Indiana University, Bloomington, IN.* <sup>2</sup>*Institute of Exercise and Environmental Medicine, Dallas, TX.*  
(No relationships reported)

Ventilatory acclimatization with chronic exposure to altitude typically results in a gain in the ventilatory response to exercise at any workload. However, a large proportion of elite endurance athletes demonstrate expiratory flow limitation (EFL) during heavy exercise and are thus mechanically constrained from increasing exercise ventilation ( $\text{VE}$ ) at high workloads. Whether EFL mitigates increases in  $\text{VE}$  at sea level, after chronic acclimatization to altitude, is unknown.

**PURPOSE:** To determine if the extent of EFL affects changes in  $\text{VE}$  from pre- to post-altitude in elite distance runners.

**METHODS:** Seventeen elite male distance runners were categorized into flow limited (FL;  $n = 9$ ) and non-flow limited (NFL;  $n = 8$ ) groups based on the percent of the tidal flow-volume loop that met the maximal flow-volume envelope during the final minute of a maximal graded exercise test at sea level (FL =  $51.5 \pm 4.8\%$ ; NFL =  $0\%$ ). Subjects completed 28d of training at moderate altitude (2,150m or 2,500m) using the "Live High-Train Low" model. Prior to and immediately upon return from altitude, subjects performed a maximal graded exercise test to quantify  $\text{VE}$  and maximal oxygen uptake ( $\text{VO}_{2\text{max}}$ ). Isocapnic hypoxic ventilatory response (HVR) was measured pre- and post-altitude. Statistical significance was accepted when  $p < 0.05$ .

**RESULTS:** HVR significantly increased in both FL and NFL after altitude training, demonstrating augmented ventilatory chemoresponsiveness. After altitude training, NFL significantly increased  $\text{VE}$  at 80% ( $107 \pm 5$  vs  $116 \pm 5$   $\text{L}\cdot\text{min}^{-1}$ ), 90% ( $135 \pm 8$  vs  $145 \pm 8$   $\text{L}\cdot\text{min}^{-1}$ ), and 100% ( $165 \pm 10$  vs  $184 \pm 9$   $\text{L}\cdot\text{min}^{-1}$ ) of  $\text{VO}_{2\text{max}}$ . However  $\text{VE}$  did not change in FL after altitude training at 80% ( $103 \pm 2$  vs  $103 \pm 4$   $\text{L}\cdot\text{min}^{-1}$ ), 90% ( $121 \pm 5$  vs  $127 \pm 4$   $\text{L}\cdot\text{min}^{-1}$ ), or 100% ( $161 \pm 6$  vs  $160 \pm 7$   $\text{L}\cdot\text{min}^{-1}$ ) of  $\text{VO}_{2\text{max}}$ . FL did not increase  $\text{VO}_{2\text{max}}$  ( $77.1 \pm 1.5$  vs  $77.7 \pm 1.1$   $\text{mL}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ ) from pre- to post-altitude, whereas NFL demonstrated a significant increase ( $75.5 \pm 1.6$  vs  $79.8 \pm 1.3$   $\text{mL}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ ).

**CONCLUSIONS:** Despite similar increases in ventilatory chemoresponsiveness in both groups, FL did not increase  $\text{VE}$  at any workload following altitude training. This is likely due to mechanical constraints imposed by expiratory flow limitation, which may hold implications for training and exercise performance during and after altitude training.

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**2919 Board #191 June 1 9:30 AM - 11:00 AM**  
**Ventilatory Mechanics During Maximal Exercise after Altitude Training in Elite Distance Runners**

Daniel P. Wilhite, Abigail S. Laymon, Jonathan L. Stickford, Joseph W. Duke, Joel M. Stager, Timothy D. Mickleborough, FACSM, Robert F. Chapman, FACSM, *Indiana University, Bloomington, IN.*  
(No relationships reported)

Ventilatory acclimatization with chronic altitude training typically manifests as an increase in both peripheral chemoreceptor sensitivity and exercise ventilation ( $\text{VE}$ ). However, many elite distance runners experience mechanical limitations to  $\text{VE}$  at high work rates, affecting operational lung volumes. How ventilatory acclimatization affects ventilatory mechanics after altitude training has not yet been characterized.

**PURPOSE:** To determine the effect of 28 days of 'live high-train low' (LHTL) altitude training on measures of ventilatory mechanics during exercise in a group of elite distance runners.

**METHODS:** Six elite male distance runners ( $\text{VO}_{2\text{max}} = 79.5$  ml/kg/min) completed a 28 d LHTL altitude training intervention at 2150m. All testing procedures took place in the week prior to departure, and again 1-2 d after returning to sea-level. For each session, subjects completed an isocapnic hypoxic ventilatory response (HVR) test, followed by a graded treadmill exercise test to exhaustion.  $\text{VE}$ , tidal volume, breathing frequency, degree of expiratory flow-limitation (EFL), end-expiratory lung volume, end-inspiratory lung volume, and duty cycle were measured during the last minute of the maximal exercise test. Subjects with 50% or more EFL were considered flow-limited.

**RESULTS:** During maximal exercise, 5 of the 6 subjects were flow-limited ( $59 \pm 7\%$ ). From pre- to post-altitude training, the HVR slope significantly increased ( $p < .05$ ) from 0.34 to 0.75  $\text{L}/\text{min}/\%\text{SaO}_2$ , indicating an increase in ventilatory chemoresponsiveness. However, there was no significant change ( $p > .05$ ) in  $\text{VE}$  from pre- to post-altitude ( $157.3 \pm 11.1$  to  $158.7 \pm 16.8$   $\text{L}/\text{min}$ ). Additionally, there were no significant changes ( $p > .05$ ) in lung volumes or values for variables describing ventilatory mechanics after altitude training.

**CONCLUSIONS:** The inability of altitude-mediated ventilatory acclimatization to manifest as an increase in  $\text{VE}$  during maximal exercise in the elite runners is likely due to the high number of flow-limited subjects in our sample. The absence of a change in operational lung volumes, despite a strong increase in ventilatory chemoresponsiveness, may reflect a balance between a mechanical limitation to expiratory flow production at lower lung volumes and the minimization of inspiratory muscle work at higher lung volumes.

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2920 Board #192 June 1 9:30 AM - 11:00 AM

**Effect Of Altitude Training At 1800m For Four Days On Ventilatory Chemosensitivity**

Takahide Kato<sup>1</sup>, Masataka Nakano<sup>2</sup>, Takamasa Mizuno<sup>3</sup>, Toshiyuki Ohya<sup>3</sup>, Takaaki Matsumoto<sup>3</sup>. <sup>1</sup>Toyota National College of Technology, Toyota, Japan. <sup>2</sup>Aichi Toho University, Nagoya, Japan. <sup>3</sup>Chukyo University, Toyota, Japan. (Sponsor: Kaoru Kitagawa, FACSM)  
(No relationships reported)

Chronic high altitude exposure leads to an increase in hypoxic ventilatory response (HVR), as an index of the ventilatory chemosensitivity to hypoxia. Moreover, recent study has shown that HVR increased after three nights in hypoxic exposure at 2650m. In Japan, most of altitude training is performed in 2000m or less. However, no study has been made to clarify the changes in ventilatory chemosensitivity for short-term exposure at an altitude of less than 2000m. Two nights in hypoxic exposure at 1800m elevated ventilation during exercise, although this experiment did not show the changes in HVR2). Therefore, we hypothesized that short-term exposure at an altitude of less than 2000m may increase HVR. It is expected that to clarify the hypothesis will provide a novel impact on Japanese altitude training.

**PURPOSE:** In field work, the purpose of this study was to investigate the effect of altitude training with short-term exposure at 1800m on ventilatory chemosensitivity.

**METHODS:** Five males and one female student endurance runners (mean age = 16.5 ± 1.0 years) participated in this study. Subjects carried out altitude training at 1800m for four days including three nights in a row. In order to estimate a changes in ventilatory chemosensitivity, HVR and hypercapnic ventilatory response (HCVR) were measured three times in each subject; 1) before altitude training (Pre) ; 2) after altitude training (Post); 3) one week after the cessation of altitude training (De).

**RESULTS:** HVR increased after altitude training (0.259 ± 0.093 l/min/% Pre, 0.544 ± 0.306 l/min/% Post, 0.370 ± 0.242 l/min/% De) (P< 0.05). HCVR didn't change after altitude training (1.408 ± 0.575 l/min/torr Pre, 1.672 ± 0.408 l/min/torr Post, 1.637 ± 0.391 l/min/torr De).

**CONCLUSION:** These results show that altitude training at 1800m for four days raise hypoxic chemosensitivity, but not affect hypercapnic chemosensitivity.

**REFERENCES** 1) Townsend NE et al. J Appl Physiol 93: 1498-1505, 2002

2) Racinasis S et al. J Strength Cond Res 24: 985-91, 2010

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2921 Board #193 June 1 9:30 AM - 11:00 AM

**When Posture is Controlled, Acute Hypoxia does not Decrease Core Temperature**

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(No relationships reported)

It has been reported that acute hypoxia causes a reduction in core temperature in humans. It was hypothesized that this occurs due to both a decrease in metabolic rate and an increase in skin blood flow. However, other studies have found that core temperature decreases with changes in posture. The methods in previous studies finding hypoxia to decrease core temperature did not control for postural changes.

**PURPOSE:** Thus, further examination is warranted to examine the effect of hypoxia on core temperature while controlling for posture change.

**METHODS:** Ten healthy adults, between the ages of 18 and 45 were recruited to participate. Subjects completed one trial consisting of breathing normoxic air (20.9%) for a 2 hour period and hypoxic air for a 1 hour period, while systematically changing posture. During this time core temperature and skin blood flow were recorded every 5 minutes.

**RESULTS:** Mean core body temperature significantly (p < 0.05) decreased by 0.4 °C when the subjects transitioned from a standing to lying position. However, acute hypoxia, which reduced the mean oxygen saturation to 85%, did not significantly affect core temperature.

**CONCLUSION:** Such results suggest that when posture is controlled, acute hypoxia does not significantly decrease core body temperature. Thus, the results of previous studies that have reported decreases in core temperature with acute hypoxia, but failed to control for posture, need to be questioned.

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2922 Board #194 June 1 9:30 AM - 11:00 AM

**Effect of Acute Hypoxia on Exercise-Induced Blood Oxidative Stress**

Graham R. McGinnis<sup>1</sup>, Brian Kliszczewicz<sup>1</sup>, Matthew Barberio<sup>1</sup>, Christopher Ballmann<sup>1</sup>, Bridget Peters<sup>1</sup>, John Cuddy<sup>2</sup>, Dustin Slivka<sup>3</sup>, Charles Dumke, FACSM<sup>2</sup>, Brent Ruby, FACSM<sup>2</sup>, John Quindry, FACSM<sup>1</sup>. <sup>1</sup>Auburn University, Auburn, AL. <sup>2</sup>University of Montana, Missoula, MT. <sup>3</sup>University of Nebraska, Omaha, NE.

(No relationships reported)

Hypoxia has been characterized by decrement in exercise performance or decreased maximal workload. Exercise and exposure to altitude have been shown to elicit cellular hypoxia independently and combined. Similarly, these stimuli also elicit perturbations in redox balance.

**PURPOSE:** The purpose of this study was to examine the effect of hypobaric chamber-simulated-hypoxia on exercise induced blood oxidative stress at variable relative intensities.

**METHODS:** Physically active males (n=12) completed 2 graded exercise tests on an electronically braked cycle ergometer starting at 95 W, increasing 35 W every 3 min until volitional fatigue or cadence < 50 rpm. VO<sub>2</sub>peak and Wmax were measured at low altitude (975m, "lowALT") and high altitude (3000m, "highALT") simulated in a hypobaric chamber. Wmax at both altitudes was used to program workloads for subsequent trials. In a randomized counterbalanced cross-over design, subjects completed 3, 60 min exercise bouts at combinations of lowALT or highALT at workloads corresponding to 60 percent VO<sub>2</sub>peak measured at 975m or 3000m (lowINT and highINT, respectively). The conditions were paired: lowALT:highINT, lowALT:lowINT, and highALT:lowINT. Subjects remained in the ambient altitude for 4 hr recovery. Blood was drawn from the antecubital vein pre-, 0, 2 and 4 hours post exercise and analyzed for biochemical markers of oxidative stress. Samples were assayed for Ferric Reducing Ability of Plasma (FRAP), Trolox Equivalent Antioxidant Capacity (TEAC), Lipid Hydroperoxides (LOOH) and Protein Carbonyls (PCs). Results were adjusted for plasma volume shift and were analyzed with repeated measures ANOVA, significance set at p < 0.05.

**RESULTS:** LOOH were elevated in highALT:lowINT group immediately post and 2HR post. highALT:lowINT was significantly elevated from lowALT:highINT at 2HR post. Main effects were seen in FRAP (for TRIAL, lowALT:highINT vs. lowALT:lowINT), PCs (for TIME), LOOH (for TRIAL and TIME) and TEAC (for TIME).

**CONCLUSIONS:** These results suggest that acute hypoxia induced by hypobaric elevation increases the oxidative stress response during exercise. Funded by USAMR&MC #W81XWH-10-2-0120 to B Ruby

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**E-33 Free Communication/Poster - Interventions to Increase Physical Activity in Children**

JUNE 1, 2012 7:30 AM - 12:30 PM

ROOM: Exhibit Hall

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2923 Board #195 June 1 11:00 AM - 12:30 PM

**Health-Related Fitness Program, Health Content Knowledge and Physical Activity Levels in Elementary School Students, Taiwan**

Mei-Yao Huang<sup>1</sup>, Chun-Chieh Kao<sup>2</sup>, Chien-Chih Chou<sup>3</sup>. <sup>1</sup>National Taiwan Sport University, TauYao, Taiwan. <sup>2</sup>Ming Chuan University, TauYao, Taiwan. <sup>3</sup>Taipei Physical Education College, Taipei, Taiwan.

(No relationships reported)

One area of major concern related to physical inactivity is the rapid increase in obesity among child and adolescent. According to the United Nations (2011), 26.8 percent of children in Taiwan between the ages of 6-12 are obese - the highest number in Asia. This trend is of particular concern because obesity has been identified as a key determinant of cardiovascular risk in the adult population.

**PURPOSE:** The purpose of this study was to determine whether or not the Hart Power educational curriculum affected the health content knowledge and physical activity levels of elementary children.

**METHODS:** Two certified elementary physical education teachers and their students (n= 180) at two different schools in Taiwan participated in the study. One teacher and school were involved as a treatment group and received the health-related fitness program for ten weeks which was adapted from American Heart Association's Heart Power educational curriculum that is a descendant of the Heart RX Program developed in 1985. The other used as a comparable group and receive a traditional physical education. The Heart Health Cognitive Test (HHCT) was used to assess knowledge change in pre-test, post-test, and follow-up test. The System of Observing Fitness Instruction Time (SOFIT) was used to determine student's activity levels.

**RESULTS:** The results indicate a) students who received the health-related fitness program were more knowledgeable than the students who did not received; b) For the physical activity levels, no statistically significant difference was found between two groups.

**CONCLUSION:** Physical education is a class in which children should be able to reach recommended amounts of physical activity for a healthier lifestyle. Teachers may need to modify existing strategies and curriculum models to assist students to be physically active as recommended for that healthy lifestyle. It is unknown how the Healthy People 2012 objectives will impact physical education, but many policy makers now are aware of the benefits of regular physical activity. Meanwhile, if schools are to carry the major responsibility for activity promotion for youth, changes will need to be made. These changes could increase the frequency and length of physical education classes, or provide the after school program to enhance their level of physical activity.

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**2924** Board #196 June 1 11:00 AM - 12:30 PM  
**Characteristics Associated With Risk Factor Reduction Following Heart Health Intervention In Urban Teenagers**

Paul S. Fardy, FACSM, Henry Wang, Ann Azzolini. *Queens College, Flushing, NY.*  
(No relationships reported)

Early onset of coronary disease (CD) and risk factors (RF) make a compelling case for school-based intervention. High prevalence of CD and RF in African American and Latino adults illustrates a special need for early intervention in these populations.

**PURPOSE:** To determine characteristics associated with RF reduction in urban teenagers following a school-based heart health program, Physical Activity and Teenage Health (PATH).

**METHODS:** Five hundred thirty-one female and three hundred forty-seven male subjects were tested in three New York City high schools before and following twelve weeks intervention consisting of exercise and health education taught within the schools' physical education curriculum. RF measures included body mass index (BMI), % body fat (BF), systolic (Sp) and diastolic (Dp) blood pressures at rest, total cholesterol, cardiovascular fitness (CVF), habitual physical activity (PA), and cigarette smoking. Pre to post changes were determined by gender for each RF and were divided into four groups according to the magnitude of change: (1) mean to +1sd, (2) +1 to +2sd, (3) mean to -1sd, (4) -1 to -2sd. The following characteristics were then evaluated in relation to magnitude of RF change: SES and pre-intervention BMI, BF, PA, CVF, heart health knowledge, and self perception of health. Means of each characteristic were calculated for each of the four groups on each RF. Mean differences were assessed by ANOVA and Tukey multiple range test.

**RESULTS:** Significant RF reduction ( $P<0.05$ ) was observed for boys and girls in Sp, Dp, BF, BMI and CVF. Magnitude of RF reduction was associated with pre-intervention PA, CVF, BMI and BF.

**CONCLUSION:** Greatest RF reduction was consistently observed in subjects who were least active, least fit, and most overweight. Findings are important in developing intervention program strategies for urban teenagers and illustrate the need for varying teaching methods according to fitness and fatness.

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**2925** Board #197 June 1 11:00 AM - 12:30 PM  
**Impact Of After School Fitness And Mentoring Program On Gpa In Latino Middle School Students.**

Paula E. Papanek, FACSM. *Marquette University, Milwaukee, WI.*  
(No relationships reported)

The Youth Empowered to Succeed program (YES) was designed to provide afterschool fitness and college mentors to assist with homework and as peer educators to Latino middle school students. The original 6<sup>th</sup> grade cohort consisted of a total of 33 students (18 girls and 15 boys) selected from a single charter school at risk for obesity and/or low academic achievement. After 6 quarters (1.5yrs) 28 of the original 33 remain enrolled and actively participating (85%).

**PURPOSE:** To determine the impact of moderate and vigorous daily fitness programing and mentoring on overall academic achievement as indicated by cumulative GPA in Latino middle school students.

**METHODS:** Exercise physiology students developed and implemented daily training protocols with 6 wk macrocycles focusing on aerobic, lower extremity strength, power or cross-training/game-like activities under the guidance of faculty. Training consisted of 1 hour daily/5 days per week with most students participating at least 3 days per week then 1 hour of academic mentoring. Boys and Girls were trained and mentored separately. Training consisted of body weight support, med ball, game simulations, plyometric based programing that emphasized a sense of play including relays. Annual measurements included PACER, sit-ups, curl-ups, broad jump, and hand grip dynamometry to progress programs and provide feedback to individual students. De-identified and coded GPA data was provided by the school and analyzed by ANOVA  $p<0.05$ .

**RESULTS:** Age matched control students (not enrolled in YES) (N=33) demonstrated a progressive and statistically significant drop in cumulative GPA over the 1.5 yr of the study ( $2.66 \pm 1.13$  to  $2.46 \pm 1.17$  mean  $\pm$  stdev) while the YES cohort (N=28) maintained cumulative GPA over the duration ( $2.62 \pm 0.95$  to  $2.77 \pm 0.87$ ).

**CONCLUSION:** A combined fitness and mentoring program by college students completely offset the drop in academic performance in Latino middle school students as measured by GPA. Supported by DHHS/OMH. 1 YEPMP090044-02

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**2926** Board #198 June 1 11:00 AM - 12:30 PM  
**Girls Learning Interrelated Techniques Targeting Environmental Risks (GLITTER): Feasibility of a Pilot Obesity Intervention**

Michelle B. Stockton<sup>1</sup>, Barbara S. McClanahan<sup>1</sup>, Tammy Overacker<sup>2</sup>. <sup>1</sup>University of Memphis, Memphis, TN. <sup>2</sup>University of Arkansas, Fayetteville, AR. (Sponsor: Heather Chambliss, FACSM)  
(No relationships reported)

**PURPOSE:** Preadolescent girls are a priority population for obesity prevention efforts. The purpose of this study was to determine the feasibility of a multi-systemic home-based behavioral intervention targeting the prevention of excessive weight gain in girls aged 8-10 years.

**METHODS:** A one-group pre-test/post-test design was used to determine the feasibility and efficacy of a multi-component home-based 12-week intervention targeting obesity in girls. The objective of the intervention was to determine how obesity made sense for each girl by systematically evaluating the socioecologic factors that influence body mass index (BMI), diet, and physical activity and to tailor the strategies for change to specific identified needs. The primary outcomes were BMI %ile and body fat percent at 6-months of follow-up. Secondary outcomes were diet and physical activity behaviors.

**RESULTS:** Of the 18 girls and families recruited, 14 completed the study (78% retention rate). At baseline, the girls were an average age of 9.6 years (SD = 0.6) and had an average BMI of 25.7 kg/m<sup>2</sup> (SD = 4.8). At 6 months' follow-up, average BMI percentiles decreased from the 94<sup>th</sup> to the 92<sup>nd</sup> percentile and body fat percent decreased from 39.3% to 38.02%. Although changes were in the desired direction, the differences in pre/post BMI percentile and body fat percent were not significant ( $p = 0.31$ ;  $0.45$  respectively). Diet and physical activity behaviors changed in the expected direction. Physical activity levels increased from 3.1(SD = 1.9) days of physical activity per week to 3.4 (SD = 1.7). There was also an increased consumption of fruits and vegetables and a decreased consumption of junk food. All of the parents reported that they enjoyed the program, their health promotion specialist, and the convenience of the home-based program. Parents also reported a high satisfaction with the amount of sessions and phone calls. Overall the parents indicated that the program helped them become aware of diet and physical activity behaviors necessary and specific to their daughter and family.

**CONCLUSIONS:** This home-based intervention targeting girls and their families is a promising and feasible obesity prevention program. Specifically, identifying multi-levelled strategies of 'best fit' for the families appears to have impact on the health of the girls.

2927 Board #199 June 1 11:00 AM - 12:30 PM

**Group Randomized Trial Of A Novel Physical Activity Program To Increase Physical Fitness And Motor Skills In Children**

Louise A. Kelly, Antonio S. McNeil, Brittany Kennedy, Blake Carney, Andrew Atkins, Malcolm Mostoles, Welsh Welsh, Spencer Wendt, Kathryn Wallace, Emily Hnath, Marcus McKinnon. *California Lutheran University, Thousand Oaks, CA.*

(No relationships reported)

**PURPOSE:** To compared changes in physical fitness, motor skill performance and body composition after a modified 8-week novel structured physical education program “Gameday” when disseminated in teacher lead format (TL), a physical education specialist format (PESL) versus a control (C).

**METHODS:** 8-week single blinded group randomized trial, 217 children (age 4.2 ±0.2) were randomly assigned to 1) Control (C;n= 47); 2) Teacher Led physical activity (TL;n=76), or 3) Physical Education specialist led physical activity (PESL;n=94). Participants in the TL and the PESL groups received 100 minutes of physical activity per week. The C received standard curriculum over the same period. The following were measured pre and post intervention: Level of motor skill was assessed using the 11-point Movement Assessment Battery for Children. Physical Fitness was assessed using the Fitnessgram®. Body composition was assessed using BMI, BMI percentiles and waist/hip circumference. ANCOVA with post-hoc pairwise comparisons assessed Across intervention group effects.

**RESULTS:** A significant overall intervention effect was found for trunk lift (P<0.01), sit and reach (P<0.01), kick (P=0.008), ball bounce (P=0.007), leap (P=0.004), punt (P<0.001), and Two - hand strike (P=0.039).

**CONCLUSIONS:** The Gameday program appears promising as a population-based approach to increasing physical fitness and enhancing motor skills performance in children.

2928 Board #200 June 1 11:00 AM - 12:30 PM

**High-intensity Training And Cardio-metabolic Risk Marker Changes In Adolescents: Project FFAB (Fun Fast Activity Blasts)**

Kathryn L. Taylor<sup>1</sup>, Alison L. Inner<sup>1</sup>, Liane B. Azevedo<sup>1</sup>, Susan Bock<sup>2</sup>, Alan M. Batterham, FACSM<sup>1</sup>. <sup>1</sup>*Teesside University, Middlesbrough, United Kingdom.* <sup>2</sup>*Durham University, Durham, United Kingdom.*

(No relationships reported)

Low-volume, high-intensity exercise holds promise for cardio-metabolic health promotion, but sustainable interventions must be practical and engaging.

**PURPOSE:** To determine the impact of a school-based, high-intensity exercise intervention on cardio-metabolic risk markers in 13-15 year olds.

**METHODS:** We recruited 102 adolescents (64 male) from four schools. In an exploratory controlled before-and-after design, two schools were assigned to the Intervention condition (n=41) and two to the Control (n=61), matching for socioeconomic status. The intervention comprised four sets of 45 s maximal effort exercise (boxing, dance, soccer and basketball drills) with 90 s rest between sets, up to three times a week for 10 weeks. The number of sets was increased by one every two weeks. Control group participants maintained their usual routine. Outcomes (before and after) were blood lipids and glucose, waist circumference, C-reactive protein, blood pressure, physical activity levels (7-day accelerometry; Evenson cutpoints), aerobic fitness (multistage fitness test), and carotid artery intima-media thickness. The difference in the change from baseline (intervention minus control) was estimated for each outcome, with sex, the baseline value, and maturity offset as covariates. Triglyceride values were first log-transformed prior to analysis. We adopted a magnitude-based inferences framework, calculating the probability (Q) that the true population effect was greater than the minimum important difference (Cohen’s d of 0.2 standard deviations).

**RESULTS:** Compliance was indicated by 75% of the intervention group completing at least 70% of the scheduled sessions. There was a mean reduction (intervention vs. control) in triglycerides of 24% (90% confidence interval, 11 to 35%). The probability (Q) that the true population effect was greater than the minimum important difference was 0.96 - “very likely to be” important. Mean waist circumference reduced by 2.7 cm (1.4 to 4.1 cm) - “likely to be” important (Q = 0.78). Mean daily moderate to vigorous physical activity increased by 14.3 minutes (-0.4 to 28.9 minutes; “likely to be” important, Q = 0.84). There was no substantial effect on any other outcome.

**CONCLUSION:** Interventions of this type might be feasible for targeting aspects of cardio-metabolic health in adolescents.

2929 Board #201 June 1 11:00 AM - 12:30 PM

**High Intensity Aerobic Training Improves Quality Of Life In Obese Adolescents**

Mara C. Lofrano-Prado<sup>1</sup>, James O. Hill<sup>2</sup>, Humberto Jose G. Silva<sup>3</sup>, Larissa S. Albuquerque<sup>3</sup>, Lisianny C. Nascimento<sup>3</sup>, Wagner L. Prado<sup>3</sup>. <sup>1</sup>*Federal University of Pernambuco, Recife, Brazil.* <sup>2</sup>*University of Colorado, Denver, CO.* <sup>3</sup>*University of Pernambuco, Recife, Brazil.*

(No relationships reported)

Obesity has adverse physical, social and psychological consequences that can negatively affect quality of life (QOL). However, nowadays data regarding to the effects of exercise intensity on QOL in obese adolescents are limited.

**PURPOSE:** To verify the effects of aerobic training intensity on QOL in obese adolescents submitted a 12 weeks of multidisciplinary intervention.

**METHODS:** Sample size was composed by 36 obese adolescents (15.46±1.56y). BMI 34.48±3.88kg/m<sup>2</sup>, from both genders, enrolled in multidisciplinary therapy (physical, psychological, nutritional and clinical). Adolescents were randomly allocated in two experimental groups - Low exercise intensity - subjects exercised on a treadmill at intensity corresponding to 20% bellow ventilatory threshold I (VTI); High exercise intensity - subjects exercised on a treadmill at VTI intensity. All exercise sessions were isocaloric (350Kcal) and 3 times each week. QOF was assessed by Generic Questionnaire for Evaluation of Quality of Life ‘Medical Outcomes Study SF-36’. Data were analyzed by means of scores and compared by two-way ANOVA, and Duncan’s test as post-hoc.

**RESULTS:** Both exercise intensities decreased body mass, body mass index and fat mass and increased fat free mass (p≥0.00). Table 1 shows the domains of QOF.

Table 1: Effects of aerobic training intensity on QOL in obese adolescents

|       |                           | Low Intensity |             | High Intensity |              |
|-------|---------------------------|---------------|-------------|----------------|--------------|
|       |                           | Pre           | Post        | Pre            | Post         |
| SF-36 | Physical Functioning      | 86.57±12.25   | 92.36±8.87* | 77.94±17.14    | 91.17±13.63* |
|       | Role Physical             | 76.31±33.82   | 88.15±15.29 | 82.35±17.14    | 86.76±26.68  |
|       | Pain                      | 79.00±19.60   | 82.73±18.60 | 78.70±19.29    | 74.47±18.70  |
|       | General Health Perception | 64.84±23.69   | 74.36±18.83 | 67.58±21.49    | 74.94±21.68  |
|       | Vitality                  | 70.00±19.93   | 76.84±13.25 | 62.05±20.99    | 78.23±14.24* |
|       | Social Functioning        | 81.57±22.19   | 88.81±15.53 | 81.61±19.32    | 83.08±22.93  |
|       | Role Emotional            | 77.19±31.53   | 87.71±19.90 | 78.43±35.23    | 88.23±20.21  |
|       | Mental Health             | 76.21±22.80   | 78.73±18.99 | 75.52±18.21    | 84.47±14.13* |
|       | Mean of dimensions        | 77.12±16.46   | 83.71±9.20* | 75.52±14.92    | 82.67±13.97* |

p ≤ .02. \*vs pre. SF-36 - Generic Questionnaire for Evaluation of Quality of Life.

**CONCLUSION:** High intensity aerobic training is more effective than low intensity to improve QOL in obese adolescents. Supported by CNPq Grant (APQ-477955/2009-6).

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## E-34 Free Communication/Poster - Muscle Damage/Injury, Lengthening

JUNE 1, 2012 7:30 AM - 12:30 PM  
ROOM: Exhibit Hall

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### 2930 Board #202 June 1 9:30 AM - 11:00 AM

#### Microvascular Perfusion Increases Following Eccentric Exercise Of The Gastrocnemius

Noelle M. Selkow<sup>1</sup>, Daniel C. Herman<sup>2</sup>, Zhenqi Liu<sup>2</sup>, Joseph M. Hart<sup>3</sup>, Jay Hertel, FACSM<sup>3</sup>, Susan A. Saliba<sup>2</sup>. <sup>1</sup>Illinois State University, Normal, IL. <sup>2</sup>University of Virginia, Charlottesville, VA.  
(No relationships reported)

Blood flow during isometric and concentric contractions has been shown to increase substantially in a healthy population immediately following exercise, however microvascular blood flow after eccentric contractions have not been studied. Eccentric contractions cause reversible muscle damage, therefore changes in blood flow could be observed over the inflammatory phase in the first 48 hours following exercise.

**PURPOSE:** To examine the effects of unilateral, eccentric exercise to the gastrocnemius on microvascular perfusion over 48 hours.

**METHODS:** An IV was placed in the antecubital vein for the delivery of the contrast agent (microbubbles) to 18 healthy subjects (3 Males, 15 Females; Age: 22.2 ± 2.2 years; Height: 166.0 ± 11.9 cm; Weight: 69.4 ± 25.0 kg). Subjects performed unilateral eccentric exercises on a randomly selected leg. Heel-lowering exercises were performed off of a step to the beat of a metronome in the sequence of 50 repetitions, 5 minutes rest, 50 repetitions. Microvascular perfusion (blood volume (dB), blood flow (dB/sec), and blood flow velocity (sec-1)) was measured before, immediately (within 5 minutes) and 48 hours after the eccentric exercise using contrast-enhanced ultrasound.

**RESULTS:** Blood volume and flow both significantly increased immediately and 48 hours after exercise (p<.05). Baseline measurements were 5.88 ± 1.33 dB and 2.34 ± 0.41 dB/sec and increased to 12.20 ± 3.31 dB (42%) and 4.53 ± 1.05 dB/sec (80%), respectively after exercise. At 48 hours, compared to baseline, blood volume and flow were still elevated to 9.64 ± 2.53 dB (28%) and 3.74 ± 0.80 dB/sec (54%), respectively. These results yielded high effect sizes immediately (blood volume ES = 2.51 (1.64-3.39) and blood flow ES = 2.89 (1.95-3.82)) and 48 hours after exercise (blood volume ES = 1.86 (1.08-2.64) and blood flow ES = 2.20 (1.37-3.03)). There was no change in blood flow velocity from baseline (.41 ± .06 sec-1) to post-exercise (.36 ± .04 sec-1) and at 48 hours (.38 ± .03) (p>.05).

**CONCLUSIONS:** Following eccentric exercise, we observed an increase in blood flow and blood volume within the microvasculature of the gastrocnemius over 48 hours. Supported by NIH Grant RR00847 and the Curry School of Education at the University of Virginia.

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### 2931 Board #203 June 1 9:30 AM - 11:00 AM

#### Repeated High Force Eccentric Exercise: Effects on Delayed Onset Muscle Soreness, Myoglobin and Creatine Kinase

Emad S. Hassan<sup>1</sup>, H. D. Tabbat<sup>2</sup>, R. B. Al-Tounisi<sup>3</sup>. <sup>1</sup>College of Sport Science and Physical Activity King Saud University, Riyadh, Saudi Arabia. <sup>2</sup>College of Applied Medical Sciences King Saud University, Riyadh, Saudi Arabia. <sup>3</sup>Prince Faisal bin Fahd Sports Medicine Hospitals, Riyadh, Saudi Arabia.  
(No relationships reported)

**PURPOSE:** This study examined the hamstring muscles' ability to adapt to high force eccentric exercise by monitoring the changes in serum Myoglobin (Mb), Creatine Kinase (CK) activity and muscle soreness (using the Visual Analog Scale VAS).

**METHODS:** The study involved fifty four healthy and moderately fit young men from the 23 ± 4 years age group. These were distributed as subjects for three types of experiments with 18 men in each. In experiments I and II (N=18 each) subjects performed two bouts of high force eccentric exercise at the hamstring muscles (by knee extension), while in experiment III they performed four bouts of the exercise. In experiment I, after performing the first bout of exercise, they were split into three subgroups (A, B, and C of six men in each) to perform the second bout after a period of 3, 6, and 9 weeks, respectively. Similarly, in experiment II (the three subgroups D, E, and F), performed the second exercise bout after 1, 2, and 3 weeks, respectively. In experiment III (group G), they performed an additional three exercise bouts spaced 1 week apart. Muscle soreness, serum Mb and CK were measured 6 and 24 hours (prior to, and after) each exercise. The fluid intake of all participants in this study was controlled during the experiments.

**RESULTS:** In experiment I, no significant differences in muscle soreness, serum Mb and CK were found between the first and second bouts. However, in experiment II, a significant decrease in muscle soreness, serum Mb and CK was found on exercise bout 2, in comparison to bout 1 (P < 0.05). In experiment III, muscle soreness, serum Mb and CK were the highest after performing the first bout, while measurements after bouts 2, 3, and 4 were not significantly different from one another.

**CONCLUSIONS:** These results conclude that performance of eccentric exercise results in an adaptation that lasts for a minimum of 3 weeks, with the greatest adaptation occurring after the first bout of exercise.

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### 2932 Board #204 June 1 9:30 AM - 11:00 AM

#### Effects of Repeated Maximum Endurance Strength Exercise on Muscle Damage and Repair

Eisuke Hiruma<sup>1</sup>, Shizuo Katamoto<sup>2</sup>, Masakazu Umimura<sup>3</sup>. <sup>1</sup>Teikyo University, Tokyo, Japan. <sup>2</sup>Juntendo University, Chiba, Japan. <sup>3</sup>Umimura Hospital, Chiba, Japan.  
(No relationships reported)

**PURPOSE:** To determine relationship among muscle damage, recovery and adaptation following repeated bouts of daily muscle endurance exercise in 3 or 7 consecutive days.

**METHODS:** The 40 female subjects (age: 21.1 ± 1.8 yr), had performed in some moderate exercise regularly, were assigned to one (one-group: n=9), three repeated exercise (3-group: n=9) or seven repeated exercise groups (7-group: n=12). This study examined creatine kinase activity (CK), dorsiflexed ankle joint angle (ROM), scale of perceived pain during resting (SPrest), maximum circumference of calf muscle (CCM), isometric muscle strength on lower leg (IMS) and long jumping of one leg (OLJ) in before and after daily exercise for 3 or 7 days of exercise periods. In the exercise period, the subjects performed the maximum calf raise exercise at 1 movement per 2 seconds until the subjects could not maintain the speed of movement. Subjects counted daily walking steps by walking step counter during this study.

**RESULTS:** All subjects walked 7000 to 8000 steps per day. CK after the initial exercise significantly increased (p<0.05) and the peak CK was on Day 4 in three groups, but the recovery times in 3- and 7-group were longer as compared with that in one-group. SPrest (p<0.01) in three groups were significantly elevated from Day 1, and the peak SPrest in one-, 3- and 7-group were on Day 2, Day 3 and Day 4, respectively. OLJ in three groups decreased significantly (p<0.01). OLJ and SPrest in three groups returned to the baseline in 3 days after the peak SPrest. There were no significant changes of IMS and CCM. ROM in each group significantly decreased during each exercise period (p<0.01) and these values did not fully returned. Both indicators of muscle damage after Day 3 were decreased, but these were not recovered during this study.

**CONCLUSIONS:** The results of this investigation suggest that muscle adaptation can be brought by continuous muscle endurance exercise for three or seven days, but the flexibility of muscle was not returned to the initial level during this study. The muscle adaptation alleviates the indicators of muscle damage and muscle function after repeated bouts of daily exercise. The daily walking may effects on swelling.

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### 2933 Board #205 June 1 9:30 AM - 11:00 AM

#### The Effects of Different Passive Warm-Up to Eccentric Exercise on Exercise Performance and Muscle Damage

Chen-Feng Tsai, Hui-mei Lin, Yu-Lin Ning, Kuo-Wei Tseng. Taipei Physical Education College, Taipei, Taiwan.  
(No relationships reported)

**PURPOSE:** To determine the effects of two different modalities of passive warm-up and exercise without warm-up on exercise performance and recovery on muscle damage.

**METHODS:** 16 volunteers were participated in this study (age = 23.88 ± 2.42 y/o), and all of subjects were involved into control group (CON), passive warm-up with heat pack (HP) and



ultrasound diathermy (USD). Each subject processed 30 repeated bouts of eccentric exercise with 80% MVC level after passive warm-up. Serum CK, MVC, ROM and CIR were measured before, immediately after exercise and at 2nd, 4th, 7th, and 10th days post-exercise.

**RESULTS:** CK on 4th day post exercise had significant difference from pre-test in CON ( $2.61 \pm 0.77$  vs.  $2.01 \pm 0.18$ ,  $p < 0.05$ ) and HP ( $2.27 \pm 0.30$  vs.  $1.96 \pm 0.16$ ,  $p < 0.05$ ) groups, but not in USD ( $2.19 \pm 0.26$  vs.  $1.97 \pm 0.19$ ,  $p > 0.05$ ). MVC in CON was lower than HP and USD in each day (fig.1). ROM of elbow joint in all groups showed significant decrease after eccentric exercise ( $p < 0.05$ ), especially the CON. ROM in USD and HP groups showed significant decrease after eccentric exercise only on 2nd day post exercise. There were significant difference between USD and the other two groups on 2nd, 4th, 7th, 10th day.

**CONCLUSION:** USD and HP have better muscle strength and performance than CON. According to the recovery procedure, USD took lesser damage on muscles than HP and CON. USD had lesser swelling **then HP and CON in recovery stage after exercise.**

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**2934 Board #206 June 1 9:30 AM - 11:00 AM**

**Alterations in Neuromuscular Junction Morphology Following Contraction-induced Injury: Exploring Neurological Contributions to Force Loss**

Stephen J.P. Pratt<sup>1</sup>, Chris W. Ward<sup>2</sup>, Sameer B. Shah<sup>3</sup>, Richard M. Lovering<sup>1</sup>. <sup>1</sup>University of Maryland School of Medicine, Baltimore, MD. <sup>2</sup>University of Maryland School of Nursing, Baltimore, MD. <sup>3</sup>University of California San Diego School of Medicine, San Diego, CA. (Sponsor: Ed McFarland, FACSM)

(No relationships reported)

High force lengthening contractions are associated with muscle damage, which is often defined within the context of the assay used to examine it. No one finding can account for the changes in contractility after injury, but considerable attention has been dedicated to myofiber damage in an attempt to understand mechanisms underlying force loss. The neuromuscular junction (NMJ) may display alterations in neuron-dependent changes in synaptic organization.

**PURPOSE:** To compare the NMJ morphology in healthy and injured muscles induced by lengthening contractions.

**METHODS:** We used a recently described injury model. Unilateral injury to the quadriceps was induced by 30 maximal lengthening contractions through an 80° arc of knee motion in Sprague-Dawley rats ( $n=6$ ). Injured and contra-lateral non-injured muscles were prepared for immunolabeling and staining by snap freezing and longitudinal sectioning (50  $\mu$ m), or by perfusion fixation and whole mount. Light microscopy was used to identify cell membranes to ensure that the totality of the sampled NMJs were within the borders of the myofiber. Motor neurons were labeled with anti-neurofilament antibodies. The pre-synaptic NMJ was identified by labeling with SV2 (synaptic vesicles) and the post-synaptic acetylcholine receptors (AChRs) were identified by alpha-bungarotoxin staining. Sections were imaged and analyzed using Image J software to measure total perimeter, total area, stained perimeter and stained area of NMJs.

**RESULTS:** Quadriceps injury was confirmed by a significant loss of isometric torque ( $37 \pm 6\%$ ). This muscle injury resulted in altered NMJ dimensions; both pre- and post-synaptic images demonstrated a less continuous perimeter and a more fragmented appearance. Quantitatively, injury resulted in changes of NMJ total perimeter (decreased 23%), total area (decreased 19%), stained perimeter (decreased 19%), and stained area (increased 7%).

**CONCLUSIONS:** The data show that muscle strain injury causes morphological changes to the NMJs. Due to the short time course used here, changes in NMJ morphology among injured myofibers is likely not due to regeneration or a change in myofiber size. This focus toward the NMJ represents a paradigm shift from more prevalent myocentric perspectives on injury.

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**2935 Board #207 June 1 9:30 AM - 11:00 AM**

**Effect Of NSAID Use On Muscle Injury: A Systematic Review And Meta-Analysis**

Brooke Adler, Laura B. Brown, Kimberly M. Morelli, Gordon L. Warren, FACSM. Georgia State University, Atlanta, GA.

(No relationships reported)

There is debate as to whether non-steroidal anti-inflammatory drug (NSAID) use is beneficial following muscle injury. Some studies have even suggested that NSAID use may be detrimental to the injured muscle.

**PURPOSE:** Conduct a systematic review and meta-analysis of the research literature to determine if NSAID use decreases muscle injury as assessed by soreness, strength loss, and/or blood creatine kinase level.

**METHODS:** Searches for studies testing the effect of NSAID use on muscle injury were performed using 10 electronic databases (e.g., PubMed, Cochrane Library, EMBASE). This yielded 693 studies that were then screened and excluded if they did not meet the following inclusion criteria:  $>5$  on PEDro scale, use of placebo, oral NSAID administration in human studies, injury to skeletal muscle, and outcome measures of soreness, strength, or blood creatine kinase level. Thirty-two peer-reviewed articles were deemed suitable for analysis. Meta-analyses were run using a random-effects model and standardized mean differences (ES) calculated from data extracted from the articles.

**RESULTS:** For all studies and markers combined, NSAID use was found to elicit a significant, small-to-moderate decrease in the markers of muscle injury (overall ES=0.29;  $p=0.003$ ). Because heterogeneity of between-study ES was moderate to large ( $I^2 = 59\%$ ;  $p < 0.001$ ), moderator variables that could potentially explain this heterogeneity were probed using subgroup analysis or meta-regression. The only moderator variable exhibiting a significant effect was the injured muscle's location ( $p=0.004$ ); NSAID use was more beneficial in studies conducted on lower-extremity muscles compared to studies using upper-extremity muscles (subgroup ES of 0.54 vs. 0.01, respectively). No significant effect was found for the following moderator variables: type of outcome measure ( $p=0.49$ ), crossover vs. independent-group studies ( $p=0.54$ ), subject gender ( $p=0.28$ ), human vs. animal studies ( $p=0.81$ ), type of NSAID ( $p=0.39$ ), NSAID dosage ( $p=0.09$ ), duration of NSAID use ( $p=0.86$ ), and when NSAID use began ( $p=0.65$ ).

**CONCLUSION:** Overall, our analysis supports NSAID use for reducing the markers of injury after muscle injury. Additional research is required to determine why NSAID use appears to be more effective when lower-extremity muscles are injured.

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**2936 Board #208 June 1 9:30 AM - 11:00 AM**

**Smokers Exhibit Blunted Changes in Muscle NF $\kappa$ B Activity after Eccentric Exercise**

Nina A. Moore, Stuart R. Chipkin, Priscilla M. Clarkson, FACSM. University of Massachusetts, Amherst, MA.

(No relationships reported)

**PURPOSE:** For unknown reasons, smoking increases the risk for musculoskeletal injury and prolonged healing. We used an eccentric exercise (muscle damaging) model to determine potential mechanisms to explain this risk. Eccentric exercise results in alterations to gene expression leading to muscle regeneration through myogenic signaling. The transcription factor NF $\kappa$ B can stimulate myogenesis through proliferation and differentiation via canonical and non-canonical pathways, respectively. We hypothesized that smokers (SM) would have altered NF $\kappa$ B signaling after eccentric exercise, potentially explaining impaired muscle regeneration and increased risk for injury.

**METHODS:** Healthy, sedentary men, 10 SM and 9 non-smokers (NS) ( $23 \pm 1$  y), performed 100 maximal eccentric contractions with the non-dominant knee extensors (EX). 48h later, muscle biopsies were taken from both legs (vastus lateralis; non-exercised leg served as the control (CON)). A custom-designed PCR array was used to compare mRNA expression between legs. NF $\kappa$ B activity was quantified with antibodies against p65 (canonical) and Rel-B (non-canonical). Data are mean  $\pm$  SEM.

**RESULTS:** Gene expression change after exercise was significantly different between NS and SM in 7 of 44 genes examined. The largest difference between NS and SM was IKK $\alpha$  expression with 2.3-fold upregulation vs -2.0-fold downregulation, respectively ( $p=0.026$ ). Since IKK $\alpha$  can activate NF $\kappa$ B signaling, we quantified NF $\kappa$ B activity. In the CON leg, SM activity was lower than NS for p65 ( $0.023 \pm 0.01$  vs  $0.06 \pm 0.008$  OD) but not Rel-B. In response to exercise NS had reduced p65 signaling ( $0.06 \pm 0.008$  CON vs  $0.01 \pm 0.005$  EX) while SM had no alteration ( $0.023 \pm 0.01$  vs  $0.022 \pm 0.01$ ). Rel-B signaling was increased in NS with exercise ( $0.046 \pm 0.02$  CON vs  $0.067 \pm 0.04$  EX); however, this did not reach significance. SM Rel-B activity was not different with exercise ( $0.044 \pm 0.01$  CON vs  $0.045 \pm 0.01$  EX).

**CONCLUSIONS:** In response to exercise: 1) IKK $\alpha$  mRNA was increased in NS but decreased in SM; 2) p65 activity decreased in NS while there was no change in SM. These data suggest impaired IKK $\alpha$  activation of NF $\kappa$ B p65 pathway and blunted myogenic signaling in SM and may indicate a mechanism through which smoking may impair muscle regeneration. Supported by a grant from the US Army Medical Research and Materiel Command

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2937 Board #209 June 1 9:30 AM - 11:00 AM

**Does A Secondary Loss Of Strength Occur Following Induction Of Muscle Injury?**

Gordon L. Warren, FACSM, Amy K. Farthing, Bemene B. Piaro, Sam R. Coley, Clint W. Satterfield, Chris D. Vlahos, James E. Lewis. *Georgia State University, Atlanta, GA.*

(No relationships reported)

It is known that there is an immediate loss of strength following virtually all types of muscle injury. There is debate as to whether a secondary loss of strength occurs in the ensuing 1 to 3 days. This issue is important to resolve because it can influence if and how these injuries are treated.

**PURPOSE:** Conduct a systematic review and meta-analysis of the research literature to determine if a secondary loss of strength occurs after muscle injury.

**METHODS:** Searches were performed using 4 electronic databases (i.e., PubMed, CINAHL, Cochrane Library, and OpenSigle). Search terms included: skeletal muscle AND (injur\* OR damag\*) AND (strength OR force OR torque). 106 peer-reviewed articles were deemed suitable for analysis. Meta-analyses were run using a random-effects model and standardized mean differences calculated from data extracted from the articles.

**RESULTS:** For all studies combined, a moderate increase in strength was found to occur between immediately post-injury and days 1, 2 and/or 3 post-injury (overall effect size [ES] = 0.40,  $p < 0.0001$ ). Strength was also found to increase progressively from day 1 to day 3 post-injury ( $p < 0.0001$ ; ES of 0.27, 0.50, and 0.65 for days 1, 2, and 3, respectively). Because heterogeneity of between-study ES was large ( $I^2 = 84\%$ ;  $p < 0.0001$ ), moderator variables that could potentially explain this heterogeneity were probed using subgroup analysis or meta-regression. There was no significant difference in overall ES between studies using humans and those using animals ( $p = 0.81$ ). Additionally, there were no significant differences among studies using differing muscle groups ( $p > 0.22$ ). The only moderator variable showing a significant effect was gender ( $p = 0.01$ ); studies utilizing females exhibited a slower rate of strength recovery after injury (overall ES = 0.29) compared to studies using males only (overall ES = 0.55).

**CONCLUSION:** Overall, our analysis does not support the occurrence of a secondary loss of strength following muscle injury. In fact, the data indicate that a significant increase in strength occurs over the first 3 days after injury.

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2938 Board #210 June 1 9:30 AM - 11:00 AM

**Ibuprofen Prolongs Functional Deficits after a Repeated Bout of Downhill Treadmill Running**

Michael S. Green<sup>1</sup>, Tyler D. Martin<sup>1</sup>, Amanda K. Benson<sup>1</sup>, Benjamin T. Corona<sup>2</sup>, Christopher P. Ingalls, FACSM<sup>3</sup>. <sup>1</sup>Troy University, Troy, AL. <sup>2</sup>United States Army Institute of Surgical Research, Fort Sam Houston, TX. <sup>3</sup>Georgia State University, Atlanta, GA.

(No relationships reported)

Non-steroidal anti-inflammatory drugs (NSAIDs) are commonly used to treat symptoms associated with exercise-induced muscle injury. Recent research raises the possibility that NSAIDs could have detrimental effects on the adaptation of muscle in response to repeated damaging exercise bouts.

**PURPOSE:** To determine the effect of NSAID (ibuprofen) supplementation on the adaptive response typically exhibited by skeletal muscle following novel eccentric contractions.

**METHODS:** Twenty-six male ( $n = 8$ ) and female ( $n = 18$ ) subjects (mean values  $\pm$  SD; age =  $22.2 \pm 3.4$  y, height =  $1.68 \pm 0.10$  m, weight =  $71.0 \pm 16.8$  kg, body fat =  $24.5 \pm 8.0$  %) performed two downhill treadmill runs (DTR1, DTR2) separated by 14d. After DTR1 only, subjects received either ibuprofen ( $1,200 \text{ mg}\cdot\text{d}^{-1}$ ;  $n = 13$ ) or placebo (flour;  $n = 13$ ) in a randomized, double-blind, gender-balanced manner for 3d. Maximum voluntary isometric quad strength (MVC) and serum creatine kinase activity (CK) were assessed at baseline, and immediately, 1, 2, and 3d post-DTR1 and DTR2.

**RESULTS:** DTR1 induced a significant and similar degree of lower extremity muscle injury in both treatment groups. Groups combined exhibited  $13.6 \pm 1.3$ ,  $10.6 \pm 1.6$ , and  $6.4 \pm 1.6$  % MVC deficits immediately, 1, and 2d post-injury, respectively, with full recovery 3d post-injury. Also, CK ( $826 \pm 183 \text{ U}\cdot\text{L}^{-1}$ ) peaked for both groups 2d post-injury. Following DTR2, the placebo group exhibited an immediate MVC deficit ( $9.0 \pm 2.0$  %) but was fully recovered 1d post-injury; evidence of the well-established repeated bout effect. Meanwhile, although the ibuprofen group exhibited a similar deficit ( $10.1 \pm 2.0$  %) in MVC immediately post-DTR2 compared to placebo, MVC remained significantly reduced by  $7.3 \pm 2.4$  and  $5.1 \pm 2.3$  % 1 and 2d post-injury, respectively, and did not fully recover until 3d post-injury. Although not affected by treatment condition, CK was lower at all times post-DTR2 compared to post-DTR1.

**CONCLUSION:** Consumption of  $1,200 \text{ mg}\cdot\text{d}^{-1}$  of ibuprofen for 3d following an initial novel bout of eccentric contractions significantly diminished the well-established neuromuscular adaptation (repeated bout effect) that commonly occurs following injurious exercise. Athletes should use caution when utilizing NSAIDs to treat lower extremity muscle pain.

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2939 Board #211 June 1 9:30 AM - 11:00 AM

**Effect Of Kinesiotaping On Muscle Damage Parameters Following Eccentric Muscle Contractions**

Kyu-Wan Lee, Seung-Hwan Kim, Jooyoung Kim, Joohyung Lee. *Kookmin University, Seoul, Korea, Republic of.*

(No relationships reported)

It is well known that repetitive eccentric muscle contractions induce muscle damage. Kinesiotaping has been designed for better blood flow and removal of fatigue materials in athletic performance. Also, it has been claimed to be useful to reduce pain but the mechanism is still unclear.

**PURPOSE:** To investigate the effect of kinesiotaping application on muscle damage markers following eccentric muscle contractions.

**METHODS:** Total 32 healthy males who had not participated within the past 6 months were recruited. Each subject was randomly assigned to either control (CON,  $n=8$ ), treatment only during exercise (KTEXE,  $n=8$ ), treatment during exercise and immediately after exercise (KTEXPO,  $n=8$ ), or treatment during exercise and 24 hour after exercise (KT24,  $n=8$ ). Each subject performed 2 sets of 25 eccentric muscle contractions of the elbow flexors. Measurements included maximal isometric force (MVC), muscle soreness (SOR), range of motion (ROM), and serum creatine kinase activity at pre, post, 24, 48, 72 and 96 hours after exercise.

**RESULTS:** There was a significant group by time interaction in MVC where KT24 had a less decrease in muscle strength and a faster recovery after exercise compared to CON and KTEXE ( $p=0.006$ ). A significant group by time interaction was shown in SOR where KTEXPO and KT24 had lower soreness compared to CON and KTEXE ( $p=0.001$ ). In ROM, there was a significant interaction in flexed arm angle ( $p=0.027$ ) but no significant group by time effect in relaxed arm angle ( $p=0.155$ ). Additionally, a significant group by time interaction was shown in CK activity where KT24 had a lower increase in CK activity compared to KTEXE ( $p=0.043$ ).

**CONCLUSIONS:** Application of kinesiotaping has demonstrated a positive effect on muscle damage markers following eccentric muscle contractions when the treatment was persistent for at least 24 hours compared to short period treatment.

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2940 Board #212 June 1 9:30 AM - 11:00 AM

**Eccentric Contractions of Gastrocnemius Induce Sciatic Nerve Injury in Wistar Rats**

Kihyuk Lee<sup>1</sup>, Koji Kobayashi<sup>1</sup>, Riki Ogasawara<sup>2</sup>, Arata Tsutaki<sup>1</sup>, Eisuke Ochi<sup>3</sup>, Koichi Nakazato<sup>1</sup>. <sup>1</sup>Nippon Sport Science University, Tokyo, Japan. <sup>2</sup>University of Tokyo, Tokyo, Japan. <sup>3</sup>Meiji Gakuin University, Kanagawa, Japan.

(No relationships reported)

Muscle strain injury is considered to be caused by severe eccentric contractions (ECs). In our study on rat gastrocnemius (GST) muscle, we showed that ECs with a larger range of motion and/or faster angular velocity cause functional and histological damage to the muscle. Although GST crush injury not only induces damage in the muscle but also in the nerve, whether ECs of the GST muscle induce nerve tissue injury has not yet been determined. We hypothesized that ECs with faster angular velocity induced connecting nerve damage, as observed during crush injury.

**PURPOSE:** To examine the effects of GST ECs on sciatic nerve by using an animal model.

**METHODS:** Wistar rats were randomly divided into the following 3 groups; control ( $n = 6$ ), fast EC group (FAST; angular velocity:  $180^\circ/\text{sec}$ ;  $n = 12$ ), and slow EC group (SLOW; angular velocity:  $30^\circ/\text{sec}$ ;  $n = 12$ ). Animals in the 2 EC groups were further divided into 2 groups as day 3 and day 7 groups ( $n = 6$  in each group). Twenty ECs were performed using electrical stimulation of the GST and simultaneous forced dorsiflexion of the ankle joint (from  $0^\circ$  to  $45^\circ$ ). For confirming functional deficit, isometric tetanic forces were measured at predetermined

times (i.e., days 1, 2, 3, 5, and 7) after the ECs. On days 3 and 7 after the ECs, the sciatic nerve branches were harvested and analyzed using western blotting. A 2-way ANOVA followed by a post hoc test was performed to compare the isometric tetanic torques and the results of western blotting.

**RESULTS:** A significant torque deficit was observed from days 1 to 7 after the ECs in the FAST as compared to the SLOW (day 1: 13% and day 7: 20% [ $p < 0.05$ ]; day 2: 31%, day 3: 22%, and day 5: 27% [ $p < 0.01$ ]). The level of myelin sheath protein zero (p0) on day 7 FAST was significantly lower than those in the other groups (day 7 FAST vs. day 7 SLOW: 0.2-fold,  $p < 0.05$ ; day 7 FAST vs. day 3 FAST: 0.5-fold,  $p < 0.05$ ). A significantly higher level of macrophage-related protein (ED1) was also observed on day 7 FAST as compared to the day 3 FAST (day 7 FAST vs. day 3 FAST: 2.0-fold,  $p < 0.05$ ). TrkC level in the day 7 FAST was also significantly higher than those in the other groups (day 7 FAST vs. day 7 SLOW: 3.3-fold,  $p < 0.05$ ; day 7 FAST vs. day 3 FAST: 9.6-fold,  $p < 0.05$ ).

**CONCLUSIONS:** The fast ECs of the GST muscle induced myelin sheath damage, macrophage invasion, and TrkC expression in the sciatic nerve, suggesting a nerve injury.

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**2941** Board #213 June 1 9:30 AM - 11:00 AM

**Mild Eccentric Exercise Increases HSP 72 Content In Adult And Late Middle-Aged Rats**

Catherine E. Amara, Evan J. Lewis, Andrew H. Ramsook, Marius Locke. *University of Toronto, Toronto, ON, Canada.* (Sponsor: Ira Jacobs, FACSM)  
(No relationships reported)

Heat Shock Proteins (HSPs) are thought to protect cells from protein damaging stressors by stabilizing denatured or unfolded proteins. In response to the stress of exercise, the ability to increase HSP 72 content has been shown to be intensity-dependent and appears to be diminished with advanced age. Furthermore, HSP 72 content is higher in slow-twitch vs. fast-twitch muscle and might offer increased cellular protection in slow twitch muscle in response to stressors, including aging.

**PURPOSE:** To determine whether a relatively mild exercise stress is sufficient to elicit an increase in HSP 72 content in the vastus intermedius (VI) and white gastrocnemius (WG) and whether this response is similar in adult (A) and late middle-aged (LMA) rats.

**METHODS:** 30 adult (6 months) and LMA (24 months) F344BN rats were divided into groups of 6: control (C), level exercise ( $16\text{m}\cdot\text{min}^{-1}$ ) sacrificed immediately post-exercise (L0) or after 48 hours (L48) and eccentric exercise ( $16\text{m}\cdot\text{min}^{-1}$ , 16 degree decline) sacrificed immediately post-exercise (E0) or after 48 hours (E48). SDS-PAGE followed by Western Blotting was performed to assess muscle HSP 72 content. A nested ANOVA with a Tukey post hoc analysis was used to determine significant difference ( $p < 0.05$ ) between groups.

**RESULTS:** For both age groups and in both muscles, no change in HSP 72 content was observed at L0 or E0. At E48, but not L48, HSP 72 content was increased in the VI for both A and LMA rats compared to level and control groups, respectively, with no differences between age groups observed. Pooled data from both age groups revealed a 20% increase in HSP 72 content at E48 compared with control. We did not detect constitutively expressed or exercise-induced HSP 72 for any group in the WG.

**CONCLUSIONS:** Even mild eccentric exercise is capable of increasing HSP 72 content in the VI and this adaptive response is preserved into late middle-age.

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**2942** Board #214 June 1 9:30 AM - 11:00 AM

**The Effects Of High Powered Laser Therapy On Muscle Repair**

Matthew Christopher Kostek, Diana Delgado. *University of South Carolina, Columbia, SC.*  
(No relationships reported)

**High powered laser therapy is an emerging modality used in rehabilitation; however its effectiveness in enhancing healing skeletal muscle has not been previously investigated.**

**PURPOSE:** The purpose of this study was to determine the effect of high powered laser treatment on markers of muscle damage and repair.

**METHODS:** Male and female subjects ( $n=16$ ) were recruited for this study and underwent a muscle damage protocol standardized in our laboratory. Participants underwent exercise induced muscle damage (20 sets of 10 repetitions of eccentric contractions of the vastus lateralis) using an isokinetic dynamometer. Damage was confirmed by creatine kinase assays (300% increase,  $P < 0.05$ ) and loss of force production ( $\sim 30\%$ ,  $P < 0.05$ ). Forty-eight hours after damage, laser was administered to one leg while the contra-lateral leg served as the control. Six hours after laser treatment, bilateral muscle biopsies were collected from each participant. Biopsies were examined for markers of muscle repair (IGF1 splice variants).

**RESULTS:** Our damage protocol increased IGF1 gene expression ( $2.1 \pm$  fold,  $P < 0.05$ ) while the effects of laser treatment are currently inconclusive. Additional subjects are currently being examined.

**CONCLUSIONS:** Preliminary results suggest that while our damage protocol is effective there is no effect of high powered laser on IGF1 gene expression.

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**2943** Board #215 June 1 9:30 AM - 11:00 AM

**Mesenchymal Stem Cells Contribute to Vascular Growth in Skeletal Muscle in Response to Eccentric Exercise**

Heather D. Huntsman, Carmen Valero, Kai Zou, Nicole Zachwieja, Marni D. Boppart. *University of Illinois at Urbana-Champaign, Champaign, IL.* (Sponsor: Jeff Woods, FACSM)  
(No relationships reported)

Tissue health is critically dependent on vascularization to support growth and function following injury. In addition to multiple implications in the regenerative potential of other tissues, mesenchymal stem cells have been shown to promote vessel formation both *in vivo* and *in vitro*. Our recent work has established that transgenic overexpression of the  $\alpha 7$  integrin in skeletal muscle ( $\alpha 7\text{Tg}$ ) can enhance the presence of Sca-1<sup>+</sup>CD45<sup>+</sup> mesenchymal stem cells (mMSCs) which facilitate myogenesis.

**PURPOSE:** The purpose of this study was to determine the extent to which angiogenesis is increased in  $\alpha 7\text{Tg}$  muscle following acute or repeated bouts of eccentric exercise and elucidate a role for mMSCs in this event.

**METHODS:** mMSCs were isolated from  $\alpha 7\text{Tg}$  muscle by fluorescent activated cell sorting (FACS) and pericyte markers were examined by flow cytometry. Wild type (WT) and  $\alpha 7\text{Tg}$  mice (5 wk) were subjected to single or multiple bouts (3x/wk, 4 wks) of downhill running exercise. Additionally, DiI-labeled mMSCs were injected into WT mice. Measures of angiogenesis and vessel growth were evaluated by immunohistochemistry.

**RESULTS:** A large percentage of isolated mMSCs were positive for pericyte markers. DiI-labeled mMSCs injected into WT muscle migrated to the vascular niche and incorporated directly into vessels. Although capillary: fiber ratio, capillary density and tortuosity index did not increase, the number of large vessels was significantly increased in  $\alpha 7\text{Tg}$  muscle following single and repeated bouts of exercise ( $p < 0.05$ ; 3-fold for repeated bouts) and in WT muscle receiving mMSC transplantation ( $P < 0.05$ ; 48%).

**CONCLUSION:** This study demonstrates that mMSCs contribute to vascular growth in skeletal muscle in response to eccentric exercise, and that this adaptation is coordinated with increased myogenesis previously reported. Well-orchestrated responses similar to this may be a key mechanism in the successful regeneration of several tissue types.

Supported by grants from the National Science Foundation, and the Ellison Medical Foundation.

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**2944** Board #216 June 1 9:30 AM - 11:00 AM

**Differential Expressions Of Tendon-related Markers After Fast/slow Velocity Lengthening Contractions In Rat Gastrocnemius Muscle**

Eisuke Ochi, PhD<sup>1</sup>, Koichi Nakazato, PhD<sup>2</sup>. <sup>1</sup>Meiji Gakuin University, Yokohama, Japan. <sup>2</sup>Nippon Sport Science University, Tokyo, Japan.  
(No relationships reported)

Although muscle strain injury is one of most important issues in sports medicine, there is little known about the molecular events on regeneration process and embryonic formation in vivo injured muscle.

**PURPOSE:** The purpose of this study was to examine the effects of lengthening contractions (LCs) on tendon-related markers signaling pathways. We hypothesized that tendon-related markers are important role for the recovery from muscle injury.

**METHODS:** We employed our originally developed device with two LC modes to modulate the intensity in rat gastrocnemius muscle. Male Wistar rats ( $n = 18$ ) were randomly divided into fast velocity LCs group (FAST, 180deg/s,  $n = 6$ ), slow LCs group (SLOW, 30deg/s,  $n = 6$ ), and control group (control,  $n = 6$ ). The FAST and SLOW rats were anesthetized with isoflurane

(aspiration rate, 450ml/min, concentration, 2.0%). The triceps surae muscle of the right hindlimb was then electrically stimulated with forced isokinetic dorsi-flexion (30°/s and from 0 to 45°). Tissue contents and localizations of tenomodulin, scleraxis, and myostatin were measured by western blotting and immunohistochemistry. The mRNA expression of type I collagen alpha 2 (colla2) and mohawk was evaluated using real time reverse transcriptase polymerase chain reaction. One-way ANOVA was used to compare the body mass, muscle mass, protein and mRNA analysis.

**RESULTS:** No significant changes were observed in both body mass and hindlimb muscles between three groups. The torque was significantly lower in FAST than in SLOW (day2; 59.9±17.2 vs. 101.5±22.9 mNm,  $P < 0.01$ ). Tenomodulin and myostatin and colla2 mRNA showed significantly enhanced expression in FAST than in the other two groups (tenomodulin; ~2.5 fold,  $P < 0.01$ , myostatin; ~3.8 fold,  $P < 0.01$ , colla2; ~8.5 fold,  $P < 0.05$ ). Immunohistochemical staining in FAST, but not in SLOW, was mainly localized in connective tissues between muscle fibers. On the other hands, scleraxis and mohawk mRNA in SLOW was significantly higher than that in control (scleraxis; ~2.7 fold,  $P < 0.01$ , mohawk; ~6.7 fold,  $P < 0.05$ ).

**CONCLUSIONS:** We conclude that fast LCs cause an increase in connective tissue fibrosis through the activated myostatin signaling pathway. In addition, the present results suggest that the severity of LCs-induced damage cause different expressions of tendon-related markers.

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## E-35 Free Communication/Poster - Neuroscience

JUNE 1, 2012 7:30 AM - 12:30 PM  
ROOM: Exhibit Hall

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### 2945 Board #217 June 1 11:00 AM - 12:30 PM

#### Effects Of Cardiorespiratory Fitness On Brain Responses To Visual Food Images

Nero Evero, Laura Hackett, Robert D. Clark, Suzanne Phelan, Todd A. Hagobian. *California Polytechnic State University, San Luis Obispo, CA.* (Sponsor: Andrew Subudhi, FACSM)

(No relationships reported)

High cardiorespiratory fitness is associated with suppressed appetite, but little is known about brain responses to food cues in people of different levels of cardiorespiratory fitness.

**PURPOSE:** To determine the effects of exercise on brain responses to visual food cues in high cardiorespiratory fitness (HF) and low cardiorespiratory fitness (LF) adults.

**METHODS:** After an overnight fast, 14 HF (21.7 ± 4.1 yr, 23.7 ± 3.1 kg/m<sup>2</sup>, 51.4 ± 5.6 ml/kg-min) and 16 LF (22.6 ± 3.6 yr, 23.5 ± 1.8 kg/m<sup>2</sup>, 38.0 ± 4.4 ml/kg-min) healthy individuals completed 60 minutes of high-intensity exercise (83% HR<sub>max</sub>) on a cycle ergometer or 60 minutes of rest (no-exercise) in a counterbalanced, cross-over fashion. Immediately after each condition, blood oxygen level-dependent responses to high-energy food compared to neutral cues (non-food) were measured during an fMRI scan using an ANOVA.

**RESULTS:** In HF relative to LF, high-energy cues compared to neutral cues significantly increased brain activity ( $P < 0.005$ , uncorrected) in regions of the cerebellum (Crus I and lobule 9), superior temporal gyrus and putamen. In the HF group alone, high-energy cues compared to neutral cues significantly increased activation ( $P < 0.005$ , uncorrected) in the precuneus and gyrus rectus and decreased activation in the superior frontal gyrus (medial surface), inferior frontal gyrus (opercular part), middle occipital gyrus and superior parietal gyrus after exercise. In the LF group alone, high-energy cues compared to neutral cues significantly decreased activation ( $P < 0.005$ , uncorrected) in the inferior frontal gyrus (triangular part), orbitofrontal cortex, insular cortex, middle and inferior occipital gyrus, fusiform gyrus and putamen after exercise.

**CONCLUSION:** We observed that cardiorespiratory fitness levels play a role in the effects of exercise on activity in frontal and visual brain regions involved in food processing. These data appear to suggest that LF individuals have a greater suppressive affect in brain regions that regulate appetite.

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### 2946 Board #218 June 1 11:00 AM - 12:30 PM

#### Effects of Parental Physical Activity on Hippocampal Gene Expression in C57BL/6 Mice

Andrew C. Venezia, Lisa M. Guth, Michael P. Marini, Estefan P. Beltran, Espen E. Spangenburg, Stephen M. Roth, FACSM. *University of Maryland, College Park, MD.*

(No relationships reported)

Physical activity has been demonstrated to maintain and enhance cognitive function. The beneficial effects of physical activity appear to be mediated through changes in expression of brain derived neurotrophic factor (*Bdnf*) and insulin-like growth factor 1 (*Igf1*), though the effects of parental voluntary wheel running on the expression of these genes in offspring has not been investigated.

**PURPOSE:** To examine the effect of parental physical activity on offspring's mRNA expression of genes critical for exercise-induced improvement of cognitive function.

**METHODS:** At 8 weeks of age, C57BL/6 mice were individually housed with (PA; n=20) or without (SED; n=20) access to a computer monitored voluntary running wheel for 12 weeks. At 12 weeks, PA males were bred with PA females and SED males bred with SED females (F0 generation); the resultant offspring make up the F1 generation. Mice in the PA condition maintained access to a voluntary running wheel for the duration of breeding, pregnancy (males and females separated), and weaning. After the weaning period, the F1 offspring were housed in sedentary cages regardless of parental condition. At 8 weeks of age, the offspring were sacrificed and hippocampi removed. Total RNA was isolated from the hippocampus and expression of total *Bdnf*, *Bdnf* transcript IV, and *Igf1* mRNA were assessed via quantitative (*Bdnf* & *Bdnf* IV) and gel based (*Igf1*) RT-PCR.

**RESULTS:** During the 12 week pre-breeding period, males and females ran an average of 4206 ± 634 and 5312 ± 637 meters/24 hours, respectively. We found no significant difference in expression of *Bdnf*, *Bdnf* IV, or *Igf1* between the F1 offspring of PA and SED mice.

**CONCLUSION:** These findings indicate that parental voluntary wheel running does not affect offspring neurotrophin and/or growth factor gene expression in the mouse hippocampus.

This work was supported by NIH grant HD062868.

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### 2947 Board #219 June 1 11:00 AM - 12:30 PM

#### The Effect of Endurance Exercise and SIRT Activation on Brain Function on Rats Artificially Selected to High or Low Running Capacity

Zsolt Radak<sup>1</sup>, Linda Sarga<sup>1</sup>, Lauren Koch<sup>2</sup>, Steve Britton<sup>2</sup>, Istvan Boldogh<sup>3</sup>. <sup>1</sup>Semmelweis University, Budapest, Hungary. <sup>2</sup>University of Michigan, Ann Arbor, MI. <sup>3</sup>UTMB, Galveston, TX. (Sponsor: Li Li Ji, FACSM)

(No relationships reported)

**PURPOSE:** Sirtuins are NAD<sup>+</sup>-dependent protein deacetylases and suggested regulators of aging, fat and sugar metabolisms and brain function. Resveratrol, an activator of SIRT1 has been shown to reduce plaque pathology in a transgenic model of Alzheimer diseases, and knock out of this enzyme significantly impair brain function. Here tested the role exercise and resveratrol treatment on brain function on low and high running capacity rats.

**METHODS:** In the present study we tested the effects of resveratrol on rats selectively bred over 24 generations for intrinsic aerobic high running capacity (HRC) or low running capacity (LRC). LRC and HRC animals were supplemented with either vehicle control or resveratrol (1000 mg/kg, oral dosing in every second day) for 4 months. Biochemical measurements were done from the hippocampus.

**RESULTS:** Exercise training over improved balance in both the HCR and LCR animals as measured by rotarod test (10-15% amelioration/groups), while in open field tests, LCR rats supplemented with resveratrol has increased exploratory behavior compared with control group. In the new object recognition LCR rats had better performance compared to HCR animals and opposite was true for long term memory. Histochemistry data showed that resveratrol alone and with exercise increased neurogenesis in both groups. While the acetylation of by 8-oxoguanine DNA glycosylase (OGG1) 8-oxoG repairing enzyme was higher in LCR groups than in HCR animals and this correlated well with the activity of SIRT1. Western blots assays show that acetylated lysine and OGG1 levels were decreased in the resveratrol-fed animal

**CONCLUSIONS:** One of the objective of the study was, to test whether regular training could overcome the health problems caused by genetic setup of LCR rats. Our data show, that regular exercise is a powerful tool to prevent genetics associated metabolic problems. Moreover, our data revealed that resveratrol selectively effects brain performance. It appears that life-style modification, physical activity and/or nutrition beneficially effects physiological performance. The biochemical analysis of hippocampus suggest that some of the beneficial changes in the brain could be mediated through SIRT1, which could included DNA repai

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**2948** Board #220 June 1 11:00 AM - 12:30 PM

**Factorial Validity of Responses to the Post Concussion Symptom Scale (PCSS)**

Scott G. Piland<sup>1</sup>, Kevin K. Byon<sup>2</sup>, Trenton E. Gould<sup>1</sup>, Hyung Lee<sup>2</sup>, Jessica R.D. Mills<sup>2</sup>, Michael S. Ferrara<sup>2</sup>. <sup>1</sup>The University of Southern Mississippi, Hattiesburg, MS. <sup>2</sup>The University of Georgia, Athens, GA. (Sponsor: Michael J. Webster, FACSM)  
(No relationships reported)

The significant role played by self-reported symptoms in the diagnosis and determination of recovery from the brain injury of concussion, accentuates the need for the continual psychometric evaluation of summative self-report symptom instruments. Strength of inferences drawn from composite scores depends upon the quality and quantity of such available validity evidence. A 4-factor measurement model has been suggested, via exploratory factor analysis methods, to describe responses to the Post Concussion Symptom Scale (PCSS).

**PURPOSE:** To confirm the factorial validity of the 4 factor response structure of both non-concussed and concussed athlete responses to the PCSS instrument found within the ImPACT computerized neurocognitive exam.

**METHODS:** Responses from non-concussed (N=908) and concussed athletes (N=146) enrolled at a southeastern Division I institution were used for this retrospective analysis. A total of three separate CFAs (i.e., two CFAs with baseline data sets and one CFA with injured sample) using Maximum Likelihood methods were performed to fit the PCSS model, which was hypothesized as four factors with 22 items (i.e., Migraine, Neuropsychiatric, Sleep, and Cognitive). Several model fit indexes were employed, including  $\chi^2$ ,  $\chi^2/df$ , CFI, and RMSEA.

**RESULTS:** Goodness of fit indexes revealed that the four-factor measurement model did not fit the data well. Values of model fit indices were as follows:  $\chi^2 = 2381.18$  ( $p < .001$ );  $\chi^2/df = 11.73$ ; CFI = .541; RMSEA = .154 (90% CI = .148 - .159). Following model re-specification as guided by modification indices, an analysis using the second subsample demonstrated that again, the measurement model did not fit the data ( $\chi^2 = 2413.02$  ( $p < .001$ );  $\chi^2/df = 11.89$ ; CFI = .516; RMSEA = .154 (90% CI = .148 - .159). Lastly, goodness of fit indices revealed that the injured responses to the PCSS measurement model also did not fit the data ( $\chi^2 = 824.51$  ( $p < .001$ );  $\chi^2/df = 4.06$ ; CFI = .656; RMSEA = .145 (90% CI = .135 - .156).

**CONCLUSION:** Responses of both non-concussed and concussed athletes failed to support the posited four-factor measurement model of the PCSS. Such evidence reduces the strength of inferences that can be drawn from the clinical use of the four symptom clusters and suggest that the summative self-report instrument may require a novel theoretical measurement framework.

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**2949** Board #221 June 1 11:00 AM - 12:30 PM

**Acute Effect Of A Stretching Session On Electroencephalogram And Behavioral Responses In Healthy Young Adults**

Bruno M. Costa<sup>1</sup>, Thiago T. Guimarães<sup>1</sup>, Lucenildo S. Cerqueira<sup>2</sup>, Alessandro O. Carvalho<sup>1</sup>, Fernando A.M.S. Pompeu<sup>2</sup>, Andréa C. Deslandes<sup>1</sup>. <sup>1</sup>Laboratório de Neurociência do Exercício-UGF, Rio de Janeiro, Brazil. <sup>2</sup>Laboratório de Biometria-EEFD-UFRJ, Rio de Janeiro, Brazil.  
(No relationships reported)

The scientific literature shows no studies that have investigated the acute effect of passive static stretching on behavioral and physiological responses. Empirical reports suggest an increased sense of well being after an acute bout of stretching.

**PURPOSE:** The aim of this study was to investigate the acute effect of a stretching session on the cortical activity (EEG), mood and anxiety of young healthy adults.

**METHODS:** Seventeen healthy young men with  $23.52 \pm 2.57$  years old,  $68.9 \pm 11.3$  kg and  $1.72 \pm 0.08$  m (mean  $\pm$  standard deviation) were recruited. The experimental procedure consisted of the evaluation of mood and anxiety through the scales of the Profile of Mood State (POMS) and State and Trait Anxiety Inventory (STAI), and the asymmetry of the EEG alpha frequency band (8 to 13 Hz). It was analyzed the electrode pairs Fp1Fp2, F3F4, F7F8, and P3P4. Evaluations were performed before and immediately after a session of tree sets of 30 seconds of passive static stretching exercises for four different positions involving the major muscle groups, with 30 seconds recovery between the sets.

**RESULTS:** The Wilcoxon test showed significant differences for the POMS factors depression ( $p=0.017$ /  $z=-2.388$ ), fatigue ( $p=0.024$ /  $z=2.257$ ), confusion ( $p=0.036$ /  $z=-2.097$ ) and total mood disturbance ( $p=0.011$ /  $z=-2.536$ ) and showed no significant difference for the abnormal variable Fp1Fp2 ( $p=0.463$ /  $z=0.734$ ). The natural log of the absolute power of alpha frequency band were analyzed by tree way ANOVA and also showed no difference between moments.

**CONCLUSIONS:** The stretching session led to an improvement in mood, but the other variables did not follow the same trend.

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**2950** Board #222 June 1 11:00 AM - 12:30 PM

**Effects Of Exercise During Human Pregnancy On The Newborn's Brain**

Elise Labonte-LeMoyné, Daniel Curnier, Dave Elleberg. University of Montreal, Montreal, QC, Canada. (Sponsor: Francois Peronnet, FACSM)  
(No relationships reported)

**PURPOSE:** Accumulating evidence suggests that an active lifestyle is beneficial for cognition in children, adults and the elderly. Recently, studies using the rat animal model found that maternal exercise during pregnancy has a beneficial influence on the development of the foetal brain (i.e., increased hippocampal neurogenesis) that ultimately leads to functional changes for the newborn rat pups (i.e., better memory and learning abilities). The aim of the present study was to verify if in humans an active lifestyle during pregnancy has an impact on the newborn's brain.

**METHODS:** Twenty-two women are enrolled in the study and were randomly assigned to an active or a sedentary group. The active group was asked to exercise a minimum of 20 minutes, 3 times per week, at a minimal intensity of 55% of their maximal aerobic capacity. The sedentary group did not exercise. Monitoring was done using a daily exercise log with pedometer readings and the periodic wearing of an accelerometer. Other measures taken include a nutrition journal, and pre-pregnancy exercise habits. The effect of exercise during pregnancy on the newborn's brain was investigated 8 - 12 days post partum by means of the mismatch negativity (MMN), a neurophysiological brain potential that is associated to auditory sensory memory and measured with electroencephalography. Mann-Whitney test was used to investigate statistical significance of results.

**RESULTS:** No significant difference was found between the two groups for mean amplitude ( $P > 0.5$ ). On the other hand, mean median latency at the left and right fontal locations (F3 & F4) was significantly slower for the babies of the active mothers (258ms.) than the babies of the sedentary mothers (180 ms.). ( $z=-2.324$ ,  $p=0.20$ ).

**CONCLUSION:** These findings suggest that exercise during pregnancy has an impact on the development of the newborn's brain.

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**2951** Board #223 June 1 11:00 AM - 12:30 PM

**Brain Imaging During Exercise- Comparison of Electroencephalography and Near-Infrared Spectroscopy**

Vera Abeln<sup>1</sup>, Christopher D. Askew<sup>2</sup>, Tobias Vogt<sup>1</sup>, Stefan Schneider<sup>1</sup>. <sup>1</sup>German Sport University, Cologne, Germany. <sup>2</sup>School of Exercise and Nutrition Sciences, Queensland University of Technology, Brisbane, Australia. (Sponsor: Romain Meeusen, FACSM)  
(No relationships reported)

During the past decade, near-infrared spectroscopy (NIRS) has been used as a surrogate method to monitor changes in brain activity during exercise. Other more direct brain-imaging methods, such as fMRI, are not feasible because of the motion restrictions required for optimal imaging. Recently, new developments have enabled brain imaging of exercising subjects via electroencephalography (EEG) (Brümmer et al., 2011). While both methods, NIRS and EEG, are reported to be sensitive to cortical activation during exercise, the relationship between these two brain-imaging methods is still questionable.

**PURPOSE:** To compare changes in cortical activity measured by NIRS and EEG in parallel during an incremental bicycle test.

**METHODS:** 32-channel EEG and 4-Channel NIRS were applied to record electrocortical and hemodynamic changes within the brain during an incremental bicycle exercise test of 10 healthy subjects ( $26 \pm 6.0$  yrs). The incremental exercise protocol commenced at 50 W and increased by 50 W every five minutes until subjective exhaustion. EEG and NIRS were recorded prior,

during and post-exercise. For EEG, low-resolution brain electro magnetic tomography (LORETA) was used to localize changes of electrocortical activity within the left and right prefrontal and parietal cortex. Oxygenated hemoglobin concentration (O2Hb) and the oxygenation index (HbDiff) within the same brain areas were analyzed using NIRS.

**RESULTS:** Electrocortical activity within prefrontal and parietal brain regions showed increases with exercise intensity and decreases post-exercise. Prefrontal O2Hb and HbDiff increased with increasing exercise intensity, but showed no change (O2Hb left + right, HbDiff right) or even a further increase (HbDiff left) following exercise. O2Hb increased within parietal regions during and post-exercise, whereas HbDiff first increased but then decreased from the 2nd last to the last measurement during exercise and increased again following exercise.

**CONCLUSION:** Localized EEG activity and NIRS derived O2Hb and HbDiff levels responded differently during incremental bicycle exercise. This indicates that NIRS activity may not accurately reflect electrocortical activity and that brain NIRS data during exercise should be interpreted with caution.

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**2952** Board #224 June 1 11:00 AM - 12:30 PM

**Cortical Current Density Oscillations In The Motor Cortex Are Correlated With Muscular Activity During Pedaling Exercise**

Stefan Schneider<sup>1</sup>, David Rouffet<sup>2</sup>, Francois Billaut<sup>2</sup>. <sup>1</sup>German Sport University, 50933 Koeln, Germany. <sup>2</sup>Victoria University, Melbourne, Australia.

(No relationships reported)

**PURPOSE:** Despite modern imaging techniques, assessing and localizing changes in brain activity during whole-body exercise is still challenging and has not been attempted successfully so far.

Using an active electroencephalography (EEG) system in combination with source localization algorithms and EMG recordings, this study aimed to assess, display and localize changes in brain cortical activity and to correlate these oscillations with oscillating electromyography (EMG) activity during pedaling exercises at moderate and high intensities.

**METHODS:** Experienced cyclists volunteered for this study. The task consisted of a standardized warm up followed by cycling bouts of ~2 min at 1, 2, 3, 4 and 5 W.kg<sup>-1</sup> at 90 rpm and interspersed by sufficient recovery to limit fatigue. EEG activity was recorded on 32 sites across the motor cortex (M1). Surface electromyography (EMG) activity was recorded from 14 lower-limb muscles. EEG and EMG patterns were time normalized to describe simultaneous changes in brain and muscle activity within the pedaling cycle. Averaging 100 cycles at different power outputs revealed a high correlation between the changes in muscular activity in the lower limbs and oscillations in cortical current density (CCD) within M1 (MNI 0/-40/60).

**RESULTS:** With increasing exercise intensity a linear increase in cortical current density in M1 as well as in EMG activity was noticeable, whereas activity patterns remained comparatively stable across different exercise intensities. Furthermore oscillations showed a clear and highly significant correlation between cortical activity within M1 and EMG activity when applying a latency of 30-50ms.

**CONCLUSIONS:** Results demonstrate that it is possible to assess and localize brain cortical activity during moderate to high-intensity cycling exercise using EEG in combination with source localization algorithms. Results of this study might help to further evaluate the effects of central vs. peripheral fatigue during exercise.

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**2953** Board #225 June 1 11:00 AM - 12:30 PM

**Catechol-O-Methyltransferase Genotype Influences Cognitive Performance and Concussion History in College Football Players**

Mark H. Sundman<sup>1</sup>, Eric E. Hall, FACSM<sup>1</sup>, Robert A. Gardner<sup>1</sup>, Walter R. Bixby, FACSM<sup>1</sup>, Paul C. Miller<sup>1</sup>, Stephen E. Folger<sup>1</sup>, Matthew C. Kostek<sup>2</sup>, Bradley S. Gordon<sup>2</sup>, Kenneth P. Barnes<sup>1</sup>. <sup>1</sup>Elon University, Elon, NC. <sup>2</sup>University of South Carolina, Columbia, SC.

(No relationships reported)

Catechol-O-Methyltransferase (COMT) is a gene that is active in the breakdown of dopamine and norepinephrine in the prefrontal cortex. It has two alleles, Val and Met, yielding three possible genotypes (Val/Val, Val/Met, Met/Met). The Val allele promotes higher enzyme activity resulting in greater levels of dopamine degradation and lower dopamine levels in the prefrontal cortex. Research suggests that those with Met/Met and Val/Met genotypes have better cognitive performance due to the lower enzyme activity associated with the Met allele. Additionally, previous findings show that Val/Val and Val/Met populations have higher concussion rates, which may be due to higher levels of dopamine degradation due to the Val allele.

**PURPOSE:** To investigate association between COMT and executive cognitive function in student-athletes and how certain genotypes affect concussion history.

**METHODS:** 18 college football players (age 18.077 years) were genotyped for COMT. Participants then performed cognitive tests using Immediate Post-Concussion Assessment Cognitive Testing (ImPACT). ImPACT obtains concussion history and measures cognitive function by using several neuropsychological tests involving word discrimination, attention span, response variability, working memory and recall, and reaction time.

**RESULTS:** 7 subjects were Met/Met genotype and 11 were Val/Met. Met/Met subjects scored higher on verbal memory test ( $p = .329$ ), visual memory test ( $p = .080$ ), and visual motor test ( $p = .163$ ). Results also show that only 14% of Met/Met subjects reported history of concussions while 27% of Met/Val subjects reported suffering at least one concussion.

**CONCLUSIONS:** While data collection is ongoing, our preliminary data supports previous findings that the Val allele decreases cognitive performance and increases risk of concussions.

Partially supported by a grant from American Medical Society for Sports Medicine.

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**2954** Board #226 June 1 11:00 AM - 12:30 PM

**Running Modulates Hippocampal Acetylcholine In Operant Conditioning**

Kun Liu, Lu Zheng, Reziwan Yimiti. Capital Institute of Physical Education, Beijing, China.

(No relationships reported)

**PURPOSE:** Physical activity is benefit to learning and memory. Although numerous studies have demonstrated that physical activity play important roles in neurogenesis and brain function, the effect of physical activity on the variation of neurotransmitters in cognitive processes has not been elucidated clearly. Previous studies have demonstrated that acetylcholine (ACh) plays a critical role in hippocampus in learning, memory construction and retrieval. However, whether running improves learning and memory by changing hippocampal ACh has not been sure. It is hypothesized in this study that running could improve the cognitive performance by modifying release of hippocampal ACh. Thus the present study was designed to determine the effect of regular running on behavior performance of operant conditioning (OC) and monitor the level of hippocampal ACh during performance of OC.

**METHODS:** In vivo microdialysis coupled with high performance liquid chromatography (HPLC) and electrochemical detection (ECD) were used for sampling and ACh detecting. Male Sprague Dawley rats were randomly assigned to running and operant conditioning (running-OC group) and operant conditioning (OC group). Furthermore, an electric foot shock (E-shock) group and a free moving (FM) group were settled as control. The correct response rate in running-OC group increased significantly faster than OC group ( $P < 0.05$ ). The hippocampal ACh levels were recorded during the retrieval performance of OC after 12 weeks of running and/or OC training.

**RESULTS:** The hippocampal ACh transiently increased in the retrieval performance of OC and decreased to the basal levels after OC training. Running caused a lower transiently increase of hippocampal ACh level ( $185.21 \pm 16.51\%$ ,  $n = 5$ ,  $P < 0.05$ ) in running-OC group than the ACh level ( $213.75 \pm 23.38\%$ ,  $n = 5$ ,  $P < 0.05$ ) in OC group. The increased hippocampal ACh level ( $291.83 \pm 28.65\%$ ,  $n = 5$ ,  $P < 0.05$ ) is highest in E-shock group of rats and had no significant change in FM group of rats.

**CONCLUSIONS:** These findings indicate that the enhanced OC performance by running is correlated with modulation of hippocampal ACh level. The contents of this study could be significant for understanding the neurochemical mechanism underlying cognitive functions enhanced by physical activity.

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## E-36 Free Communication/Poster - Running

JUNE 1, 2012 7:30 AM - 12:30 PM  
ROOM: Exhibit Hall

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2955 Board #227 June 1 9:30 AM - 11:00 AM

### Do Voluntary Activation Deficits Contribute To Eccentric Weakness Following Intermittent Running?

Ryan G. Timmins<sup>1</sup>, Nuala M. Dear<sup>1</sup>, David A. Opar<sup>1</sup>, Morgan D. Williams<sup>2</sup>, Anthony J. Shield<sup>1</sup>. <sup>1</sup>Queensland University of Technology, Kelvin Grove, Australia. <sup>2</sup>University Glamorgan, Pontypridd, United Kingdom.  
(No relationships reported)

Hamstring strain injuries (HSI) are the predominant non-contact injury in many sports. Eccentric hamstring muscle weakness following intermittent running has been implicated within the aetiology of HSI. This weakness following intermittent running is often greater eccentrically than concentrically, however the cause of this unique, contraction mode specific phenomenon is unknown.

**PURPOSE:** To determine if this preferential eccentric decline in strength is caused by declines in voluntary hamstring muscle activation.

**METHODS:** Fifteen recreationally active males completed 18 × 20m overground sprints. Maximal strength (concentric and eccentric knee flexor and concentric knee extensor) was determined isokinetically at the velocities of  $\pm 180^{\circ}.s^{-1}$  and  $\pm 60^{\circ}.s^{-1}$  while hamstring muscle activation was assessed using surface electromyography, before and 15 minutes after the running protocol.

**RESULTS:** Overground intermittent running caused greater eccentric (27.2 Nm; 95% CI = 11.2 to 43.3;  $p=0.0001$ ) than concentric knee flexor weakness (9.3 Nm; 95% CI = -6.7 to 25.3;  $P=0.6361$ ). Following the overground running, voluntary activation levels of the lateral hamstrings showed a significant decline (0.08%; 95% CI = 0.045 to 0.120;  $P<0.0001$ ). In comparison, medial hamstring activation showed an increased level of activation following intermittent running (0.12%; 95% CI = 0.049 to 0.030;  $P = 0.0102$ ).

**CONCLUSIONS:** Eccentric hamstring strength is decreased significantly following intermittent overground running. Voluntary activation deficits in the biceps femoris muscle are responsible for some portion of this weakness. The implications of this finding are significant because the biceps femoris muscle is the most frequently strained of all the hamstring muscles and because fatigue appears to play an important part in injury occurrence.

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2956 Board #228 June 1 9:30 AM - 11:00 AM

### Multiscale Entropy Is Sensitive To Speed Constraint But Not Fatigue In High-intensity Running Intervals

Timothy R. Lindsay<sup>1</sup>, Stephen J. McGregor<sup>2</sup>, Timothy D. Noakes<sup>1</sup>. <sup>1</sup>University of Cape Town, Cape Town, South Africa. <sup>2</sup>Eastern Michigan University, Ypsilanti, MI.  
(No relationships reported)

**PURPOSE:** Long range inter-stride correlations are well established for running gait. Previous research suggests that long range correlations decrease over time in a bout of intense running. We aimed to confirm this finding in a series of high-intensity runs with several complimentary non-linear analyses. We hypothesized decreasing correlations with increasing interval number in high-intensity conditions.

**METHODS:** Ten trained runners completed two track sessions: a high-intensity session (HI) of 5\*2000m following pacing lights (~75% of peak incremental test speed, mean final RPE = 16.4) and a low-intensity session (LO) of 5\*2000m at < 75% MHR and < RPE 13 (mean speed = 56% of peak, mean final RPE = 11.1). Stride time series were generated from peak accelerations of each gait cycle, measured by foot-mounted accelerometers (G-Link, Williston, VT). We used detrended fluctuation analysis (DFA), power spectral density (PSD), rate of moment convergence (RMC), and multiscale entropy analysis (MSE). We applied a 2\*5 (intensity\*interval) ANOVA for DFA and PSD and a 2\*5\*10 (intensity\* interval\*scaling window) ANOVA for MSE data. All analysis was done with Matlab (Natick, MA).

**RESULTS:** DFA indicated 100/100 trials and PSD indicated 98/100 trials showing significant statistical persistence (> 2 SD from random). Where DFA differed from (PSD+1)/2 by more than 0.1 (41/100 trials), a relatively slow RMC increased confidence of long range correlations in all but a few trials. There were no intensity or interval effects for DFA and PSD ( $p > 0.05$ ). There was an intensity effect for MSE. HI had higher overall entropy than LO (mean = 1.77 vs. 1.70,  $p = 0.03$ ). There were no other main effects or interactions.

**CONCLUSIONS:** We confirmed ubiquitous long range correlations in both HI and LO. Only MSE was sensitive to intensity, but did not change with accumulated intervals. Higher entropy in HI suggests increased disorder and lower constraint. Evidently, organismic/physiological constraint changing with time and exertion exerted a relatively minor influence compared to task/speed constraint. The latter constraint was apparently the highest when subjects were required to run at a very low intensity. These results do not agree with previous research, but we have demonstrated the sensitivity of MSE to differences in relative running intensity.

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2957 Board #229 June 1 9:30 AM - 11:00 AM

### Relationship between Hip Strength and Trunk Motion in Collegiate Cross Country Runners

Kevin R. Ford, FACSM, Jeffery Taylor-Haas, Katlin Genthe, Jason Hugentobler. *Cincinnati Children's Hospital, Cincinnati, OH.*  
(No relationships reported)

**PURPOSE:** Hip strength may directly relate to abnormal running mechanics and contribute to the high incidence of overuse injuries in distance runners. The purpose of this study was to determine the relationship between hip isokinetic strength and trunk motion during treadmill running.

**METHODS:** Isokinetic hip strength and treadmill running kinematics were collected on 24 collegiate cross country runners (14 m, 10 f). Each subject completed a running protocol on a treadmill at a self-selected speed (3.6m/s). Kinematic data was collected with retroreflective markers attached to the thorax, pelvis, and each lower extremity segment (thigh, shank, foot). Thorax and pelvis range of motion (ROM) were calculated from initial ground contact to toe off. Pearson correlation coefficients were used to determine the relationship between strength and ROM ( $p<0.05$ ). Differences between male and female athletes were tested with mixed design ANOVAs ( $p<0.05$ ).

**RESULTS:** Isokinetic hip extension and abduction torque had significant inverse correlations to thorax ROM during stance phase of running ( $r=-0.60$ ,  $r=-0.53$ ). Frontal plane pelvic drop ROM was also significantly correlated to hip strength (extension  $r=-0.49$ ; abduction  $r=-0.44$ ). Female runners had significantly decreased normalized strength (hip extension  $1.8\pm 0.4Nm/kg$   $p<0.05$ ; hip abduction  $1.0\pm 0.2Nm/kg$   $p<0.05$ ), increased pelvic drop ( $13.1\pm 2.6^{\circ}$   $p<0.05$ ), and thorax ( $34.5\pm 7.0^{\circ}$   $p<0.05$ ) ROM compared to males (hip extension  $2.5\pm 0.5Nm/kg$ ; hip abduction  $1.3\pm 0.2Nm/kg$ ; pelvic drop  $8.9\pm 1.9^{\circ}$ ; thorax  $22.6\pm 3.5^{\circ}$ ).

**CONCLUSIONS:** Increased hip strength resulted in decreased ROM for both pelvic drop and trunk rotation during the stance phase of running in collegiate athletes.

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2958 Board #230 June 1 9:30 AM - 11:00 AM

### Impact Shock Attenuation is Increased with Rearfoot Running Compared to Forefoot Running

Allison H. Gruber<sup>1</sup>, Timothy R. Derrick<sup>2</sup>, Joseph Hamill, FACSM<sup>1</sup>. <sup>1</sup>University of Massachusetts, Amherst, MA. <sup>2</sup>Iowa State University, Ames, IA.  
(No relationships reported)

Rearfoot (RF) and forefoot (FF) running differ in the vertical ground reaction force (vGRF) profile by the presents of an impact peak in RF running. The absence of this impact peak has led some to suggest FF running may be beneficial at preventing running overuse injuries. However, the differences in vGRF profile in the time domain suggests that the frequency content of the

vGRF, and thereby the frequency content of the impact shock, may also differ. Changes in the amplitude of each frequency contained in the impact shock wave may affect how the body attenuates these frequencies.

**PURPOSE:** To determine the difference in shock attenuation between the RF and FF running footfall patterns.

**METHODS:** Ten natural RF runners and 10 natural FF runners ran on a treadmill at 3.5 m/s for 3 minutes with each footfall pattern. Piezoelectric accelerometers were affixed to the frontal bone of the head and the distal antero-medial tibia. Acceleration data were collected at 1200 Hz. A DFT was performed on 15 consecutive stance phases then normalized to 1 Hz bins. The degree of shock attenuation was calculated with a transfer function by:  $10\log_{10}(\text{PSD}_{\text{head}}/\text{PSD}_{\text{tibia}})$ . A mixed factor ANOVA was used to assess differences in attenuation at frequencies 1 - 50 Hz ( $\alpha = 0.05$ ).

**RESULTS:** RF running resulted in a gain of the head signal components relative to the tibia at frequencies between 1 - 2 Hz ( $p < 0.05$ ) whereas FF running resulted in a gain at frequencies between 4 - 6 Hz. Attenuation was greater during RF running for frequencies between 5 - 11 Hz, 14 - 20 Hz and 42 - 47 Hz ( $p < 0.05$ ). FF running resulted in an insignificant increase in attenuation of frequencies between 25 - 29 Hz.

**CONCLUSIONS:** Increased attenuation of the head signal components relative to the tibia at frequencies between 10 - 20 Hz may reflect the increased amplitude of the impact peak in the RF pattern. The differences in kinematics and muscular demands between RF and FF running may explain the increased attenuation of the impact shock wave in RF running. Passive mechanisms, such as absorption of frequencies by the heel fat pad, bone and other tissues, may be responsible for the increased degree of attenuation in high frequency components with RF running. Alternatively, active mechanisms responsible for attenuating low frequency components may not provide sufficient attenuation to maintain head stability.

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**2959** Board #231 June 1 9:30 AM - 11:00 AM

**Age and Performance Related Differences in Adolescent Running Biomechanics**

Richard W. Kruse, John Henley, Chris Church, Ryan Bober, Daveda Taylor, Nancy Lennon, Kathleen O'Brien, Freeman Miller. *Alfred I. duPont Hospital for Children, Wilmington, DE.*

(No relationships reported)

Several studies have focused on associations between biomechanical gait abnormalities and prevalent running injuries. Few have looked at the changes that occur due to natural development and training. Young or untrained runners may have natural characteristics that pre-dispose them to injury and these tendencies may disappear as the runner gains experience.

**PURPOSE:** The purpose of this study is to determine the biomechanical differences associated with age and performance in children.

**METHODS:** Sixty-six subjects (29 boys, 37 girls), uninjured for prior 6 months, ages 8-20 years old participated in the study. Subjects were stratified by age into three groups: 8-11, 12-14, and 15-20 years old. The older subjects (14-20) were separately stratified by self-reported mile performance as good (< 5 min/mile), average (< 6 min/mile), and poor (> 6 min/mile or unreported). Kinetic and kinematic data was obtained for each subject during over-ground running at 9 mph ( $\pm 5\%$ ). Steady state was determined by ensuring that the braking and propulsion ground reaction forces within 25 %.

**RESULTS:** With age, cadence decreases ( $192 \pm 13$  steps/min to  $166 \pm 9$  steps/min;  $p < 0.05$ ) and step length increases ( $254 \pm 18$  cm to  $294 \pm 19$  cm;  $p < 0.05$ ). Normalized joint variability decreased with age, although this was not significant ( $1.6 \pm .2$ , young, to  $1.0 \pm .4$ , old). Age correlated with a shift from hip flexion power in youth as a primary means of propulsion ( $5 \pm 2$  N to  $3 \pm 1$  N;  $p < 0.05$ ) to ankle power in older runners ( $8 \pm 2$  N to  $12 \pm 2$  N;  $p < 0.05$ ). Older age also correlated with greater knee flexion range of motion ( $24 \pm 4^\circ$  to  $28 \pm 5^\circ$ ;  $p < 0.05$ ). This effect was consistent with increased knee flexion absorption power ( $-6.8 \pm 3$  N to  $-12 \pm 4$  N;  $p < 0.05$ ). Loading rate was significantly higher in younger runners ( $120 \pm 41$  N/BW/S) than older runners ( $88 \pm 27$  N/BW/S). Good self-reported milers had lower cadence ( $162 \pm 8$  steps/min vs.  $168 \pm 10$  steps/min) and a longer stride ( $305 \pm 14$  cm vs.  $286 \pm 18$  cm) than poor milers. Good milers trended toward less joint variability than poor milers, although this was not significant. Finally, the loading rate was significantly greater in faster milers ( $98 \pm 23$  N/BW/S) than slower milers ( $77 \pm 28$  N/BW/S).

**CONCLUSION:** Running biomechanics differ with age and performance level particularly in height-related, variability, and power generation variables.

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**2960** Board #232 June 1 9:30 AM - 11:00 AM

**Whole Body Kinematic Compensatory Mechanisms Are Magnified As Runners Fatigue Over 10 Km At Race Pace**

Desi Fuhr, Pierre Gervais, Douglas Gross, Michael Kennedy. *University of Alberta, Edmonton, AB, Canada.* (Sponsor: Darren DeLorey, FACSM)

(No relationships reported)

During a 10 km run at race pace, changes in lower extremity mechanics have been reported in male runners however mechanical changes over 10 km in female runners is unknown. Upper body mechanics at race pace has not been reported in either gender.

**PURPOSE:** To examine whole body running mechanics in female distance runners during a simulated 10 km race on a treadmill.

**METHODS:** Nine female distance runners (age:  $32.1 \pm 4.2$  yrs; ht:  $166.7 \pm 7.4$  cm; wt:  $57.8 \pm 7.0$  kg;  $\text{VO}_2\text{max} = 3.24 \pm 0.50$  L/min) completed a graded exercise test (Day 1); 10 km time trial (Day 2); and simulated 10 km treadmill run (DAY 3). Treadmill speed was 95 % of average running velocity of the Day 2 time trial. Reflective markers were placed bi-laterally and kinematic data were sampled at 120Hz at 50 m (BASE), 4450 m (MID) and 9950 m (END) using a 6-camera optoelectronic motion capture system. Bi-lateral mechanical measures calculated: stride frequency, maximum elbow flexion and maximum knee flexion (swing phase).

**RESULTS:** Stride frequency decreased for both the left and right legs (BASE to MID by 1.27strides/min for both and by 1.66 strides/min from MID to END ( $p > 0.05$ ). Overall maximum knee flexion during swing phase increased for both the left and right legs (BASE to END by  $4.3^\circ$  ( $p > 0.05$ ). Although not significant, maximum elbow flexion increased for both left and right limbs (BASE left:  $137.6 \pm 6.7^\circ$ ; END left:  $145.1 \pm 6.7^\circ$ ; BASE right:  $134.6 \pm 11.6^\circ$ ; END right:  $146.0 \pm 10.7^\circ$ ;  $P < 0.05$ ) **CONCLUSION:** These results indicate that changes in mechanics occur throughout the simulated 10 km run and these changes are magnified as runner's fatigue. Mechanical changes such as these may be compensatory in nature. Increased elbow flexion may have assisted propulsion by increasing the amount of lift acting on the body and ultimately increasing the individual's total flight time. This, combined with increased knee flexion, seem to be key coping strategies to maintain pace with fatigue induced step frequency decreases.

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**2961** Board #233 June 1 9:30 AM - 11:00 AM

**Muscle Activity During Running With Different Body Weight Support Mechanisms**

John A. Mercer, FACSM<sup>1</sup>, John A. Mercer, FACSM<sup>1</sup>, Bryon Applequist<sup>1</sup>, Kenji Masumoto<sup>2, 1</sup> UNLV, Las Vegas, NV. <sup>2</sup>Fukuoka Prefectural, Fukuoka, Japan.

(No relationships reported)

There are different mechanisms to provide body weight (BW) support during running. For example, deep water running (DWR) provides 100% BW support whereas a lower body positive pressure (LBPP) treadmill (e.g., Alter-G) can provide varying levels of body weight (BW) support. However, muscle activity during running with different BW support mechanisms is not fully understood.

**PURPOSE:** To compare lower extremity muscle activity during DWR and running using a LBPP treadmill with different amounts of BW support.

**METHODS:** Subjects (6 females, 2 males;  $40 \pm 6.5$  years;  $173 \pm 7.2$  cm;  $66.9 \pm 11.7$  kg) completed DWR and LBPP treadmill running conditions. LBPP was set to provide BW support such that the subjects weighed 60% and 80% of BW. Two styles of DWR were used: High knee (DWR-HK) and cross-country (DWR-CC). Prior to testing, preferred stride frequency (PSF) at a self-selected speed was determined running on a treadmill (no BW support). Both of the LBPP treadmill conditions (i.e., 60% and 80% of BW) were done at the self-selected speed and PSF and each DWR condition (i.e., DWR-HK and DWR-CC) at PSF. Muscle activity was recorded from the rectus femoris (RF), biceps femoris (BF), gastrocnemius (GA), and tibialis anterior (TA) of the right lower extremity using telemetry surface electromyography (EMG). Average EMG (AVG) and root mean square (RMS) were calculated for each muscle across 15-s. Repeated measures analysis of variance were used to compare SF and EMG among conditions.

**RESULTS:** SF was not different between conditions ( $80.6 \pm 9.2$ ,  $83.5 \pm 11.5$ ,  $78.8 \pm 8.2$ ,  $81.0 \pm 6.1$  strides/min for DWR-HK, DWR-CC, 60% and 80% of BW conditions, respectively;  $p > .05$ ). RF (both AVG and RMS) were different between conditions ( $p < .05$ ). In addition, BF (both AVG and RMS) were each different between conditions ( $p < .05$ ).

**CONCLUSIONS:** The mechanism of BW support nor style of DWR influenced GA or TA muscle activity during running at the same SF. However, RF and BF muscle activity were influenced not only by the mechanism of BW support but also the style of DWR.



**2962 Board #234 June 1 9:30 AM - 11:00 AM**  
**Effect of Body Weight Support on Spatiotemporal Running Mechanics**

Matthew F. Moran, Andrew B. Sullivan, Brendan J. Rickert. *Sacred Heart University, Fairfield, CT.*  
*(No relationships reported)*

Running on a treadmill (TM) that artificially reduces body weight (BW) via differential air pressure (DAP) has been shown to reduce (i) vertical ground reaction forces, (ii) muscular activity, and (iii) metabolic cost; but gait mechanics may be altered depending on the level of BW support. These findings explain the potential use of DAP TMs for both injury rehabilitation and performance enhancement. Despite the obvious applications, the relationship between BW support and spatiotemporal (stride rate, stride length) mechanics is not clearly understood. In order to improve training prescription and running mechanics specificity from DAP TMs to overground running, the current investigation systematically investigated the effects of BW support level on spatiotemporal running mechanics.

**PURPOSE:** To determine the effects of body weight support in a DAP treadmill on the spatiotemporal gait mechanics in male distance runners.

**METHODS:** Ten well-trained male runners (age 20.4 ± 2.0 yrs; height 1.78 ± 0.08 m; mass 63.9 ± 6.0 kg; years of competitive running 8.3 ± 2.4) voluntarily ran at a self-selected sub-maximal pace for 34 continuous minutes on a DAP TM at six different levels of BW (100%, 90%, 80%, 70%, 60%, and 50%). BW was either systematically reduced (n=5) from 100% to 50% or increased (n=5) from 50% to 100%. Following each 5-minute segment, a 1-minute run segment at ±5% BW was allocated to ease the transition before the next BW level. Heart rate (HR), ratings of perceived effort (RPE), and high-speed sagittal plane video (210 Hz) were collected for each trial. Stride rate (SR), stride length (SL), and stance-to-swing cycle times (SS) were computed for each segment from video analysis. All dependent variables were compared using repeated-measures ANOVAs with post hoc tests in PASW Statistics 18.

**RESULTS:** SR and SL, normalized to leg length, was significantly different for all loading conditions (p < .04) with the exception of 60% compared to 70% BW (p = .12, .13).

**CONCLUSIONS:** In a group of well-trained male distance runners, SR was significantly decreased and SL was significantly increased as the simulated BW was reduced in 10% increments. Clinicians and coaches utilizing DAP TMs should be aware of the resulting gait timing alterations and consider devices, such as a metronome, to increase cadence as BW support is increased.

**2963 Board #235 June 1 9:30 AM - 11:00 AM**  
**Are Three-Dimensional (3D) Single Leg Step Down Kinematics Correlated to 3D Running Kinematics?**

Anne-Marie V. Fox, Nicolas S. Hatamiya, Richard B. Souza, Anthony C. Luke, FACSM. *University of California, San Francisco, San Francisco, CA.*  
*(No relationships reported)*

As the worldwide popularity of running has steadily increased, so has the incidence of running-related injuries. Distinct frontal and transverse plane running kinematics have been linked with prevalent running-related injuries, such as patellofemoral pain. For clinicians without access to a treadmill, it would be useful to examine if similar kinematic patterns are demonstrated in other tasks, such as a single leg step down (SLSD).

**PURPOSE:** To determine if three-dimensional (3D) SLSD kinematics are correlated to 3D running kinematics.

**METHODS:** 19 healthy subjects (9 male, 10 female; age = 28.4 ± 4.96 years; weight = 63.6 ± 10.9 kg; height = 1.69 ± 0.09) ran on a treadmill at a self-selected pace for 6 minutes. Immediately following, 5 SLSD repetitions were completed from a height of 17 cm at a self-selected rate. For both activities, a 10 camera motion capture system (250 Hz) and cluster based marker set were used to measure kinematics. Pearson correlation coefficients were used to assess the association between SLSD and running kinematics.

**RESULTS:** Significant correlations (p < 0.05) were found for 3 of the 5 kinematic variables measured (Table 1). A strong correlation of 0.81 was found for mean knee external rotation. Moderate correlations ranging from 0.45 to 0.58 were found for all the frontal plane kinematic measurements.

**CONCLUSIONS:** These results suggest that many running kinematic measurements, which have been linked to running-related injuries, are at least moderately associated with SLSD kinematics. This association may prove to be useful for clinicians treating runners; however, further research is necessary to investigate the link between clinical observations and 3D kinematics.

Supported by NIH/NCRR UCSF-CTSI UL1 RR024131.

The average joint angles, significance of correlations (P-values) and correlation coefficients (r)

|                                |         | Angle (°) |      | r    | P-value |
|--------------------------------|---------|-----------|------|------|---------|
|                                |         | Mean      | SD   |      |         |
| Peak Rearfoot Eversion         | SLSD    | 9.42      | 2.28 | 0.58 | 0.009*  |
|                                | Running | 6.88      | 2.18 |      |         |
| Peak Hip Adduction             | SLSD    | 14.98     | 4.80 | 0.45 | 0.052   |
|                                | Running | 10.87     | 3.14 |      |         |
| Peak Contralateral Pelvic Drop | SLSD    | 3.13      | 3.57 | 0.47 | 0.042*  |
|                                | Running | 3.27      | 2.01 |      |         |
| Average Knee External Rotation | SLSD    | 3.73      | 4.49 | 0.81 | 0.000*  |
|                                | Running | 4.60      | 3.77 |      |         |
| Average Hip Internal Rotation  | SLSD    | 2.27      | 4.36 | 0.24 | 0.332   |
|                                | Running | 1.08      | 3.22 |      |         |

**2964 Board #236 June 1 9:30 AM - 11:00 AM**  
**Effect Of Lower Extremity Mass And Inertia Manipulation On Swing Phase Sprint Mechanics**

Chee-Hoi Leong<sup>1</sup>, William J. McDermott<sup>2</sup>, Alena M. Grabowski<sup>3</sup>, Craig P. McGowan<sup>4</sup>, James C. Martin, FACSM<sup>1</sup>. <sup>1</sup>University of Utah, Salt Lake City, UT. <sup>2</sup>TOSH - The Orthopedic Specialty Hospital, Salt Lake City, UT. <sup>3</sup>Massachusetts Institute of Technology, Cambridge, MA. <sup>4</sup>University of Idaho, Moscow, ID.  
*(No relationships reported)*

Maximal sprinting speeds are influenced by stance and swing phase mechanics. Because swing phase mechanics may account for substantial variations in inertial characteristics, assessing the kinematics and kinetics is essential to identifying factors that may limit maximal sprinting speed.

**PURPOSE:** To examine the effects of lower extremity mass and inertia manipulation on swing phase sprint mechanics across un-weighted (UW), weighted 100 g (W100), and weighted 300 g (W300) conditions, using mass bilaterally added to the dorsal surface of the feet.

**METHODS:** Fifteen healthy subjects (mean age = 22.6 ± 7.4 years) performed successive bouts of sprinting up to their maximum voluntary speed under three weighted conditions. An eight-camera 3D Eva Real Time motion capture system and a motorized high-speed 3D force sensing treadmill were used to collect synchronized kinematic and kinetic data. One-way repeated measures ANOVAs were used to compare maximal sprinting speeds, and kinematic and kinetic variables.

**RESULTS:** Maximal sprinting speed for both the W100 (8.0 ± 1.0 m/s) and W300 (7.7 ± 1.0 m/s) conditions were reduced by 3.0 ± 3.4 % and 6.2 ± 3.9 % respectively compared to the UW condition (p < 0.05). Maximum hip flexion power for the W300 (14.0 ± 13.2 W/kg) condition was reduced by 11.1 ± 3.9 % compared to the UW condition (p < 0.05). Hip angular velocity at maximum hip flexion power for the W300 (10.1 ± 1.7 rad/s) condition was reduced by 5.0 ± 11.8% compared to the UW condition (p < 0.05). There were no significant changes in knee flexion angles and hip joint moment at maximum hip flexion power.

**CONCLUSIONS:** Inertial manipulation reduced maximal sprinting speed and maximum hip flexion power. These data suggest that increased inertial characteristics of the swing limb play an important role in determining maximum sprinting speed. While increased foot inertia did cause a reduction in maximal sprint speed, this reduction was not due to limitations in hip power. The significant effect on hip angular velocity but not on the hip joint moment suggests further analyses are required regarding the generation of hip flexion power.

2965 Board #237 June 1 9:30 AM - 11:00 AM

### Vertical Acceleration To The Ground Can Be A Greater Component Contributing To Higher Sprinting Performance

Takeshi Oyama<sup>1</sup>, Yoshiharu Fujieda<sup>2</sup>, Hisataka Ambe<sup>3</sup>, Jumpei Hayashi<sup>3</sup>, Kenichi Suijo<sup>4</sup>, Hiroshi Yamauchi<sup>5</sup>, Kazuo Ura<sup>6</sup>. <sup>1</sup>Gunma Prefectural Maebashi Nishi High School, Gunma, Japan. <sup>2</sup>Tokyo Gakugei University, Tokyo, Japan. <sup>3</sup>Division of Health and Sport Education, The United Graduate School of Education, Tokyo Gakugei University, Tokyo, Japan. <sup>4</sup>Department of Preventive Medicine and Public Health, Tokyo Medical University, Tokyo, Japan. <sup>5</sup>Part-time Lecturer, Faculty of Sciences, Toho University, Chiba, Japan. <sup>6</sup>Casio Computer Co., LTD., Tokyo, Japan.  
(No relationships reported)

**Background** The top running speed of 100 m sprints are yielded by the accumulated accelerations of the first half to the goal. It is unfortunately impossible for us human beings to transmit all muscle powers directly into horizontal drive due to our body joint structure.

**PURPOSE:** In this study we investigated the changes of 3 - dimensional accelerations (Za vertical to the ground, Ya vertical to X and horizontal to the ground, Xa horizontal to the ground and toward the goal) of the sprinting athletes.

**METHODS:** Subjects of 13 Japanese male high school athletes underwent a single time-trial of 100 m sprint, wearing a triaxial accelerometer on their center of the gravity in the lower abdominal area. All through 100 m distance, 5 sets of split times and speeds were recorded at each 20 m section (the 1st section of 0-20 m as S1, the 2nd 20-40 m S2, the 3rd 40-60 m S3, the 4th 60-80 m S4 and 5th 80-100 m S5). Based on their total 100 m sprinting time, the upper 7 participants who showed better results were defined as the Faster and the other 6 as the Slower.

**RESULTS:** Compared the measured accelerations between the Faster and the Slower, Za of the Faster was statistically greater than that of the Slower at S4 ( $-1,691.42 \pm 373.76$  m/s<sup>2</sup> vs.  $-2,498.77 \pm 341.19$  m/s<sup>2</sup> p<0.05). The Faster also demonstrated tendencies of higher Za than those of the Slower at S1 ( $-1,868.72 \pm 407.57$  m/s<sup>2</sup> vs.  $-2,633.97 \pm 372.05$  m/s<sup>2</sup> p<0.1) and S2 ( $-1,667.65 \pm 374.15$  m/s<sup>2</sup> vs.  $-2,423.58 \pm 341.55$  m/s<sup>2</sup> p<0.1) respectively. On the other hand, Xa produced no significant differences at all sections. Discussions These findings indicate that it is difficult to predict the sprinters performance by only using horizontal acceleration data. We should consider that vertical acceleration, which is supposed to be a product of reaction force from the ground by transferring energy of the runners' body weight and their leg muscle strength to the ground, can be a greater component contributing to higher sprinting performance.

**CONCLUSION:** Vertical acceleration to the ground can be a greater component contributing to higher sprinting performance.

## E-37 Free Communication/Poster - Spine

JUNE 1, 2012 7:30 AM - 12:30 PM  
ROOM: Exhibit Hall

2966 Board #238 June 1 11:00 AM - 12:30 PM

### History of Low Back Pain affects Pelvis and Trunk Rotation During a Lift-Lower Task

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(No relationships reported)

Low Back Pain (LBP) is common, with most cases resolving within 2 weeks. Research has shown increased risk of LBP in healthy (pain-free) athletes with a history of LBP (HBP). Bending at the waist and twisting is an occupational risk factor for LBP, however few studies have explored differences in lifting mechanics between healthy people with and without HBP; insight into these differences could elucidate adaptations that occur due to LBP.

**PURPOSE:** To compare transverse plane range of motion of the trunk (ROM<sub>t</sub>) and pelvis (ROM<sub>p</sub>) during a sustained asymmetric repetitive task between a HBP group and a group with no history of LBP (NBP).

**METHODS:** N=18 Soldiers (n=9 men/group) participated in a box lift-lower task. A 11-kg box with handles was lifted for 10 min at 12 cycles/min. The box started at ankle height in front of the volunteer, was lifted to a shelf 45° off-center at waist height, and lowered to the start position. Lifting side was alternated during the trial. Kinematic data were collected during min 1 and 9 (min1, min9). 2-way ANOVA (Group X Time) were performed for ROM<sub>t</sub> and ROM<sub>p</sub>. Effect sizes (ES) were calculated as the mean difference relative to a pooled SD.

**RESULTS:** ROM<sub>t</sub> and ROM<sub>p</sub> were similar at min1. At min9, HBP group did not change, however these ROM both *decreased* in NBP group (Fig 1). ES > 1.0 further indicated large practical differences.

**CONCLUSIONS:** Differences between groups over time demonstrate residual consequences of LBP in an occupational scenario, even though the HBP group was pain-free for > 6 months prior to data collection. The decreased axial ROM over time may represent a lack of adaptability in the HBP group compared to those who never had LBP, and may lend insight as to why individuals with HBP are at increased risk for re-injury.

2967 Board #239 June 1 11:00 AM - 12:30 PM

### Lumbar Spine Kinematics in Marine Corps Soldiers Carrying Heavy Loads

Ana E. Rodriguez-Soto<sup>1</sup>, Andrew Jensen<sup>2</sup>, Rebecca Jaworski<sup>2,3</sup>, Karen Kelly<sup>3</sup>, Lawrence Frank<sup>1</sup>, Samuel R. Ward<sup>1</sup>. <sup>1</sup>University of California, San Diego, La Jolla, CA. <sup>2</sup>San Diego State University, San Diego, CA. <sup>3</sup>Naval Health Research Center, San Diego, CA.  
(No relationships reported)

Higher incidence of lumbar spine pain, perhaps due to heavy load carriage, has been observed in US military troops.

**PURPOSE:** To measure kinematic changes in the lumbar spines of Marines carrying heavy loads. We hypothesized that heavy loads would induce increased lumbar lordosis and disc compression.

**METHODS:** Sagittal T2 MR images of the lumbar spine were acquired on a 0.6T vertical MRI scanner in 8 active-duty Marines. Each Marine was scanned without load (BL), immediately after donning body armor and a backpack (total 50.8 kg), after 45 min of standing with the load (SL), after walking for 45 min with load (WL), and after 45 min of side-lying recovery. Custom software was used to measure lumbar spine kinematics, enabling measurement of whole spine angles, intervertebral angles, and regional disc heights. Repeated measurements ANOVAs and post hoc Sidak tests were used to identify significant differences between tasks ( $\alpha = 0.05$ ).

**RESULTS:** The overall position of the spine was significantly more horizontal during the SL ( $53.5 \pm 8.7^\circ$ ) and WL ( $54.5 \pm 5.2^\circ$ ) tasks compared with the unloaded task ( $85.2 \pm 3.3^\circ$ ). Lumbar lordosis was reduced during the SL ( $46.0 \pm 10.6^\circ$ ) and WL ( $38.6 \pm 17.5^\circ$ ) tasks compared with the unloaded task ( $52.3 \pm 11.6^\circ$ ). Sagittal intervertebral angles were significantly reduced in each loading task at L4-L5 (BL= $12.2 \pm 3.3^\circ$ , SL= $3.9 \pm 4.0^\circ$ , WL= $4.9 \pm 4.2^\circ$ ) and L5-S1 (BL= $10.6 \pm 3.9^\circ$ , SL= $2.9 \pm 1.2^\circ$ , WL= $3.6 \pm 2.1^\circ$ ), suggesting that reduced lordosis was driven by L4-L5 and L5-S1 flexion. Significant disc compression was evident anteriorly at L4-L5 (BL= $17.3 \pm 0.9$ mm, SL= $14.4 \pm 1.4$ mm, WL= $15.3 \pm 1.5$ mm) and L5-S1 (BL= $15.6 \pm 2.3$ mm, SL= $12.8 \pm 0.9$ mm, WL= $13.3 \pm 1.9$ mm), but was actually reduced in the posterior region at L4-L5 (BL= $10.8 \pm 1.3$ mm, SL= $13.0 \pm 1.9$ mm, WL= $12.8 \pm 2.0$ mm) and L5-S1 (BL= $9.9 \pm 1.1$ mm, SL= $12.1 \pm 1.1$ mm, WL= $11.8 \pm 1.3$ mm). All kinematic variables returned to baseline levels after 45 min of side-lying recovery.

**CONCLUSIONS:** Heavy load carrying induced lumbar spine flexion and only anterior disc compression, contrary to our initial hypothesis. These findings suggest a postural strategy aimed at centralizing a heavy posterior load over the base of support. This strategy may minimize intervertebral compression, but it may also make the lumbar spine susceptible to shear-load-induced injuries. (US ARMY RDECOM N6311610MP00182)

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**2968** Board #240 June 1 11:00 AM - 12:30 PM  
**The Effect of Pregnancy on Torso Kinematics during Gait**

Jean L. McCrory, FACSM<sup>1</sup>, April J. Chambers<sup>2</sup>, Ashi Daftary<sup>3</sup>, Mark S. Redfern<sup>2</sup>. <sup>1</sup>West Virginia University, Morgantown, WV. <sup>2</sup>University of Pittsburgh, Pittsburgh, PA. <sup>3</sup>West Penn Allegheny Health Systems, Pittsburgh, PA.  
(No relationships reported)

Numerous anatomical changes occur during pregnancy that may be related to gait alterations, which in turn may be related to increased reports of lumbar and pelvis pain during pregnancy. While other researchers have reported changes in hip and ankle biomechanics, none have quantified torso kinematics related to the “waddling gait” that pregnant women are anecdotally said to exhibit.

**PURPOSE:** The purpose of this study was to examine the effects of pregnancy on torso mechanics during gait.

**METHODS:** Data were collected on 29 pregnant subjects in the mid-second and third trimesters and on 40 control women. An 8 camera motion capture system (120 Hz) was used to collect data of subjects walking at their freely chosen speed along an 8 meter laboratory runway. Subjects wore a modified Helen Hays marker set. Right foot heel strike (RHS) and left foot toe off (LTO) were determined from force plate data (1080 Hz). The 3D angles of the thorax (i.e. upper torso) and pelvis were determined at RHS. The frontal plane movement of the C7 marker and the ranges of motion of the thorax and pelvis during gait were determined between RHS and LTO. An ANOVA was performed to determine if differences existed between pregnant women in their second trimester, third trimester, and controls ( $\alpha=0.05$ ).

**RESULTS:** There was significantly ( $p<0.01$ ) more frontal plane motion of C7 between the third trimester ( $6.5 \pm 2.7$ cm), second trimester ( $5.6 \pm 1.9$  cm), and controls ( $4.7 \pm 1.8$ cm) during the stride. At RHS, the sagittal plane position of the thorax was more extended ( $p<0.01$ ) as pregnancy advanced (third trimester:  $-6.6 \pm 4.5^\circ$ , second trimester:  $-3.5 \pm 5.1^\circ$ , Con:  $1.7 \pm 5.1^\circ$ ). No other differences in thorax and pelvis mechanics were noted.

**CONCLUSIONS:** Pregnant women demonstrated more frontal plane motion of C7 during gait, particularly in the third trimester. Because no differences in frontal plane angles of the thorax and pelvis were seen between groups, this movement of C7 is likely due to a side-to-side shifting of the body rather than a leaning. Pregnant women demonstrated a backward leaning of the thorax, which is likely to counterbalance a forward position of the center of mass due to increasing abdominal size. \*Funding: NIOSH K01 008458.

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**2969** Board #241 June 1 11:00 AM - 12:30 PM  
**The Efficacy of “The 11” Injury Prevention Program With Regard to Knee and Trunk Motion**

Yasuaki Saho<sup>1</sup>, Issei Ogasawara<sup>2</sup>, Yasuharu Nagano<sup>3</sup>, Tomohiro Ogai<sup>4</sup>, Masakatsu Setojima<sup>4</sup>, Toru Fukubayashi<sup>1</sup>. <sup>1</sup>Waseda University, Saitama, Japan. <sup>2</sup>Mukogawa Women’s University, Hyogo, Japan. <sup>3</sup>Niigata University of Health and Welfare, Niigata, Japan. <sup>4</sup>Ryutsukeizai University, Ibaraki, Japan.  
(No relationships reported)

The injury prevention program created by the FIFA is called “The 11.” It is especially useful in the prevention of non-contact injuries. However, it is unclear how this program helps reduce injuries.

**PURPOSE:** To identify the effect of “The 11” on knee and trunk motion.

**METHODS:** Eight male collegiate soccer players were recruited for this study. The players performed “The 11” twice a week for 6 months. Before and after the intervention, knee and trunk movements were recorded using a three-dimensional motion analysis system while the subjects performed cutting tasks. Cutting tasks were performed on a force plate after running. Tasks like side step, crossover step, or forward running were randomly selected and were conducted in two situations: anticipated and unanticipated. In the anticipated situation, subjects were informed about the task in advance. In the unanticipated situation, random visual cues were presented at the moment when subjects reached about 2.5m from the force plate. Only the side step task was analyzed. In each trial, we calculated knee joint angle (flexion/extension, abduction/adduction and tibial rotation) and trunk inclination (forward and lateral) using the point cluster technique, from 100 msec before foot-contact (FC) to toe-off. Each variable at 100 msec before FC, at the time of FC, and the peak value during FC was calculated in each task. Student t-test was used to compare the difference between the conditions before and after intervention ( $\alpha=0.05$  was considered significant).

**RESULTS:** The peak knee abduction angle was significantly lower after intervention than before intervention in the unanticipated sidestep task ( $6.2 \pm 3.7$  vs.  $12.1 \pm 4.3$ ,  $p<0.05$ ). The tibial external rotation angle at the time of FC after intervention was significantly lower than before intervention in the unanticipated sidestep task ( $5.7 \pm 6.8$  vs.  $10.1 \pm 8.3$ ,  $p<0.05$ ). Other knee variables and all trunk variables did not change.

**CONCLUSIONS:** “The 11” can reduce ACL injury risk as, in the anticipated situation, the knee abduction angle decreased after intervention. In this way, “The 11” can reduce sports injuries. However, trunk motion remained unchanged despite “The 11’s” core stability exercise and the instructions for trunk alignment during jumping and stepping. Some training components of this program can be improved.

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**2970** Board #242 June 1 11:00 AM - 12:30 PM  
**Electromyographic Analysis of Trunk and Hip Muscles During Swiss Ball Bridging Exercises Performed With Two Different Ankle Positions**

Rafael F. Escamilla, FACSM, Joseph M. Carinci, Edward Barakatt, Paul Broyer, Christian Butler, Jenny Ferguson, Amanda Morgan, Ricardo Morales, Ryan Rhoads. California State University, Sacramento, Sacramento, CA.  
(No relationships reported)

**PURPOSE:** Bridging exercises are commonly used in training and rehab to enhance core stability. Some trainers recommend dorsiflexing the ankles during bridging exercises to facilitate the gluteus maximus and inhibit the hamstrings. Our purpose was to compare trunk and hip muscle activity during 3 two-leg and 2 one-leg bridging exercises on a swiss ball using two different ankle positions: 1) ankle plantar flexion (PF); 2) ankle dorsiflexion (DF).

**METHODS:** Twenty healthy males and females between 22-27 y.o. served as subjects. Surface electrodes were positioned on the subject’s right side over the upper rectus abdominis (RA), external oblique (EO), internal oblique (IO), erector spinae (ES), latissimus dorsi (LD), gluteus maximus (GMA), gluteus medius (GME), medial hamstrings (MH), lateral hamstrings (LH), rectus femoris (RF), tensor fascia latae (TF), and adductor longus (AL). EMG data were collected from an EMG system during a 5 s isometric hold after obtaining the bridge position. EMG data were normalized by maximum voluntary muscle contractions. Differences in muscle activity were assessed by a one-way repeated measures Analysis of Variance ( $p < 0.01$ ).

**RESULTS:** During the two-leg bridge with knees flexed and the ball under the upper back, activity from the RF, AL, and IO was significantly greater with DF compared to PF. During the two-leg bridge with knees flexed and feet on ball, muscle activity from the RF, TF, AL, ES, and GME was significantly greater with DF compared to PF. During the two-leg bridge with knees flexed and feet on ball, muscle activity from the LH was significantly greater with PF compared to DF. During the one-leg bridge with knees extended and right foot on ball, muscle activity from the GMA was significantly greater with DF compared to PF. During the one-leg bridge with knees flexed and right foot on ball, there was no significant difference in muscle activity between PF and DF positions.

**CONCLUSIONS:** Of the 5 bridging exercises assessed, GMA was greater in DF than PF in only 1 exercise, and LH was greater in PF than DF in only 1 exercise, which implies that DF does not consistently result in greater GMA activity and less hamstring activity during bridging exercises on a ball. Moreover, DF did result in overall greater hip and trunk activity compared to PF during these bridging exercises.

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**2971** Board #243 June 1 11:00 AM - 12:30 PM  
**Threshold for EMG Onset Detection of Trunk Muscles In Golf Swing**

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(No relationships reported)

**PURPOSE:** The aim of this study was to compare temporal parameters of the trunk muscles EMG activation with two different threshold methods.

**METHODS:** Eight subjects performed ten golf swings (five with pitch, five with 4-iron). Surface EMG was recorded on both sides of trunk muscles: Rectus Abdominis (RA), External

Oblique (EO) and Erector Spinae (ES). Two methods were used for onset determination differing on threshold calculation. Method A threshold was determined by the baseline activity recorded between two maximum voluntary contraction (MVC) whereas method B calculates the mean of EMG activity before the beginning of BackSwing [-1000:-500 ms]. After threshold calculation some restrictions were established to onset calculation: a) search for onset begins 150ms before DownSwing and 150ms before BackSwing for left EO; b) 50 samples window will move forward until its' mean is higher than threshold throughout the ascendant parts of the signal. Visual inspection was performed.

**RESULTS:** Repeated Measures three factors ANOVA showed significant differences ( $p=.001$ ) between muscles for the two methods, but there were no differences in the clubs used ( $p=.521$ ). Paired-Samples T test showed similar results between methods for RA (left -  $p=.190$ ; right -  $p=.320$ ). Furthermore, both methods were appropriate for this muscle, representing the percentage of maximum EMG peak (PM) of 19% and 9% for left and right sides, respectively (left A -  $19\pm 13\%PM$  B -  $19\pm 13\%PM$ ; Right A -  $9\pm 7\%PM$  B -  $9\pm 7\%PM$ ). EO showed the greatest inter and intra subject variability with significant differences ( $p\leq .01$ ) between methods. In this muscle the onset was calculated at lower levels which could represent an anticipation of the true onset (left A -  $11\pm 4\%PM$  B -  $6\pm 2\%PM$ ; right A -  $5\pm 5\%PM$  B -  $4\pm 5\%PM$ ). ES showed significant differences between methods ( $p=.001$ ) with method A revealing better accuracy than method B that determined the onset at a higher percentage of the maximum of activation (left A -  $5\pm 3\%PM$  B -  $21\pm 13\%PM$ ; Right A -  $6\pm 5\%PM$  B -  $26\pm 12\%PM$ ).

**CONCLUSIONS:** Both methods are applicable to RA and the baseline MVC threshold is more accurate for ES. The OE shows high variability and both methods anticipate its onset calculation. In the EMG analysis of golf swing, onset calculation should be adjusted to each trunk muscle.

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2972 Board #244 June 1 11:00 AM - 12:30 PM

**Base A Concept For Health Promotion In Logistic Workers With Manual Box Lifting Activities**

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(No relationships reported)

Common occupational health problems are musculoskeletal disorders, especially low back pain. Increased reports of back symptoms are associated with physical demands of work, like lifting many heavy weights during a short time period especially when lifting is executed not ergonomically.

**PURPOSE:** The study examined a workplace intervention (BASE concept) to reduce physical stresses of manual lifting processes in a logistic company. It was conducted in three stages: description of the implementation (1), evaluation of outcome-effects of the ergonomic box lifting technique after a 10 week intervention (2) and examining learning and lasting effects (after 3 months) of workers' knowledge and behaviour with regard to health orientated box lifting.

**METHODS:** Video analysis and questionnaires were used in stage (1) for a breakdown analysis. Stage (2) and (3) collected intervention effects with a controlled pre-post design (t1-t3; N=51 male logistic workers;  $37.8\pm 10.8$  y.) The lifting process was evaluated with the PILE-Test. A 3-way ANOVA (group x weight lifting (kg) x repeated measurement) checked the interactions within common limits of significance (95% confidence interval). The cognitive representation of ergonomic object lifting was assessed by the structural dimension analysis of mental representation (with a critical value at  $\lambda_{crit} = .68$ ).

**RESULTS:** The breakdown analysis revealed common problems of repeated manual lifting processes like low back pain (65%). The workers who participated in the intervention showed a more ergonomic movement (F (5,51);  $p = .02$ ) initiated by a more functional cognitive representation in long term memory ( $\lambda_{crit} = 1.0$ ).

**CONCLUSIONS:** The BASE concept can be described as an intervention which improves ergonomic lifting successfully with lasting effects. We suggest that especially this group of employees, with little motivation to participate in health prevention interventions, benefit from the whole methodological approach of this intervention.

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2973 Board #245 June 1 11:00 AM - 12:30 PM

**The Effects of Kinesio Taping on Muscular Endurance of Deep Neck Flexors: A Pilot Study**

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(No relationships reported)

Kinesio taping (KT) has been applied in clinics for many years. However, previous studies did not have a clear conclusion in relation to the effects of KT for muscular performance. Previous researches mentioned that poor posture of neck may alter the muscular moment arm and the endurance was deteriorated as consequence. This present study examined whether the KT had the effect on changes in muscle length of the deep neck flexors in attempt to alter muscular endurance.

**PURPOSE:** To investigate the effects of KT on muscular endurance of deep neck flexors.

**METHODS:** Six healthy participants, three males (mean age  $20.0 \pm 1.0$  years) and three females (mean age  $22.0 \pm 4.3$  years) were recruited in this study. Custom-designed neck strength measure instrument, with examined between days and with-in days reliability as  $ICC=0.968-0.988$ , was used to measure the muscular endurance of deep neck flexors in two conditions (KT and without KT). KT was applied on levator scapulae and upper trapezius, subjects were asked to maintain maximal voluntary contraction (MVC) of craniocervical flexion till fatigue. We quantified muscular endurance by investigating muscle fatigue time which defined the time of the muscle moment drop to 50% of its peak value. Wilcoxon Signed-Rank Test was used to compare the differences of muscle fatigue time and muscle strength between the two taping conditions.

**RESULTS:** The mean muscle fatigue time without KT was  $26.3 \pm 22.0$  seconds and with KT was  $26.6 \pm 20.7$  seconds. There was no significant difference between two taping conditions ( $p>0.05$ ). There was also no significant difference on mean peak muscle moment between two conditions ( $p>0.05$ ),  $46.3 \pm 17.1$  kg-cm vs.  $48.0 \pm 14.0$  kg-cm as without KT vs. with KT respectively.

**CONCLUSION:** The application of Kinesio taping over the upper trapezius and levator scapulae may not be a useful taping method to enhance the muscular endurance of deep neck flexors.

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2974 Board #246 June 1 11:00 AM - 12:30 PM

**Changes in Lumbopelvic Mechanics Following Ultrasound Guided Nerve Block in the Superior Gluteal Nerve**

Carmen G. Cooper<sup>1</sup>, Karen Kendall<sup>1</sup>, Chirag Patel<sup>2</sup>, Michael B. Pohl<sup>3</sup>, Preston Wiley<sup>4</sup>, Carolyn Emery<sup>4</sup>, Reed Ferber<sup>1</sup>. <sup>1</sup>Running Injury Clinic, University of Calgary, Calgary, AB, Canada. <sup>2</sup>Foothills Hospital, University of Calgary, Calgary, AB, Canada. <sup>3</sup>University of Kentucky, Lexington, KY. <sup>4</sup>Sports Medicine Centre, University of Calgary, Calgary, AB, Canada. (Sponsor: Louis Osternig, FACSM)

(No relationships reported)

The Trendelenburg test (TT) has been described as a functional screening measure of ipsilateral hip abductor (HABD) strength and as an indicator of contralateral frontal plane pelvic stability. Few studies have specifically tested this hypothesis and no study has used a nerve block procedure to evaluate the function of the HABD.

**PURPOSE:** To assess the effect of superior gluteal nerve inhibition, and subsequent reduced function of the HABD, on the frontal plane kinematics of the pelvis during the TT and while walking.

**METHODS:** Baseline HABD maximal voluntary isometric contraction (MVIC) data were collected on 7 male subjects (median (interquartile range): 31yrs (22 to 32yrs); 176cm (168 to 181cm); 73kg (67 to 81kg)) with a force dynamometer. Baseline biomechanical data were measured using retro-reflective markers placed on the pelvis during a standardized 30s TT and while level treadmill walking at 1.34m/s. An ultrasound-guided nerve block (UNB) of the right superior gluteal nerve was performed and MVIC and biomechanical measures were repeated. Variables of interest included contralateral magnitude of pelvic drop (cMPD) during the TT and contralateral pelvic excursion (cPE), calculated from 10 consecutive footfalls during walking. Post UNB MVIC output was calculated as a percent change from baseline. Digitization was completed using Vicon Motus v9 software. Non-parametric statistical analyses using Wilcoxon signed-rank tests determined differences, if any, following the UNB.

**RESULTS:** A 52% reduction in HABD MVIC was measured following the UNB (Baseline:  $3.3$  (3.0 to 4.0); UNB:  $1.8$  (1.7 to 2.4);  $p=0.02$ ). No differences were found in cMPD (Baseline:  $0.4$  (-4.1 to 1.7); UNB:  $-1.4$  (-3.1 to 0.8);  $p=0.99$ ) during the TT, or cPE (Baseline:  $5.5$  (4.6 to 6.3); UNB:  $6.4$  (4.8 to 6.7);  $p=0.13$ ) while walking.

**CONCLUSIONS:** No significant changes in frontal plane pelvic kinematics were measured despite a significant drop in HABD MVIC, during the TT or while walking. These results suggest that the HABD may not be the primary frontal plane stabilizers of the pelvis. Further study is needed to determine if TT is adequate as a functional screening measure for HABD strength and frontal plane stability of the pelvis.

2975 Board #247 June 1 11:00 AM - 12:30 PM

**Multifidus Cross-sectional Area In Hungarian Gymnasts With And Without Back Pain - A Preliminary Study**

Caisa Brooks<sup>1</sup>, Aaron Johnson<sup>1</sup>, J. William Myrer<sup>1</sup>, Martina Uvacsek<sup>2</sup>, Miklos Toth<sup>2</sup>, Pat Vehrs, FACSM<sup>1</sup>, Ronald Hager<sup>1</sup>, Alyssa Symres<sup>1</sup>. <sup>1</sup>Brigham Young University, Provo, UT. <sup>2</sup>Semmelweis University, Budapest, Hungary.  
(No relationships reported)

Gymnasts often experience back pain due to added loads and sport specific demands. It is important to develop protocols to decrease back pain in order to allow athletes to perform at optimal levels.

**PURPOSE:** To correlate multifidus muscle cross-sectional area (CSA) to low back pain in Hungarian gymnasts.

**METHODS:** Thirteen gymnasts (males n=2, females n=11, age: 21.5 ± 1.8 years, body mass: 62.3 ± 9.5 kg, height: 1.7 ± .08 m.) were analyzed using ultrasound imaging. Participants completed a back functional index and self-reported history of back pain. Gymnasts were divided into two groups, those with and those without back pain. From a prone position, cross-section images of the right (R) and left (L) multifidus at all lumbar spinal levels were captured from video clips of each participant at rest and during contraction. Researchers capturing the images and measuring CSA were blinded to the participant group assignment. Muscle CSA was measured when the athlete was fully relaxed; clips of the muscle during contraction were used to help determine the muscle borders. The muscle borders were indicated by tracing the fascia surrounding each muscle and cross sectional area was computed by the ultrasound software. Differences in groups were determined by ANOVA, alpha at .05.

**RESULTS:** There is a significant difference in CSA between those gymnasts with and without back pain (p = .025), but not between R and L sides (p = .81) within groups.

**CONCLUSIONS:** Gymnasts with low back pain demonstrated smaller multifidus CSA than their pain-free counterparts. A study involving elite cricket players reported similar results. Specific strengthening of multifidus may be warranted.

Multifidus cross-sectional area (cm<sup>2</sup>) in Hungarian Gymnasts

| Lumbar Level | No Lumbar Pain Right | No Lumbar Pain Left | Lumbar Pain Right | Lumbar Pain Left |
|--------------|----------------------|---------------------|-------------------|------------------|
| L1           | 2.4 ± .4             | 2.5 ± .5            | 2.3 ± .4          | 2.4 ± .4         |
| L2           | 3.5 ± .8             | 3.6 ± 1.2           | 3.3 ± .5          | 3.5 ± .6         |
| L3           | 5.9 ± .8             | 5.9 ± .6            | 5.0 ± 1.1         | 5.0 ± 1.1        |
| L4           | 9.1 ± 1.3            | 8.9 ± 1.9           | 7.9 ± 1.2         | 8.0 ± 1.0        |
| L5           | 9.4 ± 1.5            | 9.6 ± 1.1           | 8.4 ± 1.6         | 8.6 ± 1.6        |

2976 Board #248 June 1 11:00 AM - 12:30 PM

**Relationship Of Back Muscular Endurance With Anthropometric Measures In Firefighters**

John M. Mayer, Ren Chen, Simon Dagenais, James L. Nuzzo, Joe L. Verna, William S. Quillen, FACSM. University of South Florida, Tampa, FL.  
(No relationships reported)

Firefighters are at risk of experiencing low back pain that may lead to reduced physical function, disability, and work loss. Decreased muscular endurance of the back is associated with abnormal anthropometric measures and may increase the risk of low back pain in the general population. However, this relationship has not been explored in firefighters.

**PURPOSE:** To assess the relationship between various anthropometric measures and back muscular endurance in firefighters.

**METHODS:** Assessments were conducted in full duty, healthy, career firefighters without low back pain from Tampa Fire Rescue (Florida, US) who participated in a randomized controlled trial. Anthropometric measures included height, body weight, body fat percentage assessed with BodPod, and thickness of the abdominal and lumbar multifidus muscles assessed with ultrasound. Isometric muscular endurance was assessed for the back with the Modified Biering Sorensen Test and core with the Plank Test. Relationships between variables were explored using Pearson's correlation.

**RESULTS:** 96 firefighters (87 male, 9 female) enrolled in the study. For back muscular endurance, significant (p < 0.05) correlations were noted with age (r = -0.29), body weight (r = -0.45), body fat percentage (r = -0.46), and thickness of the transverse abdominis, internal and external oblique abdominis, and L4-L5 multifidus muscles (r = -0.24 to r = -0.41). For core muscular endurance, significant (p < 0.05) correlations were noted with body weight (r = -0.43), body fat percentage (r = -0.54), and thickness of the L4-L5 multifidus muscles (r = -0.32 to r = -0.46).

**CONCLUSIONS:** Both increased body weight and body fat percentage were correlated with decreased muscular endurance of the back. Future research is needed to assess the impact of improving body composition on back muscular endurance to reduce the risk of low back pain.

2977 Board #249 June 1 11:00 AM - 12:30 PM

**Atrophy and Asymmetry of Trunk Muscles In Combative Sports Athletes with Lumbar Intervertebral Disc Degeneration**

Kazunori Iwai<sup>1</sup>, Takashi Okada<sup>2</sup>, Koichi Nakazato<sup>3</sup>, Kazunori Irie<sup>3</sup>, Kenji Hiranuma<sup>3</sup>. <sup>1</sup>Hiroshima National College of Maritime Technology, Hiroshima, Japan. <sup>2</sup>Ryotokuji University, Chiba, Japan. <sup>3</sup>Nippon Sport Science University, Tokyo, Japan.  
(No relationships reported)

A high incidence and prevalence of lumbar intervertebral disc degeneration (LDD) was found in combative sports with high demands on the spine. Similarly, low back pain (LBP) also occurs in combative sports. Although there are many relevant factors for LBP, it should be noted that LBP has been associated with cross-sectional areas (CSAs) of trunk muscles. However, little is known about an association between LDD and CSAs in combative athletes.

**PURPOSE:** This study examined whether the presence of LDD affects the size and symmetry of CSAs of trunk muscles in combative sports athletes.

**METHODS:** Participants in this study were 151 collegiate combative sports athletes. A total of 755 lumbar intervertebral discs from L1/2 to L5/S1 in 151 athletes were assessed using MRI and a comprehensive grading system of LDD (grades I-V). All 151 athletes were divided into 2 groups: LDD and non-LDD. CSAs of trunk muscles at the L3/4 disc level were measured on MRI. CSAs were calculated using an image analysis software, and grouped into 5 large areas because they had poorly defined borders. Each of the 5 areas was represented by the same CSA on the left and right sides of the transverse image (rectus abdominis, obliques, psoas, quadratus lumborum, and erector spinae). CSAs of the athletes were compared between the LDD and non-LDD groups using an unpaired Student's t-test. A paired t-test was employed for comparisons of CSAs between the left and right sides. The level of statistical significance was adjusted based on p < 0.05.

**RESULTS:** Sixty-nine athletes had LDD at 1 or more disc levels (45.7%). The LDD grade for the lower 2 disc levels was significantly higher than that for the other disc levels (p < 0.001). CSAs of trunk muscles in the LDD group were significantly smaller than those in the non-LDD group (rectus abdominis: p < 0.05; obliques: p < 0.05; quadratus lumborum: p < 0.01; erector spinae: p < 0.001). Furthermore, CSAs were significantly asymmetrical between the left and right sides in the LDD group (obliques: p < 0.05; quadratus lumborum: p < 0.001).

**CONCLUSION:** This study suggested the association between the presence of LDD and atrophy and asymmetry of trunk muscles in combative sports athletes.

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2978 Board #250 June 1 11:00 AM - 12:30 PM

**Bicycle Design Influence on Lumbar Spinal Anatomy**

Stephen T. Jones, MD, Philip J. Blount, MD, FACSM, Daniel T. Hankins, MD, Brittney N. Tubbs, Allen R. Moore, William T. Rosenblatt. *University of MS Medical Center, Jackson, MS.*

(No relationships reported)

**PURPOSE:** The purpose of this study is to compare intervertebral foramen diameter in the lumbar spine in the neutral standing position to that of an appropriately fit recumbent bike, hybrid bike, and diamond racing frame.

**METHODS:** Single participant was used to obtain lateral radiographs of intervertebral foramina diameters both standing and on three bicycle formats. Subject was placed on an appropriate fit recumbent bike, hybrid bike, and diamond racing bike. MSK radiologist was incorporated to standardize angling of x-ray beam and analysis of data collection.

Images were analyzed on the Philips iSite PACS system including measurement of the lumbosacral angle and the cross sectional area (CSA) of the intervertebral foramina at L3-4, L4-5, and L5-S1. The lumbosacral angle was taken as the angle between lines drawn along the vertical axis of L5 and S1. The freehand region of interest (ROI) tool was used to measure the CSA by tracing the osseous borders of the foramen on the lateral radiograph. The lateral radiograph provides a summation of the right and left foramen when the osseous borders are traced along the posterior vertebral line, pedicles, and articular facets of each intervertebral foramen level.

**RESULTS:** Cross sectional area measurements were recorded. Cross sectional area was lowest in standing at all measured disk levels. L5-S1 was smallest level in standing and on all bikes tested. Recumbent bike foramina cross sectional area was lower than the other two tested bicycles at L4-5 and L5-S1.

Lumbosacral angle measurements were also recorded. Lumbosacral angle measurements were similar between the tested bikes but higher in all bikes relative to the standing position.

There was a statistically different measurement in intervertebral foramen diameter of the bicycles when compared to standing.

**CONCLUSIONS:** Bicycle design and fit does influence intervertebral foramen anatomy.

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**E-38 Free Communication/Poster - Sports Science III: Individual Sports**

JUNE 1, 2012 7:30 AM - 12:30 PM

ROOM: Exhibit Hall

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2979 Board #251 June 1 9:30 AM - 11:00 AM

**Chronological Trends and Limits to Running Performances and Physiological Attributes of World Record Holders**

R. Hugh Morton. *Massey University, Palmerston North, New Zealand.* (Sponsor: Glenn A Gaesser, FACSM)

(No relationships reported)

The International Amateur Athletic Federation provides readily accessible data on the progression of ratified world records over the years in running events at distances from 100m to the marathon for both men and women.

**PURPOSE:** To investigate trends and limits to performances and physiological attributes of world class runners.

**METHODS:** In one dimension, for any given distance the chronological trend can be well modeled by a simple single exponential decline towards an ultimate finite limit. In the other dimension, for any given point in time existing records provide information on the physiological performance attributes of the "composite" records holder. These attributes are estimated using the 3-parameter critical power model of human bioenergetics, in which a linear feedback system links maximal voluntary effort to the declining energy availability as the race progresses. In both dimensions an indicator variable can be incorporated to account for gender differences. In so doing, for both men and women, predictions are made for records at common distances and at ten year intervals for the next fifty years; ultimate records are estimated and compared with estimates made in the past by others; and the physiological attributes of the composite ultimate super male and female runners are compared to both current composite and individual values.

**RESULTS:** Women's records have been improving at a faster rate than men's, and have stabilised at around 90% relative to men's. Ultimate forecasts are consistent with those made by other investigators. Aerobic power as represented by critical speed has been increasing significantly over the years, women always below men, and relativity is now stable at around 90%. Anaerobic power as represented by maximal instantaneous velocity trends similarly, but current relativity is around 95%. On the other hand, anaerobic (distance) capacities have been declining over the years; much more so for women than men, and are now about equal.

**CONCLUSION:** Although both male and female running performances have improved significantly over the years, parallel improvements in only two of three estimated physiological parameters occurred, while the third declined. This counter-intuitive inverse relationship is perhaps not unexpected as it has been observed in other exercise settings.

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2980 Board #252 June 1 9:30 AM - 11:00 AM

**Skill Differences for Elite Sprint Freestyle Competitive Swimmers**

Tetsuya Tanaka<sup>1</sup>, Yutaka Yoshimura<sup>1</sup>, Michio Yasukawa<sup>1</sup>, Kazuo Oishi<sup>2</sup>. <sup>1</sup>*Chuo University, Tokyo, Japan.* <sup>2</sup>*Rikkyo University, Tokyo, Japan.*

(No relationships reported)

Recently the techniques of competitive swimmers have been analyzed during the start phase and the turn phase to improve performance. However, in most cases these techniques have been assessed subjectively with no quantitative evidence.

**PURPOSE:** The purpose of this study was to analyze skills of streamlining and dolphin kicking during the turn phase and provide quantitative evidence of their value or lack of same.

**METHODS:** The subjects were 6 elite Japanese sprint freestyle competitive swimmers. All were members of the winning team at the 2011 Japan intercollegiate swimming championship. A speed meter that measures a subject's forward velocity by pulling a fine wire over a generator (Maglischo, 2003) was used. This speed meter recorded their intracyclic velocity changes during a 15m maximum effort freestyle swim following a turn. The swim included an underwater dolphin kicking phase of approximately 5m (5.18±2.07m). An underwater video analysis system was also used to check their streamlining, kicking, and stroking techniques. Based on the video data, the authors derived the length of the kicking cycle and the rate of rise during it. The rate of rise was determined as the velocity divided by the maximum water depth which was then multiplied by the dolphin kicking time. Both the rate of rise and the distance per kick (DPK) were measured for each of the 6 swimmers from the collected data.

**RESULTS:** There was a significant relationship between the time required to traverse 15m after the turn (8.21±0.44sec) and DPK (0.79±0.07m/kick) for all of the 6 swimmers (r=-0.89, P=0.017). There was also a significant (r=-0.86, P=0.028) relationship between the time to 15m and the rate of rise (0.22±0.09m/sec). Namely when the DPK and rate of rise were greater, the time to 15m was faster. The multiple regression analysis obtained was as follows: Y = -3.55X1 - 2.17X2 + 11.39 (where Y = the time required, X1 = DPK, and X2 = the rate of rise). The multiple regression analysis showed significant relationships between the time to 15m and both the DPK and the rate of rise (R<sup>2</sup>=0.908, F=14.84, P=0.028).

**CONCLUSIONS:** Improvements in DPK and the rate of rise during dolphin kicking may be important factors for improving swimming times to 15m following turns. Reference: Maglischo, E. W. (2003) Swimming Fastest. Human Kinetics.

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2981 Board #253 June 1 9:30 AM - 11:00 AM

**A Descriptive Profile of Musculoskeletal Testing of Elite Junior Tennis Players**

Todd S. Ellenbecker<sup>1</sup>, Mark S. Kovacs<sup>2</sup>, Tetsuro Sueyoshi<sup>1</sup>. <sup>1</sup>Physiotherapy Associates Scottsdale Sports Clinic, Scottsdale, AZ. <sup>2</sup>Kennesaw State University & United States Tennis Association Player Development Incorporated, Kennesaw, GA. (Sponsor: T. Jeff Chandler, FACSM)  
(No relationships reported)

The use of musculoskeletal testing to prevent injury and enhance performance is an integral part of the comprehensive care of elite athletes by sports medicine professionals. Sport specific descriptive data aids in the interpretation of these tests and helps to define characteristic adaptations inherent in certain homogenous populations.

**PURPOSE:** The purpose of this study is to present the descriptive findings of a sport specific musculoskeletal profile in elite junior tennis players.

**METHODS:** Since 2003, 140 male (M) (mean age 17.5) and 141 female (F) (mean age 16.6) players without injury underwent musculoskeletal testing to measure strength and flexibility using a standardized testing protocol by one tester. These tests included stabilized measurement of hip and shoulder ROM, isokinetic strength testing, one leg stability test, hypermobility index, and scapular evaluation. Bilateral extremity testing was performed to formulate both dominant (D) and nondominant (ND) extremity profiles. Descriptive statistics were used to produce separate male and female profiles.

**RESULTS:** The average number of years of competitive tennis play was 8.72 M & 7.04 F. 73% M & 98 F players used a 2 handed backhand. Consistent with prior reports, both (M) and (F) players had less (D) arm internal rotation range of motion (ROM) and greater external rotation ROM. Nearly symmetrical hip ROM was measured bilaterally. 20% of the M and 59% of the F were positive for hypermobility using the Beighton Index. M players failed the one-leg stability test at a rate of 65% on the D limb and 67 on the ND limb with 55% of F failing the test on their D limb and 64% on their ND limb. Visually identified scapular pathology was identified on the D arm 73% in M and 64% in F as opposed to 53% M and 46% on the ND extremity. Grip strength was greater on the dominant arm in both M and F players. Characteristic patterns of external and internal rotation strength were measured. Data presented in Table 1 below.

**CONCLUSIONS:** These data show specific musculoskeletal adaptations in elite tennis players as well as present the rate of positive tests findings (test failure) indicating increased injury risk. These data are meant to further the understanding and aid in the interpretation of musculoskeletal testing in elite junior tennis players.

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2982 Board #254 June 1 9:30 AM - 11:00 AM

**Strength: Volume Ratio For The Forearm In Climbers And Non-climbers**

Vanesa España Romero<sup>1</sup>, Phillip B. Watts, FACSM<sup>2</sup>. <sup>1</sup>Northern Michigan University, Marquette, MI. <sup>2</sup>University of South Carolina, Columbia, SC. <sup>2</sup>Northern Michigan University, Marquette, MI.  
(No relationships reported)

Many climbers and coaches perceive strength in the muscles that control finger position critical to high-level performance. It has also been recognized that handgrip strength is higher in rock climbers than non-climbers. It is well accepted that muscle cross-sectional area or mass is directly related to maximum force capability, however, whether applied experience in rock climbing affects the relationship between muscle size and maximal strength is not known. The purpose of this study was to examine if a strength: size ratio for the forearm differed between climbers and non-climbers.

**METHODS:** Twenty-eight experienced climbers (age = 25.2±9.6 yr) and 26 active adults non-climbers (age = 21±1.7) volunteered as subjects. Height and weight body were evaluated. Maximal handgrip strength (HG) was measured by dynamometry and finger force (FF) via a piezoelectric force sensor fitted with a plate to accept the distal digits of four fingers. Resting forearm volume (FAV) was determined via water displacement.

**RESULTS:** Significantly higher HG and FF were found in both hands for climbers compared with non-climbers expressed both in kg and kg per body weight (P<0.01). Significant differences were not found for FAV between climbers (1311.6 ± 397.3 ml and 1283.9 ± 380.1 ml for right and left hands respectively) and non-climbers (1382.1 ± 556.7 ml and 1326.2 ± 548.3 ml for right and left hands respectively) for either right hand or left hand (P>0.05). However, the ratio of HG to FAV (HG:FAV) and the ratio of FF to FVA (FF:FVA) were significantly higher for climbers versus non-climbers for both hands (P<0.01).

Right FAV was significantly correlated with height (r=0.42, P<0.05), weight (r=0.59, P<0.01), and right and left handgrip strength (r= 0.55, P<0.01 and r= 0.46, P <0.05, respectively) in climbers. However, right FAV was only correlated with weight in the non-climbers. Similar results were found for left FAV.

**CONCLUSIONS:** The higher HG and FF in climbers relative to non-climber controls supports a specificity of training effect on the associated muscle groups. That the ratios of handgrip strength to forearm volume and finger force to forearm volume are higher for climbers vs. controls suggest that neural factors instead of hypertrophy may account for much of the strength differences between climbers and non-climbers.

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2983 Board #255 June 1 9:30 AM - 11:00 AM

**Perceived Stress and Salivary Cortisol in Collegiate Track and Field Athletes. A Pilot Study.**

Cynthia Ferrara, FACSM, Laura Donigian, Julie Lorden, Matthew Read, Joshua Turner. *University of Massachusetts Lowell, Lowell, MA.*  
(No relationships reported)

**PURPOSE:** The purpose of this pilot study was to examine changes in perceived stress and salivary cortisol levels in four student track and field athletes over an eight month period. We hypothesized that perceived stress and salivary cortisol levels would be higher during the in season compared to the off season and salivary cortisol levels would be related to perceived stress.

**METHODS:** Measurements of psychological stress (Recovery-Stress Questionnaire for Athletes, RESTQ-52) and saliva samples for measurement of salivary cortisol were collected weekly. In season and off season values for each athlete individually and for the group were compared by t-tests and relationships between stress values and salivary cortisol were examined using Pearson correlations. Results are presented as means±SEM. Statistical significance was set at p<0.05.

**RESULTS:** From September to April, a total of 101 saliva samples and 90 RESTQ-52 surveys were collected and analyzed. Athletes who completed at least 60% of the surveys and saliva collections (1 male and 3 females) were included in the final analysis, which included 69 saliva samples and 77 RESTQ-52 surveys. Salivary cortisol levels were elevated but not statistically higher during the in season compared to the off season, when considering individual athletes or overall averages (6.1±0.7 vs. 5.0±0.9 nmol/L, p=0.3, respectively). General, emotional, and social stress values were not statistically higher during the in season compared to the off season (1.1±0.2 vs. 1.4±0.2, 1.6±0.2 vs. 1.5±0.2, 1.9±0.3 vs. 1.7±0.2, respectively, for the overall averages). Salivary cortisol levels were not significantly associated with general, emotional, or social stress values.

**CONCLUSIONS:** The results of this pilot study suggest that salivary cortisol levels may increase in athletes during the in-season compared to off-season. Levels of perceived stress may not be associated with salivary cortisol, a physiological marker of stress. Additional studies are needed with a larger sample size and to determine effective ways to monitor perceived and physiological stress in athletes, and the effects of stress on performance and risk of injury or illness.

Supported by UMass Lowell School of Health and Environment Creativity grant and Graduate Student Association grant.

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2984 Board #256 June 1 9:30 AM - 11:00 AM

**Changes In Locomotor, Respiratory And Autonomic Nervous Systems During Simplified Tai Chi Exercise**

Kaiyu Xiong, Ruiyu Yang, Hui He. *Beijing Sport University, Beijing, China.*  
(No relationships reported)

**PURPOSE:** The purpose of this study was to investigate the influence of age and training level on locomotor, respiratory and autonomic nervous system during tai chi exercise.

**METHODS:** Forty adults including young group(Y, 20-24 years old) and older group(O, over 55 years old) was divided into high level(H) group and control(C) group with 10 subjects in each one. Subjects in high level group had tai chi for over 15 years, and those in control group for 1-3 years. Test synchronously biomechanics and dynamic parameters, electromyography, cardiopulmonary function and heart rate variability indexes by QUALISYS, portable electromyography instrument, Cortex and Polar during three times simplified Tai chi exercise.

**RESULTS:** (1) Average discharge rate of lateral deltoid in H group was apparently higher than C group(P<0.05, P<0.01) during Grasp the peacock's tail (the third session of simplified Tai chi) exercise; (2) Average RR interval, RLX baseline, SD1 and RMSSD in young adults' high level group(YH) were significantly higher than young adults' control group(YC)(P<0.05), but

there was no significant difference between older adults' high level group(OH) and older adults' control group(OC); (3)Low Frequency(LF)/High Frequency(HF) in recovery period was lower than exercise period in YH group(180.1±42.4 vs. 346.6±75.9) and OH group(186.3±67.7 vs. 345.0±107.4), but higher in YC group(346.6±109.0 vs. 216.0±62.5) and OC group(316.3±59.6 vs. 202.6±62.2); (4) Tidal volume and expiratory time in YH group were significantly higher than YC group(P<0.05, P<0.01), and respiratory rate was significantly lower than YC group(P<0.05). There was no significant change between OH group and OC group; (5)Average RR interval was in high correlation with indexes of gaseous metabolism in H group (P<0.01).

**CONCLUSION:** There are important influences on respiratory and autonomic nervous systems in training level, and age can have effect heart rate variability indexes.

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**2985** Board #257 June 1 9:30 AM - 11:00 AM

**The Use of Session-RPE Method for Quantifying Training Load in Elite Taekwondo Athletes.**

Erika Casolino<sup>1</sup>, Cristina Cortis<sup>2</sup>, Carlo Minganti<sup>3</sup>, Corrado Lupo<sup>1</sup>, Laura Capranica<sup>1</sup>. <sup>1</sup>University of Rome Foro Italico, Rome, Italy. <sup>2</sup>University of Cassino, Cassino, Italy. <sup>3</sup>University of Catanzaro, Catanzaro, Italy. (Sponsor: Carl Foster, FACSM)  
(No relationships reported)

In general, heart rate (HR) responses are used to control the internal training load (ITL) in different sports. A more practical method to monitor ITL is based on subjective ratings of perceived exertion (RPE) in relation to the duration of the training session (Session-RPE).

**PURPOSE:** The aim of the present study was to evaluate the convergent validity between two methods for quantifying ITL in elite taekwondo athletes: the Edward's ITL method based on HR and the Foster's Session-RPE method based on subjective evaluation of efforts, respectively.

**METHODS:** Twenty-eight elite black belt taekwondo athletes (F = 11; M = 17; age: 23.0 ± 3.3 yr; body mass: F = 59.4 ± 7.3 kg, M = 71.9 ± 10.7 kg) with at least 5 yr of training experience consisting of 2 hr session<sup>-1</sup> for 6 days<sup>-1</sup> week<sup>-1</sup> participated in the study. Over 6 weeks, 36 training sessions (6 training sessions week<sup>-1</sup>; duration range: 22-113 min) were monitored obtaining 279 HR and RPE recordings.

**RESULTS:** Significant (P<0.05) correlations emerged between Session-RPE and Edward's ITL for individuals (range: 0.50-0.97), group (r = 0.58), and training objectives (i.e., technical/tactical: r = 0.49; physical conditioning: r = 0.48).

**CONCLUSION:** The present findings support the use of Session-RPE as a valid tool for quantifying the internal training load of elite taekwondo athletes during regular training sessions. In considering that Session-RPE can be easily administered without requiring expensive apparatus, coaches could profit of this method to monitor the individual responses of athletes to their training plans.

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**2986** Board #258 June 1 9:30 AM - 11:00 AM

**The Effect of Ability and Technique on VO<sub>2</sub> and Heart Rate Drift in Rock Climbers**

Simon M. Fryer<sup>1</sup>, Tabitha Dickson<sup>1</sup>, Nick Draper<sup>1</sup>, Gavin Blackwell<sup>1</sup>, Lee Stoner<sup>2</sup>. <sup>1</sup>University of Canterbury, Christchurch, New Zealand. <sup>2</sup>University of Massey, Wellington, New Zealand. (Sponsor: Kevin K. McCully, FACSM)  
(No relationships reported)

Previous research has speculated that the disproportionate rise in heart rate for a given VO<sub>2</sub> seen in rock climbing may be due to anxiety or nervousness, an increased amount of time spent in isometric contraction or the presence of the metaboreflex.

**PURPOSE:** To examine technique, psychological and physiological factors which affect the VO<sub>2</sub> : heart rate relationship in intermediate, advanced and elite rock climbers.

**METHOD:** The current study measured rest frequency, total static time and the percentage of static time which was spent resting as well as anxiety, heart rate and VO<sub>2</sub> responses in intermediate (n=12), advanced (n=19) and elite (n=15) rock climbers. All climbers performed at or near their maximum self reported on-sight grade (19/22/25+ Ewbank respectively).

**RESULTS:** Findings revealed a non-significant differences (p>0.05) between intermediate, advanced and elite climbers for pre climb heart rate, state anxiety and self confidence. The intermediate climbers displayed a disproportionate rise in heart rate for VO<sub>2</sub> throughout the climb whereas advanced and elite climbers showed an initial elevation before mimicking the linear relationship seen in their VO<sub>2max</sub> trials. Significant differences (P<0.05) were observed between intermediate, advanced and elite groups for rest frequency, total static time and the percentage of static time which was spent resting.

**CONCLUSION:** Our findings suggest anxiety plays no part in the observed disproportionate rise in heart rate during rock climbing. The sufficient amount of rest time during climbing appears to help maintain the heart rate: VO<sub>2</sub> relationship similar to that seen during a VO<sub>2max</sub> trial.

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**2987** Board #259 June 1 9:30 AM - 11:00 AM

**Effects Of Autonomic Tone On Short Versus Long Distance Performances In Swimmers**

Martina A. Maggioni<sup>1</sup>, Arsenio Veicsteinas<sup>2</sup>, Pietro L. Invernizzi<sup>1</sup>, Claudio Ciapparelli<sup>3</sup>, Paolo Castiglioni<sup>2</sup>, Giampiero Merati<sup>1</sup>. <sup>1</sup>University of Milan, Milano, Italy. <sup>2</sup>Don C. Gnocchi Foundation, Milan, Italy. <sup>3</sup>DDS Sport Center, Settimo Milanese, Italy.  
(No relationships reported)

Whatever the swimming specialty, swim training programs generally consist of high volume, which may shifts the heart rate (HR) autonomic control towards vagal predominance. Although it is accepted that an enhanced parasympathetic tone may improve performance on long distances, it is poorly known whether it may affect performance on short distances.

**PURPOSE:** To evaluate resting autonomic tone and swimming performance on short and long distances in highly trained swimmers.

**METHODS.** Two groups of national-level swimmers (all males, crawl specialists) were evaluated: short (S: 50-100 m; n=13; 24±3 yrs) and long (L: 1500 m; n=9; age 19±1 yrs) distance specialists. All swimmers belonged to the same team and were similar for training level. Beat-by-beat HR was recorded at rest in the morning, in supine position, by a HR monitor for 15 minutes. HR variability indexes were calculated from time (RMSSD, pNN50, indexes of vagal tone) and frequency (LF, Low Frequency and HF, High Frequency as absolute values and in normalized units (nu); LF/HF ratio, index of sympathovagal balance) domains. The anaerobic threshold was evaluated by an incremental swimming test with lactate measurements.

**RESULTS.** The percentage of swimmers who showed resting bradycardia tended to be higher in L (78%) than in S (54%) group. HRV indexes did not significantly differ between groups: RMSSD 67±23 vs 66±11 ms, pNN50 40±17 vs 48±10%, LFnu 62.3±12.3 vs 54.4±14.8, HFnu 37.6±12.3 vs 45.6±14.8, LF/HF 2.1±1.9 vs 1.5±1.0 (S vs L group, respectively). In S group, 50 m best time correlated positively (p<0.05) with RMSSD (r=0.64), pNN50 (r=0.73) and absolute HF power (r=0.64), and negatively with LFnu (r=-0.56), but not with anaerobic threshold. On the contrary, in L group 1500 m did not correlate with RMSSD, pNN50 and absolute HF power (although negative trends were perceived), negatively correlated with absolute LF power (r=-0.65 p=0.05), positively correlated with LFnu (r=0.72, p=0.02), and tended to increase with anaerobic threshold.

**CONCLUSION.** L swimmers were not more hypervagotonic than S swimmers, and such adaptation tended to be positively associated with anaerobic threshold. Conversely, high vagal tone appeared somehow detrimental on short swimming performance, as it negatively predicts performance on 50 m events, whereas anaerobic threshold did not.

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**2988** Board #260 June 1 9:30 AM - 11:00 AM

**Sex Differences In Marathon Performance With Advanced Age: Nature Or Nurture?**

Alyssa Stevens, Sandra K. Hunter, FACSM. Marquette University, Milwaukee, WI.  
(No relationships reported)

The sex difference in marathon performance increases with age however the influence of participation rates of men and women are not established.

**PURPOSE:** To determine: (1) if the sex difference in finishing place of marathon performance (1<sup>st</sup>-10<sup>th</sup> place) altered with advanced age, and (2) the association of participation ratios with the sex difference in running velocity.

**METHODS:** Running times of the first 10 placed men and women finishers and the numbers of men and women finishers who competed in the New York City (NYC) Marathon were analyzed. Online data was retrieved for 31 yrs (1980 to 2010). The running times of 3850 men and 3363 women were included in the analysis.



**RESULTS:** The men were faster than women across all age groups (13.9%,  $P<0.001$ ). Velocity decreased across the age groups (5.1 m/s for 20-29 yrs and 2.9 m/s for 70-79 yrs for the top finisher,  $P<0.001$ ). The sex difference in running velocity increased across age groups ( $P<0.05$ ) and decreased across the 31 yrs but more so for the older age groups (age x year,  $P<0.05$ ). The sex difference in velocity increased with the place of the runner (11.0% for 1<sup>st</sup> place to 15.5% for 10<sup>th</sup> place) consistently for all age groups ( $P<0.05$ ). The widening sex difference between 1<sup>st</sup> and 10<sup>th</sup> place was due to greater decrements in velocity of women compared with men (10<sup>th</sup> place was  $81.5 \pm 7.2\%$  vs  $86.5 \pm 6.7\%$  of top finisher). The sex difference in velocity with place also decreased across years between 1980 and 2010 (12.8% to 9.9%,  $P<0.05$ ). The ratio of men to women finishers decreased from 6.8 in 1980 to 1.8 in 2010. The ratio however, decreased more for the older age groups than the younger across years (age x year,  $P<0.05$ ). The men to women ratio in 1980-1985 to 2006-2010 changed from 4.0 to 1.0 for the 20-29 yrs and 23.6 to 5.9 for the 70 to 79 yrs. Importantly, there was a positive association between the ratio of men to women finishers within a 10 year age group over the 31 years and the sex difference in velocity ( $r=0.57$ ,  $r^2=0.33$ ,  $P<0.05$ ).

**CONCLUSION:** The widening sex difference in performance with increased place of the finishers is due to the greater relative decline in velocity of the women across place compared with the men. Furthermore, sex differences in marathon running times over the last 31 years were predicted by participation rates of men and women, especially with advanced age.

**2989** Board #261 June 1 9:30 AM - 11:00 AM  
**Comparison of Running Economy Between Sexes in Ultra-Marathon Runners and Marathon Runners**

Laura Christine Streeper. *San Francisco State University, San Francisco, CA.* (Sponsor: Marialice Kern, FACSM)  
(No relationships reported)

Many researchers have examined sex differences in running economy (RE) in short, middle, and marathon distance runners. However, few investigations have focused primarily on sex differences in RE in ultra-marathon (UMar) runners (>42.2km) and marathon (Mar) runners.

**PURPOSE:** To investigate sex differences in RE in UMar and Mar runners.

**METHODS:** Maximal oxygen consumption ( $VO_{2max}$ ) was measured via a graded exercise test in all participants. Oxygen consumption was then measured in male (M) and female (F) UMar and Mar runners (Age range: 24-60; Mar-M: n=6; Mar-F: n=7; UMar-M: n=9; UMar-F: n=6) during 6 minutes of treadmill running at: 1) 6 mph and 1° grade and 2) 80% of  $VO_{2max}$  and 1° grade. RE was calculated as  $mlO_2 \cdot kg^{-1} \cdot km^{-1}$ . Heart rate (HR) and rating of perceived exertion (RPE) were recorded during each condition. An independent t-test was used to examine differences in variables between the male runners (UMar-M and Mar-M) and female runners (UMar-F and Mar-F). All tests were considered significant at the 0.05 level.

**RESULTS:** The males ran faster than the females at 80% of  $VO_{2max}$  ( $13.72 \pm 0.24$  vs.  $11.59 \pm 0.45$  km/hr,  $p<0.01$ ). Although there were no significant sex differences in RE at 80% of  $VO_{2max}$  (M:  $198.61 \pm 3.40$ , F:  $209.89 \pm 5.19$   $mlO_2 \cdot kg^{-1} \cdot km^{-1}$ ,  $p=0.074$ ). RE at 6mph was significantly different between the sexes with the male runners exhibiting superior RE compared to the females (M:  $192.80 \pm 3.41$ , F:  $204.72 \pm 4.35$   $mlO_2 \cdot kg^{-1} \cdot km^{-1}$ ,  $p=0.038$ ). The males had a significantly higher HR during 80% of  $VO_{2max}$  compared to the females ( $163.40 \pm 2.65$  vs.  $150.77 \pm 3.26$  bpm,  $p<0.01$ ), but there was no sex-difference in HR at 6mph (M:  $129.2 \pm 2.9$ , F:  $133.7 \pm 4.2$  bpm). Furthermore, the males had a significantly higher maximal HR compared to the females ( $183.9 \pm 2.1$  vs.  $175.0 \pm 2.9$  bpm,  $p=0.016$ ). RPE did not significantly differ between sexes at either intensity (80%: M:  $13.7 \pm 0.3$ , F:  $13.2 \pm 0.5$ ,  $p=0.40$ ; 6mph: M:  $8.93 \pm 0.3$ , F:  $10.2 \pm 0.6$ ,  $p=0.052$ ).

**CONCLUSION:** The finding that RE is greater at 6mph in male UMar and Mar runners suggests that male runners are more economical at a sub-maximal speed compared to the females.

**2990** Board #262 June 1 9:30 AM - 11:00 AM  
**Heart Rate Variability in Orthostatic Test During Different Training Periods in Elite Swimmers**

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(No relationships reported)

Intense training has been shown to change the autonomic modulation of the heart in endurance athletes assessed by heart rate variability (HRV) analysis. In overtraining state HRV diminished in athletes of different sports.

**PURPOSE:** This study investigated the effects of intensified training and tapering on HRV in elite swimmers.

**METHODS:** Eleven elite swimmers (7 F and 4 M, age  $17.9 \pm 1.9$  y) lived and trained for 8 weeks before national championships qualifying for European championships. This follow-up period was divided to following microcycles: preparatory general, intensified training, preparatory specific, pre-competition (tapering), and competition periods. RR-intervals were recorded every morning in supine (8-min) and orthostatic (6-min) positions with beat-by-beat heart monitors. Breathing was paced to 12 breaths/min. HRV was analyzed from the last 5-min period of both positions with FFT and autoregressive (AR) spectral power analysis. TRIMPs of every training session were calculated to estimate training. Results are presented as averages of each period and expressed in relative changes.

**RESULTS:** Training load increased during the intensified training period (+86%,  $p=0.01$ ) and progressively decreased during the pre-competition and competition periods from the pre-week. HF spectral power during supine rest increased during intensified training (+38%,  $P=0.03$ ) but recovered to baseline thereafter and stayed near baseline levels during tapering and competition periods. LF/HF ratio during supine rest progressively increased from preparatory general to tapering (+58%,  $P=0.02$ ) and competition periods (+66%,  $P=0.01$ ).

**CONCLUSION:** The present findings are different from previous literature of HRV in endurance athletes. Intensive training has been reported to decrease HRV acutely and a rebound was observed after a relative resting period. In this study, increase of HRV seemed to be related to positive coping with increased training stress of elite swimmers. Interpretation of LF/HF ratio has been questionable, but it has been used as an indicator of the balance of autonomic nervous system. Therefore, these findings suggest that the sympathetic activity of elite swimmers may increase during rest as an anticipatory effect of competition period.

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**2991** Board #263 June 1 9:30 AM - 11:00 AM  
**Oxygen Uptake And Cardiopulmonary Demands Of World-class Judoist Performing The Uchikomi Fitness Test**

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(No relationships reported)

**PURPOSE:** To describe the pulmonary gas exchange and metabolic demand during an intermittent test simulating judo combat, the Uchikomi Fitness Test (UFT).

**METHODS:** Four male world-class judoists (age =  $22 \pm 3$  years, weight =  $75.93 \pm 7.06$  kg and height =  $175.25 \pm 7.06$  cm) completed the UFT three weeks before the Pan American judo Championships 2011. The  $VO_2$  and cardiopulmonary responses were assessed at rest and during UFT using a telemetry system (Cosmed K4b<sup>2</sup>). Aerobic energy (W-aerobic) was equal to the difference between the  $VO_2$  area integrated during UFT and the  $VO_2$  at rest. The anaerobic energy was calculated with the accumulation oxygen deficit (AOD) as described by Medbo et al (1996). The workload during UFT was quantified subjectively using Borg's scale (RPE).

**RESULTS:** Mean $\pm$ SD of the following variables at rest were: BMI =  $24.83 \pm 1.54$   $kg \cdot m^{-2}$ , body fat =  $14.60 \pm 4.17\%$ , lean mass =  $43.53 \pm 2.40\%$ ,  $[La]_{rest}$  =  $2.15 \pm 0.47$   $mmole \cdot l^{-1}$ , HR =  $57 \pm 6$   $beat \cdot min^{-1}$ ,  $VO_{2rest}$  =  $4.31 \pm 0.33$   $ml \cdot min^{-1} \cdot kg^{-1}$ , right and left handgrip strength (HGS) =  $52 \pm 9$  and  $53 \pm 8$  Kg, respectively. During UFT HR $_{mean}$  =  $174 \pm 5$   $beats \cdot min^{-1}$ ,  $VO_{2peak}$  =  $45.72 \pm 2.20$   $ml \cdot min^{-1} \cdot kg^{-1}$ , VE =  $118.50 \pm 7.40$   $l \cdot min^{-1}$ , W-aerobic =  $38.89 \pm 2.80$   $ml \cdot kg^{-1}$ , AOD =  $10.48 \pm 3.58$   $ml \cdot kg^{-1}$ , breathing frequency =  $49 \pm 6$   $br \cdot min^{-1}$ , oxygen pulse =  $21.10 \pm 3.97$   $ml \cdot beat^{-1}$  and tidal volume =  $2.5 \pm 0.22$  l/br. The total number of Uchikomi was  $53 \pm 3$  and post effort right and left HGS =  $53 \pm 11$  and  $55 \pm 6$  Kg, respectively. Peak values for HR,  $[La]_{3min}$ , RQ and RPE were  $187 \pm 6$   $beats \cdot min^{-1}$ ,  $15.13 \pm 1.08$   $mmol \cdot l^{-1}$ ,  $1.26 \pm 0.08$ ,  $18 \pm 2.16$ , respectively. In addition, significant correlations were found between  $VO_{2peak}$  and total number of uchikomi (0.94,  $p<0.05$ ) and between total number of Uchikomi and world ranking list of judoists (-0.98,  $p<0.01$ ).

**CONCLUSIONS:** Comparable cardiopulmonary demands were recorded during judo combat by Ahmaidi et al. (1999). This would suggest that the UFT is representative of the effort provided during judo combat and can be used to predict the judoists's performances.

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2992 Board #264 June 1 9:30 AM - 11:00 AM

**Acute Effects of an Elastic Device on Bench Press Performance in Young Resistance Trained Males**

Xin Ye, Daeyoel Kim, Christopher A. Fahs, Jeremy P. Loenneke, Robert S. Thiebaut, Eonho Kim, Lindy M. Rossow, Kyle A. Sherk, Takashi Abe, Travis W. Beck, Debra A. Bembien, FACSM, Michael G. Bembien, FACSM. *University of Oklahoma, Norman, OK.*  
(No relationships reported)

The one-repetition maximum (1RM) bench press is a standard method to assess upper body strength. Recently, a novel elastic supportive device was developed to increase maximal bench press training loads.

**PURPOSE:** To investigate the acute effects of wearing a supportive elastic device during a high load bench press on strength, average power output, average bar velocity, and the reliability of those measures in resistance trained males.

**METHODS:** Eleven men aged 18-35 years completed 4 testing sessions, each separated by 1 week and at the same time of day. On visit 1, subjects were familiarized with the use the elastic device and on the 2<sup>nd</sup> visit were assessed for 1RM bench press strength, bar velocity, and power. During the 3<sup>rd</sup> and 4<sup>th</sup> visits, subjects reproduced their original 1RM efforts wearing the elastic supportive device. Then the bench press loads were increased until a new 1RM value was obtained (SS 1RM). Average bar velocity and average power output was also determined for each trial. Reliability was assessed by paired t-tests and Pearson correlation coefficients between visits 3 and 4, and differences across the 3 testing visits were assessed by repeated measures ANOVA with statistical significance set at  $p \leq 0.05$ .

**RESULTS:** Reliability for SS 1RM was excellent between visits 3 and 4 ( $r=0.981$ ,  $p<0.001$ ) and the means were within 2.1 kg ( $p=0.124$ ). For measures of power, the correlations for bar velocity and average power were low and non-significant; there were also no differences between means between the two days. Significant improvement for 1 RM ( $p<0.001$ ) was found with a 15.1% increase, but no differences for velocity and power between visit 2 and visits 3 and 4. The correlation between each individual's 1RM percentage increase and their original 1RM was low and non-significant. When comparing the original 1RM in different lifting situations (visits 2, 3, and 4), both average bar velocity ( $p<0.001$ ) and average power output ( $p<0.001$ ) significantly increased.

**CONCLUSIONS:** These results suggest that using the elastic device can significantly increase the bench press training loads and power in a reliable and consistent manner.

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2993 Board #265 June 1 9:30 AM - 11:00 AM

**Higher Iron Content And Antioxidant Depletion In Plasma Of Athletes After 1RM/strength Test.**

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(Sponsor: Tania Pithon-Curi PhD, FACSM)  
(No relationships reported)

**One-repetition maximum test (1RM) has been long used as an appropriate method of measuring isotonic muscle strength. Regarding oxidative stress, augmented xanthine oxidase activity in cytosol of muscle cells is apparently more related to overproduction of reactive oxygen species (ROS) during strength exercises than mitochondrial processes. Thus, key metabolites of iron homeostasis and purine metabolism have been currently suggested as accurate biomarkers of redox metabolism during resistance exercise. Abrupt drops in performance, exacerbated inflammation processes, and injury risks are notoriously associated to excessive production of ROS in athletes.**

**PURPOSE:** This work aims to evaluate the role of iron and uric acid in the plasma redox status of young athletes after strength exercise.

**METHODS:** Young college athletes ( $n = 11$ ; age  $23.1 \pm 2.6$  years; height,  $174.1 \pm 6.9$  cm; weight  $78.2 \pm 8.2$  kg) performed a 1RM test for chest press (pectoralis major extension) after a standard warming protocol (5 min-general warm up, 5 min-upper body stretching, and 1 set of 10 repetitions at estimated 60% 1RM). Blood samples (10 mL) were collected immediately before and 5 min after the 1RM test (pre-/post effect), and glycemia, xanthine oxidase (XO) and creatine kinase (CK) activities, and Trolox-equivalent antioxidant capacity of plasma (TEAC) were compared to total iron, heme-iron, uric acid, and thiobarbituric acid reactive substance (TBARS, biomarker of lipid oxidation) concentrations in plasma.

**RESULTS:** Significant higher glycemia (ca. 10%;  $p = 0.0432$ ) and iron content in plasma (84%;  $p = 0.011$ ) were related to 63% lower TEAC levels ( $p = 0.0067$ ) after the 1RM test. However, only tendencies for higher XO activity ( $p = 0.245$ ) and uric acid concentrations ( $p = 0.181$ ) were evidenced in plasma. Pre-/post 1RM analyses revealed no significant changes in both CK and TBARS indexes.

**CONCLUSIONS:** Iron-related oxidative stress conditions were imposed by maximal strength effort in young subjects, culminating in severe depletion of antioxidant capacity in plasma. Although immediate (oxidative) lesions were not observed, further analyses are necessary to evaluate long-term effects. Purine metabolism is still suggested as a potential source of ROS during strength/resistance exercise. Financial support: FAPESP, CAPES & CNPq (Brazil).

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2994 Board #266 June 1 9:30 AM - 11:00 AM

**An Analysis Of The Physiological Demands Of Race Riding Using A Horse Racing Simulator**

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(No relationships reported)

Despite the international popularity of horse racing, the physiological demands of this challenging sport remain largely unknown. Paramount to all jockeys is the need to chronically maintain a low body mass, necessary to attain the stipulated competition riding weights, whilst maintaining a sufficient level of physical conditioning in order to compete in several races each day.

**PURPOSE:** To determine the physiological demands of simulated race riding.

**METHODS:** Eighteen male trainee jockeys (age  $16 \pm 1$ yr; height  $1.67 \pm 0.05$ m; body mass  $55.68 \pm 5.5$ kg; BMI  $19.88 \pm 1.65$ kgm<sup>-2</sup>; % body fat  $8.13 \pm 1.65$ %) performed a maximal incremental cycle ergometer test starting at 60W and using 25W increments to volitional exhaustion for determination of maximal oxygen consumption (VO<sub>2</sub> max) and maximum heart rate (HR<sub>max</sub>). Two race simulation trials were then completed on a horse racing simulator at a velocity of 30km/hr. Trial 1: a simulated race for the typical time duration to cover a race distance of 1400m. Trial 2: a simulator riding test to exhaustion. A recovery period of 5 minutes was provided between each trial. Physiological function was assessed through measurement of respiratory metabolic measures and heart rate.

**RESULTS:** Mean VO<sub>2</sub> max during the incremental cycle ergometer test was  $57.11 \pm 4.72$  ml/kg/min, with the mean ventilatory threshold (VT) occurring at  $81.2 \pm 5.4$ % VO<sub>2</sub> max and HR<sub>max</sub> was  $188 \pm 12$  beats/min. During the simulated race over 1400m (Trial 1), peak oxygen consumption (VO<sub>2</sub> peak) was  $75 \pm 11$ % of VO<sub>2</sub> max while peak heart rate (HR<sub>peak</sub>) was recorded as  $86 \pm 7$  % HR<sub>max</sub>. In contrast, during the simulator riding to exhaustion (Trial 2) VO<sub>2</sub> peak and HR<sub>peak</sub> were  $82 \pm 10$ % and  $87 \pm 8$ % of the maximal values attained in the incremental cycle test, respectively.

**CONCLUSION:** Determination of the physiological demands of simulated riding provides a clearer insight and understanding of the specific requirements of these athletes during training and competition. The novel results from this study suggest horse racing is a very demanding sport, requiring jockeys to perform close to their physiological limit to be successful. Further research is required to determine the specific physiological demands of horse racing during actual competition.

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2995 Board #267 June 1 9:30 AM - 11:00 AM

**Differences in Running Acceleration and Economy between Collegiate Runners and Cyclists Identified Using High-Resolution Accelerometers**

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(No relationships reported)

We previously reported differences in running economy between highly trained runners and triathletes using high-resolution accelerometry (HRA) and indirect calorimetry, which were partly attributed to greater training volume in the runners.

**PURPOSE:** To determine the differences in axial accelerations and running economy between collegiate runners (RUN) with high or low  $\dot{V}O_{2max}$  and cyclists (CYC) of comparable cardiovascular fitness during treadmill locomotion.

**METHODS:** Subjects gave informed consent to procedures approved by the EMU-CHHS Human Subjects Review Committee. 16 NCAA DI distance runners, divided by  $\dot{V}O_{2max}$  into HI ( $66.3 \pm 0.4$  kg,  $68.7 \pm 1.9$  ml/kg/min) or LO ( $66.1 \pm 0.5$  kg,  $59.9 \pm 5.1$  ml/kg/min), and 8 cyclists (CYC;  $73.5 \pm 4.9$  kg,  $60.7 \pm 3.8$  ml/kg/min) performed incremental  $\dot{V}O_{2max}$  trials starting at 8 kph and increasing 2 kph every 3 min until exhaustion while wearing HRA (Microstrain, VT; 617 Hz). Accelerations in g were recorded for vertical (VT), anterior/posterior (AP), medial/lateral (ML), axes and Euclidian resultants were computed (RES). Group comparisons were made for 10-14kph. Axial root mean square (RMS), RMS relative to speed (EC), and ratio of RMS/RES (Ra) were compared between groups. Expired gases were collected using an Oxycon Mobile (Viasys, CA).  $\dot{V}O_2$  was used to determine  $O_2$  cost ( $O_2C$ ) and energy expenditure (EE). HRA parameters and metabolic parameters were compared by MANCOVA using PASW 17.0 (SPSS; IL)  $\alpha=0.05$ .

**RESULTS:** CYC  $\dot{V}O_{2max}$  was significantly lower than HI ( $p<0.05$ ), but not different than LO. CYC acceleration parameters were significantly greater ( $p<0.05$ ) for  $ML_{RMS}$ ,  $AP_{RMS}$ ,  $VT_{RMS}$ , and  $RES_{RMS}$  compared to both HI and LO.  $ML_{RA}$  was also significantly greater for CYC vs. HI and LO ( $p<0.05$ ), but  $VT_{RA}$  and  $AP_{RA}$  were both lower for CYC than HI and not significantly different from LO.  $O_2C$  was lower in CYC vs. HI ( $177.5 \pm 19.5$  vs.  $184.13 \pm 21.0$  ml/kg/km), but not different from LO. RER was higher in CYC vs. HI and LO ( $1.0 \pm 0.06$  vs.  $0.89 \pm 0.1$  and  $0.86 \pm 0.1$ , respectively), therefore, EE was not different between groups.

**CONCLUSION:** These data show that CYC accelerate more in all axes in absolute terms than HI and LO, however in CYC,  $AP_{RA}$  and  $VT_{RA}$  were similar to LO. Therefore, despite training, running economy ( $O_2C$ ) may be less dependent on absolute accelerations than the relationship between VT and AP, relative to RES.

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2996 Board #268 June 1 9:30 AM - 11:00 AM

### Physiological Testing In Road Cycling, Metabolic And Cardiorespiratory Differences Between Long- And Short-stage Protocols

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(No relationships reported)

Most scientific studies use short duration stages test protocols (1-4 min) to measure the physiological responses of road cyclists. Recently, a new protocol with longer stages (10-min) has been proposed to measure in a more accurately way the physiological responses to exercise in road cyclists. However, it has not been compared to a shorter stage protocol.

**PURPOSE:** To compare the effects of a long- and a short-stage test on metabolic and cardiorespiratory responses in road cyclists.

**METHODS:** 21 well-trained road cyclists performed two incremental tests until exhaustion on cycle ergometer with a week of difference. The first test involved short stages ( $T_1$ ) (warm-up: 100 W·10 min<sup>-1</sup>, started at 200 W, increments: 30 W·3 min<sup>-1</sup>), the second test involved long stages ( $T_2$ ) (warm-up: 2 W·kg<sup>-1</sup>·10 min<sup>-1</sup>, increments: 0.5 W·kg<sup>-1</sup>·10 min<sup>-1</sup>).  $\dot{V}O_2$ ,  $\dot{V}CO_2$ , HR and  $[La]_b$  were measured throughout the test. Fat and carbohydrate oxidation rates ( $FAT_{OXR}$  and  $CHO_{OXR}$ ) were estimated by means of Frayn's equations. Results in  $T_1$  were interpolated at the same relative workload than  $T_2$ . All data of both tests was compared by Students' t-test for paired data. Statistical significance was set at 0.05.

**RESULTS:**  $T_1$  was shorter than  $T_2$  ( $35:30 \pm 3:57$  vs.  $53:44 \pm 10:29$  min,  $p<0.001$ ). Maximal parameters were higher in  $T_1$  vs.  $T_2$  ( $PO_{Peak}$ :  $4.41 \pm 0.68$  vs.  $4.10 \pm 0.53$  W·kg<sup>-1</sup>,  $p<0.01$  and  $323 \pm 39$  vs.  $302 \pm 36$  W,  $p<0.01$ ;  $HR_{max}$ :  $185 \pm 12$  vs.  $177 \pm 10$  ppm,  $p<0.001$ ;  $[La]_b$  max:  $9.51 \pm 3.00$  vs.  $6.76 \pm 2.62$  mM,  $p<0.001$ ;  $\dot{V}O_{2Peak}$ :  $4.38 \pm 0.50$  vs.  $4.10 \pm 0.54$  L·min<sup>-1</sup>,  $p<0.05$ ;  $CHO_{OXR}$ :  $6.22 \pm 1.06$  vs.  $3.57 \pm 1.17$  g·min<sup>-1</sup>,  $p<0.001$ ) although  $FAT_{OXR}$  was lower in  $T_1$  vs.  $T_2$  ( $0.37 \pm 0.13$  vs.  $0.65 \pm 0.47$  g·min<sup>-1</sup>,  $p<0.001$ ). In general, all physiological parameters were significantly higher in  $T_1$  vs.  $T_2$ , except at  $4.5$  W·kg<sup>-1</sup> where HR,  $[La]_b$  and  $\dot{V}O_2$  did not shown differences.  $FAT_{OXR}$  was significantly lower for  $T_1$  vs.  $T_2$  at all intensities.

**CONCLUSION:** There were physiological differences between a long and short stage protocol throughout the test. The bioenergetics of both protocols are different. Short stage protocols are more glycolytic due to a faster initiation of the physiological stress response. Due to the longer duration of stages, a long stage protocol is more lypolytic and it could be more suitable for physiological testing of road cyclists due to the more aerobic nature of road cycling events.

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2997 Board #269 June 1 9:30 AM - 11:00 AM

### Gravity-Assisted Downhill Mountain Biking: Physiological Demands and Health Benefits

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(No relationships reported)

Participation in mountain biking, a form of off-road cycling, is becoming increasingly prevalent. While the physiological demands and health benefits of cross-country mountain biking have been well investigated, little research exists regarding the physiological effects of downhill mountain biking (a gravity propelled form of off-road cycling).

**PURPOSE:** To characterize the physiological demands of gravity-assisted downhill mountain biking during standard riding conditions.

**METHODS:** Oxygen consumption ( $\dot{V}O_2$ ) and heart rate (HR) were measured in 20 (12m, 8f) cyclists during a typical downhill ride. Measures of HR, blood pressure (BP), and hand grip strength were taken prior to and immediately following a downhill ride. Participants also reported a rating of perceived exertion (RPE) for the duration of the ride. Following the downhill ride, each participant completed a standardized incremental exercise test on a cycle ergometer, during which HR, BP, RPE, and  $\dot{V}O_2$  were recorded. Individual linear regressions were constructed from the exercise test matching  $\dot{V}O_2$  with HR, RPE and BP, and allowing comparison of exercise responses while riding and in the laboratory. Paired samples t-tests were used to compare the changes in blood pressure and grip strength pre and post ride, as well as the difference between the forecast and measured riding HR, BP, RPE.

**RESULTS:** The average  $\dot{V}O_2$  and HR while riding were  $23.6 \pm 6.6$  mL·kg<sup>-1</sup>·min<sup>-1</sup> (52 ± 14% of maximal capacity), and 146 ± 11 bpm (80 ± 6% of max), respectively. More than 65% of the ride duration occurred at an intensity level associated with improvements in health and fitness, according to current ACSM guidelines. Riding HR and RPE were elevated above the levels predicted for the measured metabolic demands (HR + 21 bpm,  $p = 0.001$ , RPE +3,  $p < 0.001$ ). In addition, post-ride grip strength was reduced by  $5.2 \pm 9.8$  kg ( $p = 0.04$ ) compared to pre-ride measurements, indicating significant muscular fatigue.

**CONCLUSION:** Participation in gravity-assisted downhill mountain biking presents substantial physiological demands at intensities that are associated with health and fitness benefits.

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2998 Board #270 June 1 9:30 AM - 11:00 AM

### Running Efficiency: Sprinters Vs. Distance Runners

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(No relationships reported)

**INTRODUCTION:** In the world of running, one of the most important concepts is running economy, which is a measure of how efficiently a person uses oxygen while running at a given pace.

**PURPOSE:** The purpose of this research project was to compare two different types of collegiate level runners. Sprinters and distance runners were compared to determine which type of runner is more efficient in their running techniques. It was hypothesized that distance runners are more efficient.

**METHODS:** Eight distance runners and eight sprinters were assessed for lean mass using air displacement plethysmography. Subjects were assessed for  $\dot{V}O_2$  consumption at a submaximal level, using a treadmill. All subjects ran at a 0.0 incline for 7 minutes at a 6.0 mph pace. The heart rate was measured and recorded with a heart rate monitor as well as weight (kg) and height (cm).

**RESULTS:** Distance runners had a mean oxygen consumption of  $42.56 \pm 1.8$  ml/kg/LBM as compared to sprinters, with  $43.22 \pm 2.6$  ml/kg/LBM. Distance runners had a mean LBM percentage of 81.16%, while sprinters had an average of 87.4%. A T-test was applied to tell if the means of the results were different enough to be beyond chance. The T-test result was 0.28, which indicated that the difference in the mean oxygen consumption was not significant enough to say that one group was more efficient than the other.

**CONCLUSION:** Based on the data collected, the conclusion supports the hypothesis that distance runners are more efficient than sprinters when running 6 mph. Although the means of oxygen consumption data indicated that distance runners were more efficient, the difference was not significant. Therefore, each runner runs efficient enough for their type of race. Additionally the data indicates that sprinters have significantly higher lean body mass average percentage. However, their level of oxygen consumption was still higher at a submaximal level. Thus, according to the results, lean body mass percentage does not affect running economy. **Key Words:** running efficiency, lean body mass, oxygen consumption.

Supported by the University of Central Missouri

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2999 Board #271 June 1 9:30 AM - 11:00 AM

**Acute Metabolic And Mechanical Effects Of Different Sprint Workouts In High Level Sprinters**

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(No relationships reported)

Knowledge of acute effects of training load in sprint training sessions is essential for improving performance. The ultimate goal of training is to prepare athletes to perform at their best at important competitions. Therefore, it's a need the training load's individualization for sprint training.

**PURPOSE:** To analyze the acute metabolic and mechanical response to different sprint workouts (SW). SW with different number of repetitions (R) for each subject in short distance traveled (DT) and SW with same number of R in long DT.

**METHODS:** Eighteen high level sprinters (age  $23.1 \pm 4.4$  yr, body mass  $73.7 \pm 4.6$  kg, height  $177.6 \pm 5.9$  cm; body fat  $9.6 \pm 2.9\%$ ) took part in this study. Six sessions separated by a week were performed. Three sessions for 40, 60 and 80m performed at highest possible speed up to lose 3% of speed with 4, 6 and 8 minutes rest between sets (same ratio work/recovery for different DT); thus, different R for the same DT [(x)RxDT]. Other three sessions performed over 150, 250 and 500m with the same R and DT for all subjects: 3xDT with 15 minutes rest between sets. Mechanical responses (i.e. height performance in countermovementjump (CMJ) and speed loss) and metabolic responses (i.e. blood lactate, uric acid and ammonia concentrations) were measured pre-exercise, during exercise each repetition performed and post-exercise.

**RESULTS:** CMJ height loss pre-post session were significant for all sprint workouts analyzed and highly correlated to metabolic responses ( $r = 0.86-0.98$ ). The speed losses produced in the successive sprints presented a high relation between the distances and reduction in CMJ height. These losses were between 9.1% for 40m and 26.3% for 500m. The fatigue, measured as CMJ height loss, increases with DT, and, is strongly correlated to lactate ( $r = 0.93$ ), uric acid ( $r = 0.86$ ) and ammonia ( $r = 0.98$ ).

**CONCLUSIONS:** The metabolic stress developed during the effort can be estimated by controlling CMJ because of the high correlation between CMJ and blood lactate, uric acid and ammonia concentrations. The high correlations found between mechanical (speed and CMJ height losses) and metabolic (lactate, uric acid and ammonia) measures of fatigue highlight the utility and validity of using CMJ to monitor training load in different sprint workouts and quantify objectively neuromuscular fatigue during sprint workouts.

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3000 Board #272 June 1 9:30 AM - 11:00 AM

**Physiological Correlates Of Cycling Efficiency, Economy And Performance In Elite Junior Cyclists**

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(No relationships reported)

Among of the proposed determinants of cycling performance is cycling economy (CE) and work efficiency (WE). Enhanced CE is accompanied by a decrease in the percentage of VO<sub>2</sub>max required to sustain a given mechanical work. Improvements in WE can also theoretically maximize cycling performance as it is a measure of effective work and is expressed as a percentage of total energy expended that produces external work. Data in the literature are limited to elucidate the contribution of WE and CE in cycling endurance performance.

**PURPOSE:** The aim of this study was to investigate the correlation of WE and CE with physiological parameters. The contribution in 3 km indoor individual time trial of WE and CE was also studied.

**METHODS:** Subjects were eleven elite junior road cyclists (age  $17.7 \pm 0.5$  years, body mass  $66.8 \pm 4.9$  kg, body height  $176.3 \pm 7.4$  cm, VO<sub>2</sub>max  $69.7 \pm 2.56$  ml.kg<sup>-1</sup>.min<sup>-1</sup>). Physiological parameters were determined by continuous incremental testing. This protocol had steps of 2 min and increments of 30 W. Cyclists also performed two exhaustive trials in random order at 90%VO<sub>2</sub>max (tlimit90) and 100%VO<sub>2</sub>max (tlimit100) seven days apart. Five days after the last exhaustive trial cyclists performed an individual 3 km time trial on an indoor wooden track. CE was calculated as  $\text{watt.L}^{-1}\text{.min}^{-1}$ , while WE expressed as the ratio of work accomplished per minute (watt) was converted to kcal.min<sup>-1</sup> to energy expended per minute (in kcal.min<sup>-1</sup>).

**RESULTS:** Mean  $\pm$  sd WE and CE were  $20.11 \pm 1.03\%$  and  $84.23 \pm 4.28$  watt.L<sup>-1</sup>.min<sup>-1</sup>. WE and CE did not correlate with VO<sub>2</sub>max, power at VO<sub>2</sub>max, tlimit90, tlimit100, maximal blood lactate concentration and the 3 km cycling performance ( $p > 0.05$ ). WE was only related with ventilatory threshold ( $r = 0.62$ ,  $p = 0.04$ ). WE also presented a weak ( $r = -0.45$ ,  $p = 0.12$ ) relationship with 3km performance time. CE was only related with maximal pedalling revolutions ( $r = 0.65$ ,  $p = 0.03$ ).

**CONCLUSIONS:** Although WE and CE has been proposed to be the physiological criterion for efficient performance the data of the present study does not support their use for evaluation of cycling performance. Future research may elucidate better this by studying longer distances with a larger subject number.

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3001 Board #273 June 1 9:30 AM - 11:00 AM

**Interaction Among Vo<sub>2</sub> Kinetics, Acid-base Status And Running Speed During On-track 800-m Running**

Tomoharu Kitada, Hisashi Naito, Yoshito Konno, Shizuo Katamoto. *Juntendo University, Chiba, Japan.*  
(No relationships reported)

During 400-m running, a fall in VO<sub>2</sub> has been observed towards the end of the race. The decline in running speed as well as this fall in VO<sub>2</sub> has been found to be correlated with acid-base status. The lactic acidosis therefore may contribute to the decline in running speed directly by perturbing contractile mechanisms, and also indirectly by impairing O<sub>2</sub> supply. The interactions among VO<sub>2</sub> kinetics, acid-base status and running speed during 800-m running however has not been studied to date. It is of interest whether decline in running speed during 800-m running would result from similar fatigue mechanisms to those of 400-m running.

**PURPOSE:** To investigate VO<sub>2</sub> kinetics, acid-base status and running speed during on-track 800-m running.

**METHODS:** Seven male 800-m runners (age:  $19.4 \pm 1.7$  y-o, season best:  $120.4 \pm 3.1$  s) performed a maximal 800-m running for the best performance on track, following a warm-up. They also ran 400-m and 600-m on different days at the pace resembling that of 800-m running to collect blood samples at these distances. VO<sub>2</sub> was measured by the K4b2 portable gas exchanges system. The average running speed was calculated for each 100-m using digital moving images (60 Hz). Breath-by-breath gas data were averaged within each 25-m. Blood samples (pH, HCO<sub>3</sub><sup>-</sup> and Lactate) were taken from the ear-lobe after the warm-up and then 1-min after completing each trial to be analyzed.

**RESULTS:** The average 800-m performance time was  $130.3 \pm 4.5$  s. The running speed peaked ( $24.5 \pm 0.8$  km•h<sup>-1</sup>) in the first 100-m then decreased gradually towards the end ( $20.9 \pm 1.8$  km•h<sup>-1</sup>). VO<sub>2</sub> peaked ( $55.5 \pm 3.3$  ml•kg<sup>-1</sup>•min<sup>-1</sup>) about 425-m and remained similar until the end of the trial. For the acid-base status parameters, only the pH values at 400-m were negatively correlated with the decline in running speed in the last 200-m intervals. ( $r = -0.77$ ,  $p < 0.05$ ).

**CONCLUSIONS:** For Japanese collegiate 800-m athletes, VO<sub>2</sub> remained elevated throughout the latter half of 800-m running, implying that the decline in running speed towards the end of the event could not be attributed to a fall in VO<sub>2</sub>. The ability to prevent a profound decrease of pH until 400-m may be the key to maintaining faster running speed near the end of the race.

No grant for this study.

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3002 Board #274 June 1 9:30 AM - 11:00 AM

**Comparison of Sport Vision Between two Elite Athletes of Volleyball and Shooting**

Yi-Jia Lin<sup>1</sup>, Cheng-Hsiu Lai<sup>1</sup>, Chia-Hua Kuo<sup>1</sup>, Shih-Wei Chou<sup>2</sup>, Alice May-kuen Wong<sup>2</sup>. <sup>1</sup>Taipei Physical Education College, Taipei, Taiwan. <sup>2</sup>Chang Gung Memorial Hospital, Tao-yuan, Taiwan.  
(No relationships reported)

Sports vision is fundamental for both volleyball (V) and shooting (S) disciplines but may be different between. Quantification of sport vision may help differentiate the components of sport vision required and also assess any training effects, if possible.

**PURPOSE:** For preliminary comparisons of sport vision between two disciplines of sports, i.e., volleyball and shooting.

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**METHODS:** Two female elite athletes, one of volleyball and the other of shooting (Aged: V/S=22/29 years, BHT: V/S=178/161 cm, BWt: V/S=67/73 kg, career duration: V/S=9/12 years) were recruited to receive training which includes whole body stretching and strengthening exercise for one month. Visual performance was measured by a sport vision measurement software, including dynamic visual acuity (DVA), eye movement (EM), peripheral vision (PV), and momentary vision (MV). DVA was measured in four directions including left-to-right, right-to-left, up-to-down, and down-to-up. Measured variables were compared between two disciplines as well as before and after training.

**RESULTS:** For the comparison between two disciplines before training, better PV (V:24.9 vs. S:3.1 degrees) and MV (V:400 vs. S:600 pixels/frame) were found in volleyball. For the comparison of the post-test data, better EM (V:100 vs. S:200), PV (V:31.2 vs. S: 3.1 degrees) and MV (V:200 vs. S:600 pixels/frame) as well as DVA in right to left direction were found in volleyball. For training effect, all the items were improved in volleyball disciplines. However, effect of training was found only in DVA scores in shooting discipline.

**CONCLUSION:** Better PV and MV in volleyball suggested that peripheral vision and momentary vision were important to track ball between two groups of players. Better DVA in shooting suggested that dynamic visual acuity was essential to track targets in free dimension from fixed head position. Difference in sports-specific characteristics response to training was found mainly in PV. It can be explained that, for the shooting, focus ability was more important than PV within the range of shooting gun, therefore PV test conducted in shooting players was suggested to modify. Although peripheral vision was essential for the shooting performance; however, it may only be true when the evaluation was conducted in the distance larger than the length of the shooting gun.

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**3003 Board #275 June 1 9:30 AM - 11:00 AM**

**Comparisons in Running Economy and Mechanics between Collegiate Pole Vaulters and Runners using High-Resolution Accelerometers**

Andrea D. Workman, Shean Conlon, Tim Muth, Anna Daoud, Aaron Stickel, Stephen J. McGregor. *Eastern Michigan University, Ypsilanti, MI.*

(No relationships reported)

Sprint and plyometric training have both been shown to improve running economy in distance runners. Pole vaulters are both sprint and plyometric trained athletes who do not perform endurance training. We have previously used high resolution accelerometers (HRA) to demonstrate differences in kinematics that contribute to running economy. The purpose of this study was to compare running economy and mechanics between NCAA Division I Pole Vaulters (PV) and Cross Country Runners (XC) using HRA's during an incremental treadmill test. We hypothesized that despite lower aerobic fitness, PV would be more economical runners than XC.

**METHODS:** 8 collegiate PV athletes, 5 males (19.6 ± 0.67 yr, 74.3 ± 3.7 kg, 54.2 ± 2.6 ml/kg/min) 3 females (19.25 ± 0.94 yr, 66.8 ± 0.7 kg, 42.6 ± 1.9 ml/kg/min) and 15 male collegiate XC athletes (22.1 ± 1.5 yr., 66.5 ± 5.7 kg, 71.1 ± 5.2 ml/kg/min) consented to procedures approved by EMU-CHHS-Human Subjects Committee and performed an incremental running test (VO<sub>2max</sub>) consisting of 3 minutes stages, beginning at 8 kph and increasing 2 kph until exhaustion while wearing tri-axial HRA's (Microstrain, VT). Group comparisons were made from 10 kph to 14 kph. Accelerations for vertical (VT), anterior/posterior (AP), medial/lateral (ML), axes were recorded and Euclidean resultants were computed (RES). Axial root mean square (RMS), RMS relative to speed (EC), and ratio of RMS/RES (RA) were compared between PV and XC athletes to determine if differences in acceleration profiles could be identified between the two groups. Expired gasses were collected using an Oxycon Mobile (Viasys, CA). VO<sub>2</sub> and RER were used to determine O<sub>2</sub> cost (O<sub>2</sub>C) and energy expenditure (EE). MANOVAs were performed using SPSS 19.0 (IBM, NY)  $\alpha = .05$ .

**RESULTS:** XC exhibited greater VT<sub>RA</sub> and AP<sub>RA</sub> than PV (p<.001) but ML<sub>RMS</sub>, ML<sub>RA</sub> and AP<sub>RMS</sub> were lower (p<.001). O<sub>2</sub>C was lower (p<.001) in PV (173.1 ± 13.7 vs 181.5±22.6, respectively) at every speed but RER was greater, therefore EE (p=.151) was not different among groups.

**CONCLUSION:** PV indeed exhibited better O<sub>2</sub>C than XC, but energy expenditure was not different between groups. Differences do exist in acceleration profiles between PV and XC, but these do not seem to contribute to reduced energy expenditure of running, as differences in O<sub>2</sub>C appear to relate to metabolic differences between PV and XC.

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**3004 Board #276 June 1 9:30 AM - 11:00 AM**

**Field Testing vs. Physiological Testing in Novice Marathoners**

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(No relationships reported)

**INTRODUCTION:** Field testing, such as the use of time-trials (TT) and training races are utilized to assess and predict performance in endurance races. TTs have been studied as a method of predicting performance at races of different distances. VO<sub>2</sub>MAX has been considered one of the best physiological predictors of performance in endurance sports. Lactate threshold, running economy, and peak treadmill running velocity during a VO<sub>2</sub>max test (PTV) are also factors used in predicting running performance.

**PURPOSE:** To compare VO<sub>2</sub>MAX, PTV, and TT as predictors of marathon (26.2 mile) performance in novice marathoners.

**METHODS:** Forty-seven novice and minimally-experienced college-aged subjects (13 male, 34 female) age 21.1 +/- 2.8 years, trained for and completed a marathon as part of a university course. Three TTs were performed: a 3200 meter, 3 months prior to the marathon; a 1/2-marathon, (13.1 miles), 2 months prior; and a second 3200M, 10 days before the marathon. Forty-seven subjects completed the first 3200M, and 41 subjects completed the additional TTs. The VO<sub>2</sub>MAX test was conducted on a treadmill one to three weeks prior to the marathon, using a graduated protocol with starting speed adjusted according to time-trial results. PTV was defined as the treadmill speed during the final stage of the test, with velocity adjusted for treadmill elevation.

**RESULTS:** Using Pearson's correlations, VO<sub>2</sub>MAX, PTV, and three TTs were correlated with marathon finishing time (p<.01). While the correlation values were not significantly different, the half marathon and second 3200M TT had a higher correlational value specific to the marathon finish time (r = 0.91 and 0.89) than either the first 3200M TT (r = .85), VO<sub>2</sub>MAX (r = -0.78), or PTV (r = 0.81).

**CONCLUSIONS:** TTs of distances shorter than the marathon, VO<sub>2</sub>MAX and PTV correlate with marathon finish time. TTs closer to the date of the marathon had higher correlation values with marathon time than PTV or VO<sub>2</sub>MAX, though the differences were not statistically significant. Conducting testing at distances closer to the race distance or closer to the date of the race may strengthen the association. While this method does not provide the additional physiological data available through laboratory testing, it is less expensive and easier to conduct and shows a relationship to finish time.

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**3005 Board #277 June 1 9:30 AM - 11:00 AM**

**Proposal Of A Specific Exercise Test For Taekwondo Athletes: Comparison To Traditional Cardiopulmonary Exercise Test**

Gabriel Espinosa<sup>1</sup>, Jonas Lirio Gurgel<sup>1</sup>, Flávia Porto<sup>2</sup>, Allan Sales<sup>1</sup>, Renata Castro<sup>1</sup>, Renata Castro<sup>1</sup>, Antonio Claudio Nobrega<sup>1</sup>. <sup>1</sup>Fluminense Federal University, NITERÓI, Brazil. <sup>2</sup>Gama Filho University, Rio de Janeiro, Brazil.

(No relationships reported)

**PURPOSE:** Compare the cardiorespiratory responses of a treadmill incremental exercise test (TREADtest) and a Tae Kwon Do incremental exercise test (TKDtest).

**METHODS:** Seven (5 men and 2 women) Brazilian Taekwondo elite athletes (age: 21.29 ± 3.35yrs; weight: 77.20 ± 11.32kg; height: 1.75 ± 0.10m) were submitted to a two-day protocol separated by 2 to 7 days. 1st day: anthropometric assessment TKDtest and familiarization to the treadmill. 2nd day: TREADtest. The TKDtest was based on the most common kick technique (dolio chiagi), work increment was given by kick frequency (increment of 3 kicks per minute) and each stage took one minute. The test was interrupted when the subject could not respect the sonorous stimulus for three consecutive kicks. The TREADtest was an individualized ramp and was based on predict VO<sub>2</sub>max obtained by a questionnaire (Wisén et al., 2002). Maximum velocity was determined based on ACSM equation. Initial velocity for all subjects was 60% of maximum predict velocity and increment was calculated for test duration of 10 minutes. Shapiro Wilks test were applied for confirmation of normality, a bi-caudal paired-samples Student t test was applied to verify significance differences between the two tests (TREADtest and TKDtest). The significance level was set at  $\alpha = 0.05$ .

**RESULTS:** For all analyzed variables there was no significant difference between the TREADtest and TKDtest (see table -1).

**Table 1 - Results from the comparison of the two exercise tests TREADtest x TKDtest.**

|            | VO2peak       | VT1           |              | VT2           |              | HRpeak  | Time at Peak    |
|------------|---------------|---------------|--------------|---------------|--------------|---------|-----------------|
|            | (ml.kg.min-1) | (ml.kg.min-1) | (%VO2peak)   | (ml.kg.min-1) | (%VO2peak)   | (bpm)   | (s)             |
| TREADtest  | 46.93 ± 8.39  | 37.99 ± 9.24  | 80.22 ± 8.76 | 41.83 ± 7.93  | 89.10 ± 6.01 | 193 ± 9 | 560.71 ± 175.31 |
| TKDtest    | 47.95 ± 9.56  | 41.99 ± 9.89  | 87.21 ± 6.21 | 44.46 ± 9.74  | 92.31 ± 4.25 | 195 ± 9 | 383.14 ± 137.80 |
| t-Test (α) | 0.68          | 0.11          | 0.14         | 0.34          | 0.27         | 0.61    | 0.06            |

**CONCLUSION:** The presented data did not show differences between the TREADtest and TKDtest for the tested sample. These results suggest that the new specific protocol developed is valid to assessment cardiorespiratory capacity of Tae Kwon Do athletes.

**3006 Board #278 June 1 9:30 AM - 11:00 AM**

**Examination of Warm-up Effects by Highly Concentrated Artificial Carbonic Acid Water Forearm-Bathing**

Akihiro Taimura<sup>1</sup>, Masaru Matsunami<sup>2</sup>, Masashi Sugawara<sup>1</sup>, Masaki Nakagaichi<sup>1</sup>. <sup>1</sup>Nagasaki University, Nagasaki, Japan. <sup>2</sup>Beppu Mizobe Gakuen College, Beppu, Japan.

(No relationships reported)

Warm-up induces increased muscle metabolism and muscle temperature. Immersion in highly concentrated artificial carbonic acid water might induce not only skin vasodilation but also increased oxygen consumption and blood flow in skeletal muscle (Yamamoto N, Hashimoto M, 2008).

**PURPOSE:** This study examined the effects of warm-up by observing the influence of highly concentrated artificial carbonic acid water bathing before exercise.

**METHODS:** Subjects were 10 male students who consented to participate in the present study. After immersing both upper arms in highly concentrated artificial carbonic acid water (38°C) or tap water (38°C) for 20 minutes, they exercised using a portable hand ergometer at 20w for 10 minutes in an artificial climate chamber (26°C, 40%rh). The skin blood flow, the skin temperatures, heart rate, sub-lingual temperature, thermal sensation and thermal comfort were measured.

**RESULTS:** The skin blood flow of non-immersed parts (upper arm) with carbonic acid water during immersion decreased to 97±5%, but that with tap water increased to 118 ± 7%. And during exercise, that with carbonic acid water increased to 190 ±13% and with tap water increased to 269 ± 28%. There was no significant difference between each, but that with carbonic acid water during exercise was more effective in suppressing an increase skin blood flow than with tap water. The skin temperatures of non-immersed parts with carbonic acid water during exercise decreased to 0.44 ± 0.18°C and with tap water decreased to 0.31 ± 0.09°C. The decrease of that with carbonic acid water was significantly larger than with tap water (P < 0.05). Heart rate with carbonic acid water during exercise increased to 29.78 ± 8.49 bpm and with tap water increased to 34.10 ± 10.24 bpm. That of with carbonic acid water during exercise more significantly attenuated an increase than that of with tap water.

**CONCLUSIONS:** Carbonic acid water had a larger decline of skin blood flow and skin temperature of active parts, and larger attenuation of increase of heart rate during exercise compared to tap water. These data indicate that immersion in highly carbonic acid water might have a warm-up effect. Future study will require whole body bathing, and exercise, because this study concentrated only on both arm bathing and exercise.

**3007 Board #279 June 1 9:30 AM - 11:00 AM**

**Speed Training: Impact of Land vs Aquatic Environment**

Jon Adams, Paul Reneau, Michael J. Ryan. Fairmont State University, Fairmont, WV.

(No relationships reported)

**PURPOSE:** To investigate which type of training method; land or water, would be more beneficial to increase speed.

**METHODS:** Twenty healthy students, 10 male and 10 female, served as subjects (age= 21.1 + 1.89yr). Subjects initially participated in a 30yd, 60yd, 100yd, and 200yd maximal sprint to establish pre-training times. Subjects were then divided into two training groups; land or water, for a three week training period. Both groups consisted of five males and five females each. Each group was given the same workout consisting of speed drills and plyometrics performed 3 times per week. Subjects were then re-tested for post-training times at the same distances. Data between groups pre and post test times were analyzed using an independent t-test. Data within group's pre to post training times were analyzed using a dependent t-test.

**RESULTS:** A significant difference (p<.05) was found between the pre-training and post-training times for both groups across all distances. No significant difference (p>.05) was found between the two groups pre-training results or post-training results for all distances.

**CONCLUSIONS:** These results indicate that three weeks of training increases a persons speed irrelevant of whether they utilize dry land or water as the training environment. Additionally, the data suggested there is no difference between land and water on increasing a persons speed.

| Sprint Distance | Pre Train Land | Pre Train Water | Post Train Land | Post Train Water |
|-----------------|----------------|-----------------|-----------------|------------------|
| 30 yards        | 4.29(.54)      | 4.45(.58)       | 4.16(.42)*      | 4.39(.60)*       |
| 60 yards        | 7.94(1.22)     | 8.15(1.13)      | 7.72(.96)*      | 8.01(1.14)*      |
| 100 yards       | 13.44(2.15)    | 13.83(2.41)     | 13.11(1.80)*    | 13.71(2.44)*     |
| 200 yards       | 32.21(4.36)    | 33.16(4.23)     | 31.19(3.59)*    | 32.29(4.83)*     |

**3008 Board #280 June 1 9:30 AM - 11:00 AM**

**Effect of High-Intensity Interval Training On Stride Distance During Treadmill Double-Pole Roller-Skiing**

Phillip B. Watts, FACSM, Molly E. Burger, Jordan D. Dalgord. Northern Michigan University, Marquette, MI.

(No relationships reported)

**PURPOSE:** Short-term high intensity interval training (HIT) improves maximal aerobic power and time-trial performance in competitive events. Whether HIT improves power output and stride characteristics during repetitive techniques such as double-poling in XC skiing is unknown. The purpose of this study was to test effects of a short-term double-poling (DP) HIT regimen on average stride distance (SD) during treadmill roller-skiing.

**METHODS:** 12 collegiate XC skiers signed informed consent to participate in the study (age = 21.5±1.2 yr). Subjects completed 4x30 sec DP intervals on a motorized treadmill at 4.92, 5.14, 5.36 and 5.59 m·sec<sup>-1</sup> at a constant 2.6% grade and with 2 min resting recovery between intervals (PRE). Digital video was recorded in the frontal plane during each interval. The time between pole tip contacts with the treadmill belt for the last three strides at each speed was determined using MaxTRAQ 2D analysis software. Average SD at each speed was calculated from the total time interval for the 3 strides. Following PRE testing each subject completed a series of 6 HIT training bouts evenly spaced over a 16-day period. The HIT sessions involved repetitions of 30-sec maximal DP intervals on a modified VASA Ergometer with 2.5-min rest between repetitions. The 6 HIT sessions involved 4, 4, 6, 6, 8, and 4 repetitions respectively. During the first (HIT1) and final HIT (HIT6) sessions VO<sub>2</sub> was measured via expired air analysis and average power in Watts (Pavg) was recorded from the VASA ergometer for each interval. Within 2 days of the final HIT session each subject repeated the treadmill rollerski protocol (POST).

**RESULTS:** Peak HIT VO<sub>2</sub> was unchanged over the training period (56.0±12.5 vs 51.6±7.7 ml·kg<sup>-1</sup>·min<sup>-1</sup> for HIT1 vs HIT6 respectively) however peak Pavg was higher (p<.05) for HIT6 (318.9±115.2 W) vs HIT1 (293.6±110.4 W). No significant differences were found between PRE and POST for SD at any speed during the treadmill rollerski intervals. SD values at 5.59 m·sec<sup>-1</sup> were 5.24±1.89 and 5.43±1.78 m·stride<sup>-1</sup> for PRE and POST respectively.

**CONCLUSIONS:** Short term HIT training for double-poling improves peak average power in the specific training mode without a change in peak VO<sub>2</sub>. The mode-specific training effect does not carry over to treadmill rollerski performance.

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## E-39 Free Communication/Poster - Sweating and Fluid Imbalance

JUNE 1, 2012 7:30 AM - 12:30 PM  
ROOM: Exhibit Hall

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### 3009 Board #281 June 1 11:00 AM - 12:30 PM

#### Effect of Hypohydration and Environment on Dynamic Postural Stability

Robert W. Kenefick, FACSM, Kurt J. Sollanek, Brett R. Ely, Samuel N. Cheuvront, FACSM, Michael N. Sawka, FACSM. *U.S. Army Research Institute of Environmental Medicine, Natick, MA.*

(No relationships reported)

Postural balance is critical to physical performance, completion of work tasks and a potential contributor to accidents. However, the influence of environmental temperature and hydration state has not been well studied.

**PURPOSE:** To determine the impact of hypohydration and a range of environmental temperatures on measures of dynamic balance.

**METHODS:** Following 5 days of training to reduce learning and within subject variation, 32 men (22 ± 4 yr) were divided into four matched cohorts (n=8), and tested (Biodes Balance System) in one of four T<sub>a</sub> (10, 20, 30, 40°C) while eu- (EUH) and hypohydrated (HYPO; -4% body mass via exercise-heat exposure). Training and testing consisted of three, 20 second trials where volunteers, wearing t-shirt and shorts, stood on an unstable platform and attempted to hold it in a level position. Balance measures consisted of % time in region A (%A), mean deflection (MD), and overall stability index (OSI).

**RESULTS:** Overall, core temperatures were stable across each environment. Skin temperature increased by -4°C with each 10°C increase in T<sub>a</sub> and thermal sensation was markedly different (p<.05) in each environment, with no effect of HYPO. Intra-individual %CV calculated from training days 3-5 was 14.1% (%A), 24.6% (MD), and 22.5% (OSI). In general, HYPO vs. EUH balance measures were not different (p>.05) thus, EUH and HYPO trials were collapsed. A mixed model ANOVA revealed differences (p<.05) between 10°C vs. other environments for %A, MD and OSI.

**CONCLUSION:** Hypohydration of -4% body mass does not alter dynamic postural stability. However exposure to cold does appear to negatively impact dynamic postural stability which may be related to low skin temperatures and thermal sensation. Individuals who work, train or compete in the cold should be aware that dynamic postural stability may be compromised, possibly increasing risk for accidents or injury.

The opinions or assertions contained herein should not be construed as official or reflecting the views of the Army or the DoD.

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### 3010 Board #282 June 1 11:00 AM - 12:30 PM

#### A Comparison Of Hyperhydration Vs. Ad Libitum Fluid Intake Strategies On Markers Of Oxidative Stress

Angela R. Hillman<sup>1</sup>, Mark C. Turner<sup>2</sup>, Daniel J. Peart<sup>1</sup>, Lee Taylor<sup>2</sup>, Jason C. Siegler, FACSM<sup>3</sup>. <sup>1</sup>University of Hull, Hull, United Kingdom. <sup>2</sup>University of Bedfordshire, Bedford, United Kingdom. <sup>3</sup>University of Western Sydney, Penrith, Australia.

(No relationships reported)

Both in vitro and in vivo work has demonstrated that dehydration augments oxidative stress while euhydration can attenuate this trend. Similarly, in vitro work has demonstrated hyperhydration can attenuate oxidative damage. Glycerol is often employed as a hyperhydrating agent that is evenly distributed among the intra- and extracellular compartments, which would likely maintain cellular integrity providing protection against oxidative stress.

**PURPOSE:** The purpose of this experiment was to compare pre-exercise hyperhydration with glycerol (G) or water (W) to no hyperhydration (C) on markers of oxidative stress.

**METHODS:** Seven trained males (28 ± 8 yrs, 178.4 ± 7.8 cm, and 73.2 ± 9.6 kg) were hyperhydrated by consuming either 1.2 g of glycerol·kg<sup>-1</sup> body mass (BM) in 26 ml·kg<sup>-1</sup> BM or an equal volume of aspartame flavoured water. Drinks were evenly administered every 30 min for a 120 min period followed by a 90 min time trial (TT) in a hyperthermic environment (35°C and 40% RH). Blood was drawn pre-ingestion (PRE), post-ingestion/pre-exercise (PI), post exercise (PE), and one hour post exercise (1HR) and analysed for whole blood total (TGSH) and oxidised (GSSG) glutathione, as well as plasma glycerol, protein carbonyl (PC), and lipid hydroperoxide (LOOH) concentrations.

**RESULTS:** Hyperhydration increased BM (0.6 ± 0.2 kg, p < 0.01) and plasma volume (6.1 ± 0.7%, p < 0.01) PI and increased total fluid retained PE (1.8 ± 0.1 L, p < 0.01). Plasma glycerol concentration increased PI and remained elevated at 1HR in G (peak: 4.5 mmol/L, p < 0.01). TGSH increased PI to PE in G and W (p < 0.01), while GSSG was lower PI and PE in G vs. C (p = 0.03). PC concentration increased PE during the C trial only (p = 0.04). Furthermore, PC concentration had a moderate negative relationship with hydration status PRE to PI (r<sub>2</sub> = -0.4, p = 0.01) as well as PI to PE (r<sub>2</sub> = -0.3, p = 0.04). There were no significant changes in LOOH (p < 0.05). Core, mean body, and skin temperatures as well as heart rate increased with exercise (p < 0.01 for all) but were not different between trials. Finally, there was no difference between trials for total distance covered (p > 0.05) or mean power output (p > 0.05).

**CONCLUSION:** Hyperhydration enhanced fluid balance and attenuated oxidative stress; however this did not translate to any thermoregulatory or performance enhancements during exercise.

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### 3011 Board #283 June 1 11:00 AM - 12:30 PM

#### Hypohydration Impairs Strength And Alters Peripheral And Corticospinal Excitatory Output

Jo Bowtell<sup>1</sup>, Gareth Avenell<sup>2</sup>, Katya N. Mileva<sup>2</sup>. <sup>1</sup>Exeter University, Exeter, United Kingdom. <sup>2</sup>London South Bank University, London, United Kingdom.

(No relationships reported)

Muscle isometric (MVC) and isokinetic (IK) strength is impaired by hypohydration, due at least in part to reduced central drive. However, it is not clear whether this is due to hypohydration *per se* or accompanying hyperthermia, and no neural excitability data are available.

**PURPOSE:** To investigate whether the hypohydration-induced decline in muscle strength is related to altered peripheral and corticospinal excitatory output.

**METHODS:** 7 male trained taekwondo players completed two trials (hypohydrated, Hy; euhydrated, Eu) comprising 6x15 min cycling bouts at 85% HR<sub>max</sub> at 40°C and 50% relative humidity, with core temperature (T<sub>c</sub>) measured throughout. MVC and IK (90°·s<sup>-1</sup>) strength and skin temperature (T<sub>sk</sub>) were measured pre and post, and peripheral (femoral nerve) and transcranial magnetic stimulation were applied during MVC to quantify voluntary activation (VA) and evoked potential amplitude in vastus medialis (Mwave and motor evoked potential, MEP respectively). Data were analysed with 2way repeated measures ANOVA.

**RESULTS:** Body weight decreased by 2.7±0.1% in Hy, but there was no difference between conditions in pre and post T<sub>c</sub> (pre: 37.3±0.1 vs post: 37.4±0.1, Eu; pre: 37.3±0.2 vs post: 37.6±0.1, Hy; °C) or T<sub>sk</sub> (pre: 18.5±0.3 vs post: 18.6±0.1, Eu; pre: 18.7±0.2 vs post: 18.1±0.2, Hy; °C) in either condition. Both MVC (pre: 677.1±50.8 vs post: 645.9±55.2, Eu; pre: 679.2±68.7 vs post: 576.6±57.5, Hy; Nm) and IK eccentric (pre: 646.3±84.0 vs post: 559.5±67.9, Eu; pre: 745.3±91.0 vs post: 505.4±47.4, Hy; Nm) strength decreased to a greater extent in Hy (condition x time interaction, P<.05), but the decrease in VA was not significantly different between conditions (Hy: -8.9±3.7, Eu: -5.2±3.1 %). Mwave amplitude decreased significantly from pre (3.96±0.77, Hy; 4.14±1.15, Eu; mV) to post (-10.1±13.3, Hy; -28.7±18.5, Eu; %, P<.05). MEP amplitude was higher in Eu (1.53±0.28, pre; 2.01±0.37, post) than Hy (1.39±0.18, pre; 1.39±0.32, post; mV; P=0.09).

**CONCLUSIONS:** The hypohydration-induced reduction in strength does not appear to be due to greater reductions in voluntary activation. Excitatory output was enhanced in the hypohydrated condition, presumably in an inadequate attempt to preserve function in the face of reduced contractility.

Supported by European Hydration Institute.

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**3012** Board #284 June 1 11:00 AM - 12:30 PM

**Does Dehydration affect Peak Loading Rate during Landing in Adolescent Boys following Intermittent Exercise?**

Jason C. Dorman<sup>1</sup>, Szu-Ping Lee<sup>2</sup>, Thayne A. Munce<sup>1</sup>, Paul A. Thompson<sup>1</sup>, Ashley L. Miller<sup>1</sup>, Christopher M. Powers, FACSM<sup>2</sup>, Michael F. Bergeron, FACSM<sup>1</sup>.  
<sup>1</sup>Sanford USD Medical Center, Sioux Falls, SD. <sup>2</sup>University of Southern California, Los Angeles, CA.

(No relationships reported)

Injury risk reduction in youth sports is an ongoing priority. A potential contributing factor for a greater risk of certain musculoskeletal injuries during prolonged exercise is an increase in peak loading rate (PLR). Elevated loading rates have been linked to several lower extremity injuries, and fatigue is one factor common in sport that may increase these rates. We hypothesized that the combined effect of fatigue and dehydration would compound the problem.

**PURPOSE:** To investigate the influence of dehydration ( $\approx 2\%$  body weight deficit) on measures of PLR during a one-hop jump test in young athletes before and after an intermittent, moderate-intensity bout of exercise.

**METHODS:** Twenty-five physically active adolescent boys ( $16.6 \pm 0.9$  yr) were grouped into one of three exercise conditions: Dehydration-hot (DE-HOT: 35°C, 50% relative humidity (rh), with no fluid replacement), hydration-hot (HY-HOT: 35°C, 50% rh with fluid replacement) or hydration-mild (HY-MILD: 22.2°C, 50% rh with fluid replacement). Exercise trials consisted of one 60-min bout of intermittent exercise (alternating treadmill running @ 60%  $\dot{V}O_{2max}$  & cycle ergometry @ 40%  $\dot{V}O_{2max}$ ). Immediately before (PRE) and after (POST) each exercise bout, PLR was assessed by the performance of a unilateral one-hop jump test on a force platform.

**RESULTS:** Peak measures of core body temperature, heart rate, rating of perceived exertion, and thermal stress rating were significantly higher in the DE-HOT ( $39.1 \pm 0.4^\circ\text{C}$ ,  $187.4 \pm 12.1$  bpm,  $16.0 \pm 2.0$ ,  $11.0 \pm 0.6$ ) and HY-HOT ( $38.9 \pm 0.5^\circ\text{C}$ ,  $182.3 \pm 11.8$  bpm,  $16.1 \pm 3.0$ ,  $11.6 \pm 0.8$ ) groups vs. the HY-MILD ( $38.1 \pm 0.3^\circ\text{C}$ ,  $161.0 \pm 14.6$  bpm,  $11.6 \pm 1.3$ ,  $8.4 \pm 0.9$ ) group ( $p < 0.01$ ). Mean PLR progressively increased Pre vs. Post in each exercise condition bout, as seen by the Pre vs. Post differences (DE-HOT  $1243 \pm 1758$ , HY-HOT  $792 \pm 2304$ , HY-MILD  $403 \pm 1321$  body weight/sec), though not statistically significant.

**CONCLUSIONS:** One hour of moderate-intensity, intermittent exercise, similar to that commonly experienced in youth sports, did not result in significant changes in PLR. Contrary to our hypothesis, inducing dehydration did not result in a consistent decrease in PLR. Therefore, greater levels of dehydration may be required to see an increase in injury risk during landing.

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**3013** Board #285 June 1 11:00 AM - 12:30 PM

**Deep Ocean-Based Desalted Mineral Water Attenuate Dehydration Exercise-Induced Oxidative Stress and Inflammation in Healthy Young Men**

KUNG-KUN YANG<sup>1</sup>, Chien-Wen Hou<sup>1</sup>, Feng-Chih Hsu<sup>2</sup>, Sheng-Chih Huang<sup>1</sup>, Mallikarjuna Korivi<sup>1</sup>. <sup>1</sup>Taipei Physical Education College, Taipei, Taiwan. <sup>2</sup>National Taoyuan Agricultural & Industrial Vocational High School, Taoyuan, Taiwan. (Sponsor: Kuo Chia-Hua, FACSM)

(No relationships reported)

**PURPOSE:** Dehydration for long time in the body cause oxidative stress and influence other biochemical parameters. Exercise under high temperature conditions cause dehydration, which is probably due to the loss of minerals from the body. In the present study, we investigated the effect of deep ocean-based mineral water (DOMW) supplementation on dehydration exercise-induced oxidative stress and inflammation levels in young men.

**METHODS:** Twelve-young healthy male college students were recruited for this double-blind crossover study. Dehydration was achieved by performing the treadmill running at 40%  $\dot{V}O_{2max}$  under 30°C in a closed room, leading to 3% body weight loss. Then subjects were orally supplemented with deep ocean-based desalted mineral water (DOMW, N=6) or pure water (placebo, N=6) in a volume equivalent to 1.5 fold of their body weight loss, and consumed in 150-min. Malondialdehyde (MDA), interleukin (IL-6), erythropoietin (EPO), testosterone, myoglobin and lactate dehydrogenase (LDH) levels were measured in the blood before exercise, 4-h and 24-h after exercise.

**RESULTS:** Dehydration exercise-induced lipid peroxidation was evidenced by increased ( $P < 0.01$ ) MDA levels along with increased IL-6 concentration in both trial. However, MDA and IL-6 levels were significantly suppressed in DOMW received trial during recovery compared to placebo trial. Estimated EPO was not significantly altered in placebo trial, but increased ( $\sim 130\%$ ,  $P = 0.06$ ) in the DOMW trial. Rise in myoglobin (muscle damage marker) and drop in testosterone, which normally observed after exercise, were significantly attenuated in the DOMW trial.

**CONCLUSIONS:** From our findings, it is concluded that deep ocean-based desalted mineral water is able to attenuate the oxidative damage and suppress the inflammation caused by dehydration exercise.

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**3014** Board #286 June 1 11:00 AM - 12:30 PM

**Beverage Sodium Concentration and Total Ionic Load Increase Post-Exercise Fluid Retention**

Lindsay B. Baker, Adam J. Reimel, Kelly A. Barnes, Ryan P. Nuccio, John R. Stofan. *Gatorade Sports Science Institute, Barrington, IL.*

(L.B. Baker: Salary; PepsiCo.)

Replacement of Na is important for post-exercise rehydration. However, the potential additive effect of other electrolytes, such as K, Cl, Mg, and Ca in promoting rehydration is not well understood.

**PURPOSE:** To compare the impact of beverage [Na] and total ionic load (combined mEq/L from Na, K, Cl, Mg, and Ca) on rehydration in athletes.

**METHODS:** After a 10-h (overnight) fast, 18 men ( $25 \pm 2$  y,  $72 \pm 2$  kg) exercised (70-75%  $HR_{max}$ ) for 90 min in a warm room (27°C, 57% rh) without drinking. After exercise, subjects sat at rest for a 4-h rehydration period. From min 30 to 80 of rehydration, subjects drank 1 of 5 beverages in a volume equivalent to 100% of fluid losses (sweat and urine) incurred during exercise. The 5 beverages were consumed in random order in 5 separate trials and consisted of flavored water with no electrolytes (PLA) or 6% carbohydrate-electrolyte solution with 18 mEq/L Na and 32 mEq/L ionic load (LL), 18 mEq/L Na and 110 mEq/L ionic load (LH), 36 mEq/L Na and 59 mEq/L ionic load (HL), or 36 mEq/L Na and 110 mEq/L ionic load (HH). Subjects voided their bladder and were weighed at min 90, 120, 180, and 240 to determine percent fluid retention throughout the 4-h rehydration period. Data are reported as means  $\pm$  stdev.

**RESULTS:** Subjects lost  $2.3 \pm 0.5\%$  of body mass during exercise and consumed  $1656 \pm 382$  mL of beverage during rehydration (consistent across all trials,  $P > 0.05$ ). In general, fluid retention increased as beverage [Na] and total ionic load increased ( $51.3 \pm 15.8\%$ ,  $57.4 \pm 16.8\%$ ,  $63.2 \pm 15.3\%$ ,  $65.3 \pm 15.8\%$ , and  $69.2 \pm 14.6\%$  for PLA, LL, LH, HL, and HH, respectively). At 3 and 4-h of rehydration, fluid retention was higher with LH, HL, and HH vs. PLA and with HL and HH vs. LL ( $P < 0.05$ ). There were trends for higher fluid retention with LL vs. PLA ( $P = 0.057$ ), LH vs. LL ( $P = 0.074$ ), and HH vs. LH ( $P = 0.077$ ). Fluid retention did not differ between LH and HL ( $P = 0.533$ ) or HL and HH ( $P = 0.203$ ). Total urine volume decreased as beverage [Na] and total ionic load increased ( $813 \pm 359$  mL,  $687 \pm 302$  mL,  $616 \pm 332$  mL,  $571 \pm 275$  mL, and  $515 \pm 297$  mL for PLA, LL, LH, HL, and HH, respectively). Total urine volume was lower with LL, LH, HL, and HH vs. PLA and with HH vs. LL ( $P < 0.05$ ).

**CONCLUSION:** In agreement with previous studies, increasing beverage [Na] increased fluid retention; however, total ionic load also improved fluid retention, especially when beverage [Na] was relatively low.

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**3015** Board #287 June 1 11:00 AM - 12:30 PM

**Influence Of Deep Ocean-based Desalted Mineral Water On Performance After Dehydration Exercise Regimen**

Chien-Wen Hou<sup>1</sup>, Yi-Ming Yeh<sup>2</sup>, Feng-Chih Hsu<sup>3</sup>, Mallikarjuna Korivi<sup>1</sup>. <sup>1</sup>Taipei Physical Education College, Taipei, Taiwan. <sup>2</sup>Hsin Sheng College of Medical Care and Management, Taoyuan, Taiwan. <sup>3</sup>National Taoyuan Agricultural & Industrial Vocational High School, Taoyuan, Taiwan. (Sponsor: Kuo Chia-Hua, FACSM)

(No relationships reported)

**PURPOSE:** Exercise under high temperature conditions cause dehydration that causes loss lot of minerals, which simultaneously influence the individual performance. The present study was purposed to investigate the impact of deep ocean-based desalted mineral water (DOMW) on athlete's performance after performing the dehydration exercise regimen.



**METHODS:** In this double-blind cross over study, we recruited twelve healthy young men. All the subjects were performed prolonged treadmill running at 40%  $\text{VO}_2\text{max}$  under 30°C leading to 3% body weight loss. Then subjects were orally supplemented with deep ocean-based desalted mineral water (DOMW, N=6) or pure water (placebo, N=6) in the volume equivalent to 1.5 fold of their body weight loss, and consumed in 150-min. One-week after washout crossover trial was performed. Leg explosive power (instantaneous force change measured by force plate), maximal aerobic capacity ( $\text{VO}_2\text{max}$ ) and changes in heart rate variability (HRV) were measured at 4-h and 24-h during post-exercise recovery.

**RESULTS:** We found that exercise challenge caused a significant drop in explosive power at 4-h of recovery. However, DOMW supplementation showed higher recovery rate in explosive power above the placebo trail. Furthermore, only in DOMW trail,  $\text{VO}_2\text{max}$  was significantly improved with concurrent increased heart rate variability (HRV) during recovery.

**CONCLUSIONS:** The result of the present study provides some supportive evidences that deep ocean-based desalted mineral water can accelerate recovery in physical performance after prolonged exercise challenge under high temperature condition.

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**3016** Board #288 June 1 11:00 AM - 12:30 PM

**Rehydration and Cognitive Performance after Moderate Endurance Exercise in a Hot and Humid Environment in Women**

Yajun Chen, Stephen H.S. Wong, FACSM, Fenghua Sun. *The Chinese University of Hong Kong, Hong Kong, Hong Kong.*

(No relationships reported)

**PURPOSE:** this study was to observe the effectiveness in rehydrating women and the cognitive performance after a 60 min moderate endurance exercise in a hot and humid environment of three different beverages.

**METHODS:** Ten active eumenorrheic women ( $n = 10$ , mean  $\pm$  S.E.M; 22.6  $\pm$  0.8 years, 56.5  $\pm$  6.1 kg; 37.9  $\pm$  4.6 ml $\cdot$ kg<sup>-1</sup> $\cdot$ min<sup>-1</sup> and 185  $\pm$  3 beats $\cdot$ min<sup>-1</sup>) ran for 60 min on three occasions on a level treadmill at 60%  $\text{VO}_2\text{max}$ . Each trial was performed in a hot and humid environment (29.2  $\pm$  0.9 °C, 71%  $\pm$  5% relative humidity) and was separated by at least seven days. During 4 hr REC, the subjects consumed either a volume of a carbohydrate electrolyte beverage (CE), lemon tea (LT), or distilled water (DW) equal to 150% of the body weight lost during the previous run. The fluid was consumed in 6 equal volumes at 30, 60, 90, 120, 150, and 180 min of REC. A battery of CogState tests in Chinese Version was selected in sequence: four-choice reaction time, visual vigilance, match-to-sample, repeated acquisition, and grammatical reasoning, to provide information on a variety of cognitive parameters on arrival, immediately after exercise, and at the end of 4 hr recovery period.

**RESULTS:** By the end of REC, of the ~1.4% BW fluid losses, 55.6  $\pm$  14.0%, were replaced when the CE was ingested during the 4 hr REC. This is higher compared with 45.6  $\pm$  15.7 % when the LT was drunk ( $p < 0.05$ ), and 40.9  $\pm$  9.3 % when DW was consumed ( $p < 0.05$ ). When compared with DW, the CE drink improved ( $p < 0.05$ ) the speed performance of Detection in the end of 4 hr REC (2.55  $\pm$  0.10 vs. 2.50  $\pm$  0.13 vs. 2.47  $\pm$  0.09). The carbohydrate drink, CE and lemon tea, are both benefiting to the accuracy performance of working memory compared to DW ( $p < 0.05$ ) (CE vs. LT vs. DW: 1.26  $\pm$  0.08 vs. 1.16  $\pm$  0.13 vs. 1.08  $\pm$  0.07).

**CONCLUSION:** During a 4 hr REC following exercise in a hot environment, a CE solution is a more effective rehydration beverage than other drinks typically consumed in Hong Kong, such as LT and DW. In addition, when compared to DW, the carbohydrate drink, especially the CE, also have the potential benefits for the Working memory, Detection, and Learning in a short-term REC following a moderate exercise in hot environment.

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**3017** Board #289 June 1 11:00 AM - 12:30 PM

**Mild Dehydration Impairs Exercise and Cognitive Performance During a Cycle-Based Simulated Ice Hockey Game**

Matthew S. Palmer, Rachel L. Driscoll. *University of Guelph, Guelph, ON, Canada.* (Sponsor: Lawrence L Spriet, FACSM)

(No relationships reported)

Dehydrating by ~2% body mass (BM) during moderate intensity exercise and stop and go sports has been shown to decrease physical performance, brain blood flow and cognitive function. On average, ice hockey players lose 1.3% BM during a game with 1 in 3 players losing between 1.8 - 4.3% BM, but few studies have examined the effects of mild dehydration on hockey performance.

**PURPOSE:** To determine if mild dehydration in hockey players ( $n = 9$ , 1.80  $\pm$  0.01 m, 77.0  $\pm$  2.9 kg, 21  $\pm$  0 years, 56.8  $\pm$  1.9 mL $\cdot$ kg<sup>-1</sup> $\cdot$ min<sup>-1</sup>) affects exercise performance, perceived exertion (RPE), cognitive performance (modified Stroop test), and reaction time in period 3 (P3) of a cycle-based protocol to simulate an ice hockey game, as compared to staying hydrated with a carbohydrate-electrolyte solution (CES).

**METHODS:** Subjects performed a cycle-based intermittent sprint protocol that was designed to simulate an ice hockey game on two occasions and either restricted their fluid intake prior to exercise and did not ingest fluid (DEH), or drank 500 mL of water 1-2 hours prior to exercise and fully replaced sweat losses with a CES (HYD).

**RESULTS:** Subjects lost a total of 1.7  $\pm$  0.2% BM following P2 and 2.5  $\pm$  0.2% BM after P3. RPE was higher in P3 for the DEH group (18.1  $\pm$  0.4 vs. 17.2  $\pm$  0.7,  $p < 0.05$ ). Performance of a modified Stroop test following the protocol was lower in DEH (Score; 147  $\pm$  54 vs. 216  $\pm$  74,  $p < 0.05$ ). Reaction time assessed after the protocol however, was improved in DEH (212  $\pm$  9 vs. 262  $\pm$  32 ms,  $p < 0.05$ ). Sprint performance decreased over time in both groups but was lower in P3 in DEH (179.7  $\pm$  7.7 vs. 186.0  $\pm$  8.0 kJ,  $p < 0.05$ ). Mean  $T_c$  was not different between groups, but  $\Delta T_c$  increased sharply in P1 in DEH (1.0  $\pm$  0.1 vs. 0.6  $\pm$  0.0  $\Delta^\circ\text{C}$ ,  $p < 0.05$ ). Mean sprint HR was higher in P1 (174  $\pm$  3 vs. 171  $\pm$  3 bpm,  $p < 0.05$ ) and P2 (178  $\pm$  2 vs. 176  $\pm$  2 bpm,  $p < 0.05$ ) in DEH, but similar in P3 (176  $\pm$  2 vs 174  $\pm$  3 bpm).

**CONCLUSIONS:** Mild dehydration had a negative impact on perceived exertion and exercise performance in period 3 of a cycle-based simulated hockey game. Performance of a modified Stroop test was also impaired after the game. Hockey players benefited from improved cognitive and physical performance later in a simulated hockey game, by ingesting a CES to minimize body mass losses. Supported by GSSI and NSERC Canada.

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**3018** Board #290 June 1 11:00 AM - 12:30 PM

**Effects of Hyperthermia and Dehydration on Physiological and Perceptual Measurements During Exercise in Two Environments**

Julie K. DeMartini, Douglas J. Casa, FACSM, Robert A. Huggins, Megan VanSumeren, Rachel Karslo, Rebecca L. Stearns, Lindsay J. DiStefano, Lawrence E. Armstrong, FACSM, Carl M. Maresh, FACSM. *University of Connecticut, Storrs, CT.*

(No relationships reported)

Limited research has evaluated combined effects of hyperthermia and dehydration on body temperature, heart rate, and perception during exercise while carrying a military rucksack.

**PURPOSE:** Evaluate separate and combined effects of hyperthermia and dehydration (%BML) on rectal temperature ( $T_{re}$ ), heart rate (HR), and rating of perceived exertion (RPE) during exercise while carrying a 20.5 kg load.

**METHODS:** Twelve males (age = 20  $\pm$  2 y, height = 182  $\pm$  8 cm, body mass = 74.0  $\pm$  8.2 kg, body fat = 9  $\pm$  3%,  $\text{VO}_2\text{max}$  = 57.0  $\pm$  6.0 mL $\cdot$ kg<sup>-1</sup> $\cdot$ min<sup>-1</sup>) completed four randomized, 90-min treadmill bouts (1.34-1.78m $\cdot$ s<sup>-1</sup>; 5% grade) in a climate controlled chamber under two hydration states and two environmental conditions: euhydrated temperate (EUT), dehydrated temperate (DYT), euhydrated hot (EUH), and dehydrated hot (DYH). Temperate and hot conditions were performed in 18  $\pm$  0.2°C, 50  $\pm$  3.5% RH, and 34  $\pm$  0.3°C, 45  $\pm$  4.5% RH, respectively. Dependent variables were recorded prior to (PRE), at 45-minutes (MID), and post (POST) exercise. Data were analyzed via two-way (condition X time) repeated measures ANOVA and Tukey post-hoc tests.

**RESULTS:** %BML was greater in DYT and DYH than EUT and EUH (-3.80  $\pm$  1.22% and -5.66  $\pm$  1.57% vs. 0.10  $\pm$  0.90% and -1.30  $\pm$  0.85%, respectively;  $p < .001$ ). A significant interaction occurred for  $T_{re}$  ( $p < .001$ ), HR ( $p = .007$ ), and RPE ( $p = .001$ ). At MID, DYH  $T_{re}$  exceeded EUT and EUH (38.7  $\pm$  0.29°C vs. 37.86  $\pm$  0.25°C, 37.96  $\pm$  0.51°C, respectively), while at POST, DYH  $T_{re}$  exceeded EUT, HYT, and EUH (39.32  $\pm$  0.43°C vs. 37.86  $\pm$  0.33°C, 38.22  $\pm$  0.29°C, 38.25  $\pm$  0.63°C, respectively). At MID, DYH HR exceeded EUT and DYT (156  $\pm$  17 bpm vs. 135  $\pm$  15 bpm and 138  $\pm$  13 bpm) and remained higher POST (175  $\pm$  12 bpm vs. 132  $\pm$  12 bpm, 145  $\pm$  10 bpm, respectively). In addition, HR POST in EUH exceeded EUT (156  $\pm$  17 bpm vs. 132  $\pm$  12 bpm, respectively). At MID, DYH RPE exceeded EUT (16  $\pm$  2 vs. 13  $\pm$  1, respectively). At POST, DYH RPE exceeded EUT and DYT (18  $\pm$  1 vs. 14  $\pm$  2, 14  $\pm$  2, respectively).

**CONCLUSIONS:** Combined effects of hyperthermia and dehydration had additive, detrimental effects on  $T_{re}$ , HR, and RPE compared to individual effects. Most notably, DYH resulted in a 1.1°C (2°F) increase in  $T_{re}$  compared to EUH and DYT. This suggests a greater risk for exertional heat stroke when individuals are both dehydrated and hyperthermic while carrying a load, as is the case with military personnel.

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3019 Board #291 June 1 11:00 AM - 12:30 PM

**Influence of Dehydration on Internal Body Temperature Changes During Exercise In The Heat: A Meta-Analysis**

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(No relationships reported)

Dehydration (DHY) increases the rise of internal body temperature (T) compared to a euhydrated state during exercise in the heat. Numerous original research studies have quantified the effect of DHY on T; however a wide range has been reported (0.01-0.43°C·1%BML<sup>-1</sup>) difference.

**PURPOSE:** To systematically review the current literature to determine  $\Delta T$  per 1% body mass loss (%BML) difference.

**METHODS:** PubMed, SPORTDiscus, Web of Science, Rehabilitation & Physical Medicine, CINAHL and Cochrane Reviews were searched from inception to March 2011 with limitations on human subjects and English. Key words included: *dehydration, dehydrated, hypohydration, hypohydrated, hyperthermia, hyperthermic, core temperature, and core body temperature.* Original research articles which met these criteria were included: 1) reported mean and SD of valid T and %BML difference 2) hyperthermia  $\geq 38.9^\circ\text{C}$  in one trial condition, 3) exercise mode was similar between conditions other than hydration status. Of the 1192 articles retrieved, 281 examined the effects of DHY on T during exercise. Twenty original research studies met the inclusion criteria and were scored using the Physiotherapy Evidence Database (PEDro) Scale (7.0  $\pm$  0.6). Means and SD for trial conditions were compiled for final  $^\circ\text{C}$  and %BML difference. Meta-analysis was performed to determine pooled and weighted mean differences (MD) between the greater and lesser DHY trials for  $^\circ\text{C}$  and %BML difference.

**RESULTS:** Final weighted MD for  $^\circ\text{C}$  were (0.54 $^\circ\text{C}$ , 95% CI 0.51 to 0.54) and %BML difference (2.45%, 95% CI 2.42 to 2.48). For every 1% BML difference, T increased 0.22 $^\circ\text{C}$  during exercise in the heat.

**CONCLUSION:** This meta-analysis precisely defines the rise in T for exercising individuals per 1% BML difference. Clinically, this information confirms that the rise in T is increased with greater body mass loss. Furthermore, sports medicine personnel and researchers can better determine the rise of T in an individual exercising in the heat based on their %BML difference and prevent heat illness.

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3020 Board #292 June 1 11:00 AM - 12:30 PM

**Validation of the OMNI Perceived Sweating Scale during Treadmill Walking while Wearing Thermal Protective Clothing**

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(No relationships reported)

**PURPOSE:** Concurrent and construct validation of the OMNI Sweating Scale was examined using adult male (n=16) and female (n=5) subjects. This category scale contains verbal and pictorial descriptors positioned along a narrow (1-10) numerical range.

**METHODS:** Subjects were 27.9  $\pm$  4.6 years old, weighed 73.5  $\pm$  15.5 kg, were 174.5  $\pm$  9.4 cm tall and had a maximal oxygen uptake of 50.3  $\pm$  8.3 ml·kg<sup>-1</sup>·min<sup>-1</sup>. Subjects ingested a thermistor capsule for the measurement of core temperature approximately 8 hrs before the experimental trial. Weighted mean skin temperature was calculated using the following formula: Tsk = chest (0.25) + back (0.25) + thigh (0.30) + arm (0.20). Concurrent validity was established by correlating OMNI sweating scale ratings (OMNI-SW) with core (Tc) and weighted mean skin (Tsk) temperatures obtained during treadmill walking while wearing firefighter thermal protective clothing. Construct validity was established by correlating OMNI-SW with a construct specific 10 cm visual analogue scale (VAS).

**RESULTS:** Tc ranged from 37.1  $\pm$  0.1 $^\circ\text{C}$  to 38.9  $\pm$  0.1 $^\circ\text{C}$  and Tsk ranged from 33.8  $\pm$  0.1 $^\circ\text{C}$  to 38.7  $\pm$  0.1 $^\circ\text{C}$ . OMNI-SW ranged from 1-10 and distributed as a positive linear function of Tc (r = 0.75, p < 0.01) and Tsk (r = 0.81, p < 0.01). OMNI-SW distributed as a positive linear function of the VAS responses which ranged from 0-10 cm (r = 0.97, p < 0.01).

**CONCLUSIONS:** Concurrent and construct validity were established for the OMNI Sweating Scale in healthy adults performing treadmill walking while wearing firefighter thermal protective clothing.

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3021 Board #293 June 1 11:00 AM - 12:30 PM

**Effect Of The Vasopressin2 Receptor On Sweat Composition, Fluid Balance And Performance**

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(No relationships reported)

Previous data revealed statistically significant linear relationships between sweat, urine and blood sodium concentration ([Na<sup>+</sup>]) as well as arginine vasopressin ([AVP]) during steady-state running.

**PURPOSE:** To determine if sweat sodium concentration is regulated by [AVP] through activation of the Vasopressin2 (V2) receptor.

**METHODS:** 10 subjects participated in 3 double-blind randomized trials ingesting a: placebo, V2 agonist or V2 antagonist. Each treadmill trial consisted of 60 minutes running at 60% peak speed (Steady-State) followed by an incremental test to exhaustion (Performance). Blood, urine and saliva samples were collected at baseline and following both Steady-State and Performance segments. Sweat samples were obtained after the Steady-State and Performance segments from side-by-side shoulder patches, followed by a whole body washdown. Water was allowed ad libitum.

**RESULTS:** Significant decreases (p<0.05) in urine [Na<sup>+</sup>] noted with the V2 antagonist (18; 16; 31mmol/L) versus the placebo (106; 82; 57mmol/L) and V2 agonist (132; 89; 65mmol/L) (Baseline mean; after Steady-State mean; after Performance trial mean, respectively). Significant increases (p<0.05) in plasma [Na<sup>+</sup>] noted from baseline vs. after Performance in the: placebo (143 vs. 145mmol/L), V2 agonist (143 vs. 146mmol/L) and V2 antagonist (143 vs. 148mmol/L) trials and between the placebo vs. V2 antagonist after Performance. Similar increases in endogenous [AVP] from baseline to performance noted with the V2 agonist (0.4 vs. 2pg/mL) and V2 antagonist (0.2 vs. 4pg/mL) trials and between placebo vs. V2 antagonist after Performance. Significant increases (p<0.05) in saliva [Na<sup>+</sup>] noted from baseline vs. after Performance in the: V2 agonist (18 vs. 33mmol/L) and V2 antagonist (18 vs. 42mmol/L) trials. No significant difference in sweat [Na<sup>+</sup>] seen between the placebo (80; 14mmol/L), V2 agonist (77; 13mmol/L) or V2 antagonist (82; 12mmol/L)(after Performance sweat patch; whole body washdown) trials. No significant difference in performance between the placebo (586sec), V2agonist (612sec) and V2 antagonist (617sec) trials.

**CONCLUSION:** Sweat [Na<sup>+</sup>] is not regulated by the V2 receptor. Increased plasma [Na<sup>+</sup>] and [AVP] with the V2 antagonist had no detrimental effect on performance, with a trend towards augmented performance.

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3022 Board #294 June 1 11:00 AM - 12:30 PM

**Determinants of Sweat Na<sup>+</sup> Concentration in Elite Athletes Training in a Hot and Humid Environment**

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(No relationships reported)

Reductions in serum sodium concentration and exercise-associated skeletal muscle cramps have been related to high sodium losses during exercise in the heat.

**PURPOSE:** To determine factors associated with sweat sodium concentration in elite heat acclimatized athletes training in a hot and humid environment.

**METHODS:** Elite athletes (N=109; males=73 females=36; mean age= 25.2  $\pm$  4.9 yr) were tested during training sessions (mean duration=82.9  $\pm$  22.5 min) in running, cycling, beach volleyball, soccer, tennis, and fencing in a hot and humid climate (WBGT=30.1  $\pm$  1.8 $^\circ\text{C}$ ). Exercise intensity was estimated using an accelerometer worn by the athletes during the entire session. Acute changes in body mass were used to estimate sweat rate. A sweat sample was collected with an absorbent patch to measure sweat [Na<sup>+</sup>]. Saliva samples were obtained for genetic analysis in athletes with high sweat [Na<sup>+</sup>].

**RESULTS:** The average training time in a hot and humid climate in the past month (3,056.7  $\pm$  2,477.5 min) indicated that the athletes were heat acclimatized. The mean sweat [Na<sup>+</sup>] was 67.5  $\pm$  22.2 mmol/L. Gender, environmental heat stress, and training time in the heat in the past month were not significantly correlated with sweat [Na<sup>+</sup>]. Stepwise multiple regression revealed that

sweat rate ( $1.3 \pm 0.5$  L/h) and exercise intensity ( $3,976.7 \pm 2,466.5$  activity counts/min) accounted for approximately 16% of the sweat  $[Na^+]$  ( $R^2=0.16$ ,  $P<0.001$ ). Sweat  $[Na^+]$  and total sweat  $Na^+$  loss was similar in athletes with a history of muscle cramps ( $68.5 \pm 23.1$  mmol/L and  $2,191.5 \pm 1,131.8$  mg) compared to those reporting no cramping ( $66.9 \pm 22.2$  mmol/L and  $2,176.4 \pm 1,255.3$  mg),  $P > 0.05$ . Twenty nine athletes with a sweat  $[Na^+] > 70$  mmol/L and sweat  $[Cl^-] > 60$  mmol/L provided saliva samples for genetic analysis. One athlete was identified as having heterozygous presence of the  $\Delta F508$  mutation in the CFTR gene and had a history of whole body muscle cramps.

**CONCLUSIONS:** In heat acclimatized elite athletes training in a hot and humid environment, sweat sodium concentration is related to exercise intensity and sweat rate but not to gender, environmental heat stress, or heat exposure time in the previous month.

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**3023** Board #295 June 1 11:00 AM - 12:30 PM

### Preventing Mild Dehydration with a Carbohydrate Electrolyte Solution Improves Performance during an Ice Hockey Scrimmage

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(M.E. Linseman: Salary; GSSI paid my graduate student stipend, but did not have a say in how the study was conducted.)

Mild dehydration (1.5-2%) is associated with increased core temperature (Tc), heart rate (HR) and mental fatigue (MF), and decreased performance during "stop-and-go" sports such as basketball and soccer. Similar studies in ice hockey players are scarce, and many ice hockey players lose more than 1.5% body mass (BM) through sweating during games.

**PURPOSE:** To investigate the effects of remaining hydrated with a carbohydrate electrolyte solution (CES) vs. dehydrating by 1.5-2% BM on Tc, HR, on-ice performance, and MF during ice hockey.

**METHODS:** High-level male hockey players ( $n = 14$ ,  $21.3 \pm 0.2$  yrs,  $80.1 \pm 2.5$  kg,  $182 \pm 1.2$  cm) participated in a randomized crossover study. Players performed a set of three on-ice performance drills before and after a 70-min on-ice hockey scrimmage. Players ingested no fluid to progressively dehydrate by 1.5-2% BM (NF), or ingested CES to maintain BM (CES).

**RESULTS:** Peak Tc was lower in CES than in NF ( $38.69 \pm 0.10$  vs.  $38.92 \pm 0.11$  °C,  $p < 0.05$ ). Tc peaked at ~49 min in CES and ~44 min in NF, and was lower throughout the scrimmage in CES. In-game HR was not different between trials. In the last 20 min of play, CES players committed fewer turnovers/min with the puck ( $1.6 \pm 0.3$  vs.  $3.1 \pm 0.7$ ,  $p < 0.05$ ) and completed a higher percentage of attempted passes ( $78 \pm 5$  vs.  $51 \pm 8\%$ ,  $p < 0.05$ ). From 30-50 min, CES players had higher mean skating speed ( $3.57 \pm 0.10$  vs.  $3.45 \pm 0.12$  m/s,  $p < 0.05$ ) and time at high effort ( $179 \pm 11$  vs.  $159 \pm 11$  s,  $p < 0.05$ ). Mean post-scrimmage sprint skating drill time was faster in CES ( $26.33 \pm 0.26$  vs.  $26.81 \pm 0.32$  s,  $p < 0.05$ ). There were no between-trial differences in shooting or slalom drill performance. MF, assessed by two post-trial questionnaires, was lower in CES. Hockey Fatigue Questionnaire total score ( $29.5 \pm 2.8$  vs.  $37.1 \pm 1.6$ ,  $p < 0.05$ ) and Profile of Mood States fatigue subsection score ( $15.1 \pm 1.3$  vs.  $19.4 \pm 1.0$ ,  $p < 0.05$ ) were lower in CES. Since responses to mild dehydration were highly variable, individual data were also analyzed. Players demonstrating improved skating performance in CES tended to have lower Tc and MF in CES, and a BM that was higher than the mean.

**CONCLUSION:** Maintaining BM with a CES resulted in decreased Tc, improved skating and puck handling performance, and decreased mental fatigue, compared to dehydrating by 1.5-2% BM during an on-ice hockey scrimmage. Supported by GSSI and NSERC Canada.

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**3024** Board #296 June 1 11:00 AM - 12:30 PM

### Effective Microorganism-x Attenuates The Hit-induced Increases In Plasma Superoxide Dismutase Within A Hot Humid Environment

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(No relationships reported)

Extracellular HSP72 (eHSP72) increases in response to aerobic and resistance exercise stress, no such data is available with regard to the impact of high-intensity interval training (HIT) within hot or temperate environments. *In vitro*, effective microorganism-x (EMX) can attenuate certain pro-inflammatory and redox balance responses. Supplementation of EMX may play a role in mediating any HIT induced alterations in redox balance and eHSP72 expression.

**PURPOSE:** Elucidation of the eHSP72 response and redox balance disturbances of HIT within temperate and hot conditions and the impact of EMX supplementation on such responses.

**METHODS:** Six recreationally active male subjects reported to the laboratory on 6 occasions. **Visit 1:**  $VO_{2max}$ . **2:** Maximal Anaerobic Running Test (MART). **3-6:** Four high intensity interval running protocols ( $HIT_{RPT}$ : ~40 minutes duration,  $20 \times 10$  secs fast high intensity runs at peak MART velocity, interspersed with 80 sec of active recovery at 35%  $VO_{2max}$ ). Two visits were completed in temperate conditions ( $HIT_{RPT}$ ) ( $20.4 \pm 1.7$  °C;  $41 \pm 4.2\%$  RH), and 2 in hot and humid conditions ( $HIT_{RPH}$ ) ( $34.7 \pm 2.0$  °C;  $51.7 \pm 4.5\%$  RH), with EMX supplementation ( $HIT_{RPT/EMX}$  or  $HIT_{RPH/EMX}$ ) or without (placebo) ( $HIT_{RPT/PLA}$  or  $HIT_{RPH/PLA}$ ). Typical physiological measures were recorded throughout with blood lactate and glucose assessed quarterly. Venous whole blood samples were obtained at rest pre and immediately post completion of  $HIT_{RPT}$  for assessment of plasma eHSP72 and superoxide dismutase (SOD) using commercially available ELISAs.

**RESULTS:** Plasma eHSP72 increased significantly pre- to post  $HIT_{RPT}$  ( $F = 62.1$ ,  $p < 0.001$ ), with eHSP72 in  $HIT_{RPT}$  increased by  $0.8$  ng·mL<sup>-1</sup> (95% CI =  $0.3$  to  $1.2$  ng·mL<sup>-1</sup>,  $p = 0.005$ ), compared to  $1.5$  ng·mL<sup>-1</sup> in  $HIT_{RPH}$  (95% CI =  $1.1$  to  $1.9$  ng·mL<sup>-1</sup>,  $p < 0.001$ ). Plasma SOD activity significantly increased pre- to post  $HIT_{RPT}$  ( $F = 70.1$ ,  $p < 0.001$ ), with SOD in  $HIT_{RPT}$  significantly increasing  $0.10$  U·mL<sup>-1</sup> (95% CI =  $0.047$  to  $0.16$  units,  $p = 0.001$ ), compared to a  $0.22$  U·mL<sup>-1</sup> increase in the  $HIT_{RPH}$  (95% CI =  $0.16$  to  $0.28$  U·mL<sup>-1</sup>,  $p < 0.001$ ). SOD activity was  $0.10$  U·mL<sup>-1</sup> significantly higher in  $HIT_{RPH/PLA}$  compared to the  $HIT_{RPH/EMX}$  (95% CI =  $0.045$  to  $0.16$  U·mL<sup>-1</sup>,  $p = 0.001$ ).

**CONCLUSION:** EMX supplementation may convey some protection to the HIT induced disturbances to redox balance within a hot and humid environment.

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**3025** Board #297 June 1 11:00 AM - 12:30 PM

### The Effect Of Selected Foods On Urinary pH

Jo M. Welch, Jason C. Davis. *Dalhousie University, Halifax, NS, Canada.*

(No relationships reported)

Sodium bicarbonate consumed before a competition can delay metabolic acidosis by raising the pH level in the body but this intake can be unpleasant and cause indigestion.

**PURPOSE:** To test the hypothesis that certain foods consumed in one snack can alter urinary pH similarly to sodium bicarbonate.

**METHODS:** Nine healthy subjects (5 men), aged 19-26, were assigned to one of three treatment groups and proceeded to subsequent treatments based a Latin square design. Each treatment consisted of a small meal which was anticipated to elicit an acidic, basic, or neutral response. Subjects consumed the same standardized diets during each day prior to the mid-afternoon experimental snacks. Urine samples were analyzed for pH and hydration before and also 2 hours after consumption of each snack. Subjects completed all three diets with a minimum of one washout day between treatments. The difference between pre-meal and post-meal urine pH was analyzed using repeated measures ANOVA.

**RESULTS:** Urine pH decreased by an average of 0.281 after an acidic snack while changes in urine pH for neutral and basic snacks dropped by 0.006 and 0.034 respectively. Pairwise comparisons showed a trend towards significance between the acidic and neutral snacks ( $p=0.07$ ) and between the acidic and basic snacks ( $p=0.06$ ) but no difference between the neutral and basic snacks. Urinary pH was not correlated with hydration status.

**CONCLUSION:** Both the basic and neutral snacks resulted in a higher urinary pH than did the acidic snack. Attention to pre-competition diet could play a role in delaying metabolic acidosis in athletes in some sports.

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**3026** Board #298 June 1 11:00 AM - 12:30 PM

### Time To Plasma Sodium Accumulation Of Three Different Beverages Of Varying Sodium Concentration At Rest

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<sup>2</sup>DatalysCenter, Indianapolis, IN.

(No relationships reported)

The National Athletic Trainers' Association recommends adding 0.3 - 0.7 g/L sodium ( $Na^+$ ) to fluids ingested 2 - 3 hrs prior to exercise to prevent negative effects of  $Na^+$  depletion. Optimum time of ingestion before exercise and amount of  $Na^+$  needed to raise plasma sodium concentration ( $[P_{Na^+}]$ ) in  $Na^+$  depleted individuals has yet to be determined.

**PURPOSE:** To examine changes in  $[P_{Na+}]$  and urine  $[Na^+]$  ( $[U_{Na+}]$ ) in euhydrated and  $Na^+$  depleted individuals ( $[P_{Na+}] < 137.5$  mmol/L) over a period of 3 hrs of rest following ingestion of 3 different beverages of varying  $[Na^+]$ .

**METHODS:** A randomized crossover design examined the effects of water (W), carbohydrate electrolyte beverage (CEB), and enhanced CEB (E-CEB) on  $[P_{Na+}]$  and  $[U_{Na+}]$ . Participants were given 500 mL of assigned beverage and electrolyte measures were taken over 3 hrs of rest. CEB was commercially available and the E-CEB was a packet, added to the CEB, containing additional electrolytes.  $[P_{Na+}]$  and  $[U_{Na+}]$  were analyzed using ion selective electrodes ( $Na^+/K^+$  Easylyte, Medica Corporation, Bedford, MA).

**RESULTS:** Participants were 9 (3 male and 6 female; mean age = 22.1 yr, weight = 66.5 kg, height = 67.2 cm) moderately active individuals from the surrounding area. Mean  $[Na^+]$  for W = 0 g/L, CEB = 5.1 g/L, and E-CEB = 12.5 g/L. Repeated measures ANOVA was used to calculate  $[P_{Na+}]$  and  $[U_{Na+}]$  changes over 3 hours (180 min). We found a significant increase in overall  $[P_{Na+}]$  from 0 to 150 min (134.9 mmol/L to 136.4 mmol/L,  $p = 0.045$ ) and 0 to 180 min (134.9 mmol/L to 137.1 mmol/L,  $p = 0.003$ ). There was a significant increase in overall  $[U_{Na+}]$  from 0 to 180 min (6.5 mmol/L to 14.2 mmol/L,  $p = 0.002$ ). No significant difference were found between the 3 beverage groups for  $[P_{Na+}]$  and  $[U_{Na+}]$  across time. Although not statistically significant, only the E-CEB increased  $[P_{Na+}]$  above our cutoff for  $Na^+$  depletion (mean  $[P_{Na+}]$  at 180 min = 137.7 mmol/L).

**CONCLUSION:** While participants' overall  $[P_{Na+}]$  increased over time, the CEB and E-CEB were not significantly different from W. The CEB or E-CEB did not significantly increase  $[P_{Na+}]$  in our  $Na^+$  depleted participants during rest. While hydration protocols should be individualized, the time and amount of  $Na^+$  suggested by the recommendations should be further examined and adjusted accordingly to ensure individuals are sodium balanced prior to physical activity.

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**3027** Board #299 June 1 11:00 AM - 12:30 PM

**Urinary Parameters Are Relevant Hydration Markers In Real Life Conditions**

Alexis Klein<sup>1</sup>, Romain Barnouin<sup>2</sup>, Sebastien Vergne<sup>1</sup>, Deborah Metzger<sup>2</sup>, Nicolas Girard<sup>2</sup>, Agnes Demazieres<sup>2</sup>, Isabelle Guelinckx<sup>1</sup>, Nathalie Pross<sup>2</sup>, Erica Perrier<sup>1</sup>.  
<sup>1</sup>Danone Research, Palaiseau, France. <sup>2</sup>Forenap, Rouffach, France.

(No relationships reported)

**PURPOSE:** Despite its importance for health, knowledge on what optimal hydration status is and how it could be evaluated is conflicting. Previous works indicate that 24h urine parameters can differentiate fluid intake habits, and that they may be valid hydration markers under real life conditions. However to confirm this, assessment of their adjustment to mild changes in fluid intakes is needed.

The purpose of this study was: first to determine if urinary parameters of hydration change rapidly in response to modifications of fluid intake; and second to assess whether shorter urine collection periods are adequate to accurately reflect hydration status.

**METHODS:** Forty-eight participants (age:  $24.7 \pm 3.1$  yrs; BMI:  $22.4 \pm 1.6$  kg/m<sup>2</sup>) were classified as Low (n=29) or High drinkers (n=19), and completed a 6-day inpatient parallel group trial. During the first 2 days (baseline), participants followed a fluid regimen quantitatively comparable to their self-reported intake habits (1.0L/d for Low drinkers and 2.5 L/d for High drinkers). In the second 3 day phase, fluid intakes between groups were reversed. Urine was collected in three to five-hour intervals during waking hours.

**RESULTS:** Statistical comparisons showed that the 24h urinary osmolality (Uosm), Specific Gravity (USG), and color were significantly higher in the Low as compared to High drinker group at baseline ( $841 \pm 180$  vs.  $332 \pm 52$  mOsm/kg;  $1.022 \pm 0.004$  vs.  $1.010 \pm 0.002$ ;  $5.4 \pm 1.0$  vs.  $2.6 \pm 0.6$ ; respectively;  $p < .001$ ). This was also the case for shorter collections. Moreover, these parameters were significantly altered by fluid intake modification in both groups ( $p < .001$ ), with the alterations being statistically significant on the first day of the intervention. No differences were observed for blood osmolality (Bosm) whatever the group or the period.

**CONCLUSIONS:** The study confirms that parameters such as 24h urinary volume, color, Uosm, USG, but not Bosm accurately detect mild changes in hydration status. Moreover, findings support use of shorter urine collection periods to this aim. Urinary parameters appear as most sensitive markers to differentiate low and high drinkers, and to detect changes in hydration status caused by modifications of fluid intake mimicking the ones that can be encountered in real life conditions.

This study has been granted by Danone Research

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**3028** Board #300 June 1 11:00 AM - 12:30 PM

**Effect of Skin Surface Contamination on Sweat Mineral Concentration During Heat Acclimation.**

Matthew R. Ely<sup>1</sup>, Robert W. Kenefick, FACSM<sup>1</sup>, Samuel N. Cheuvront, FACSM<sup>1</sup>, Troy D. Chilver<sup>1</sup>, Craig P. Lacher<sup>2</sup>, Henry C. Lukaski, FACSM<sup>2</sup>, Scott J. Montain, FACSM<sup>1</sup>. <sup>1</sup>USARIEM, Natick, MA. <sup>2</sup>USDA, Grand Forks, ND.

(No relationships reported)

Heat acclimation reportedly conveys conservation in sweat mineral concentrations. It was recently reported that removing surface contamination through comprehensive cleaning of the skin surface negated sweat micro-mineral reductions during prolonged sweating. It is unknown if the sweat mineral conservation reported with heat acclimation may also be an artifact of surface contamination.

**PURPOSE:** To measure sweat mineral concentrations during heat acclimation and determine if surface contamination plays a role in the reported decrements of sweat minerals.

**METHODS:** Sweat mineral concentrations were measured in ten male volunteers from arm bag and scapular pouches on day 1, 5, and 10 of a heat acclimation protocol. To assess the potential contribution of skin contamination the initial mineral residue of the skin on the arm/hand was assessed with a 10-ml distilled water rinse. The arm was then meticulously cleaned to minimize surface contamination and sweat samples were obtained 20-25 minutes after the initiation of exercise using an arm bag. Additionally, sweat was simultaneously and serially sampled (two times each day) from a cleaned (WASH) and un-clean (No-WASH) site on the scapular surface via pouch technique. All rinse and exercise sweat samples were analyzed by spectrometry for Ca, Cu, Fe, Mg, and Zn.

**RESULTS:** No heat acclimation effect on sweat micro-minerals was observed. Sweat mineral concentrations from the WASH site were relatively low and did not change between Day 1, 5, or 10 or within each day of heat acclimation (Ca:  $0.29 \pm 0.14$  mmol/L, Cu:  $0.58 \pm 0.81$   $\mu$ mol/L, Fe:  $0.12 \pm 0.22$   $\mu$ mol/L, Mg:  $0.04 \pm 0.04$  mmol/L, Zn:  $1.45 \pm 1.33$   $\mu$ mol/L). The initial mineral concentration from the No-WASH site did not change from Day 1, 5 or 10 but were significantly greater than concentrations from WASH and declined 45-57% from initial to subsequent samples within each day becoming similar to the WASH site. The arm/hand surface rinse micro-mineral concentrations were higher than the sweat samples from the cleaned skin.

**CONCLUSION:** When the skin surface is not cleaned mineral residue inflates initial sweat mineral concentrations. Heat acclimation does not confer a reduction in sweat Ca, Cu, Fe, Mg, or Zn concentrations.

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## E-40 Free Communication/Poster - Weight Loss Interventions

JUNE 1, 2012 7:30 AM - 12:30 PM

ROOM: Exhibit Hall

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**3029** Board #301 June 1 9:30 AM - 11:00 AM

**Absenteeism In A Metropolitan Law Enforcement Agency Weight Loss Competition**

Allen R. Mullins<sup>1</sup>, Robert W. Boyce, FACSM<sup>1</sup>, Tyler K. Willett<sup>1</sup>, Glenn R. Jones<sup>2</sup>, Edward L. Boone<sup>3</sup>. <sup>1</sup>University of North Carolina Wilmington, Wilmington, NC 28403, NC. <sup>2</sup>Work Physiology Associates Inc, Charlotte, NC. <sup>3</sup>Virginia Commonwealth University, Richmond, VA 23284, NC. (Sponsor: Robert W Boyce, FACSM)

(No relationships reported)

Evaluation of absentee patterns provides valuable insight into effective health promotion programs. Little has been published regarding absenteeism in weight loss competitions in law enforcement agencies.

**PURPOSE:** To report absenteeism outcomes of a police weight loss competition and compare participants who completed the program with irregular attendees.

**METHODS:** A police department held a twelve week weight loss competition involving five person teams composed of civilians and sworn officers. Weigh-ins were held at beginning and bi-weekly. Teams recording most weight loss won. ANOVA procedures were used to compare starting body mass of those who completed all weigh-ins (Reg) with three irregularly attending groups: Those missing the final weigh-in (Irreg1), those missing two or more weigh-ins (Irreg2), and those weighing-in at week 2 & missing all other weigh-ins (Irreg3). The proportion of those absent, expressed as a percent, was used to evaluate trends: Police vs. civilians, gender comparisons, and obese vs. non-obese.

**RESULTS:** 381 participants began the competition: 260 sworn officers and 121 civilians; 137 females and 244 males. All participants attended the first weigh-in & 14% failed to complete the final weigh-in. Reg were significantly ( $p \leq 0.01$ ) lighter,  $99.9 \pm 22.6$  kg at the start of the program than groups Irreg2,  $110.6 \pm 26.1$  kg and Irreg3,  $124.8 \pm 30.9$  kg. Comparing the Reg group with the Irreg1 group, the Reg group had significantly ( $p \leq 0.05$ ) greater losses in body mass at week 2 and between weeks 2 and 4;  $1.8 \pm 1.8$  kg vs.  $1.2 \pm 1.4$  kg and  $1.0 \pm 1.5$  kg vs.  $0 \pm 1.4$  kg, respectively. The Reg group also had significantly ( $p \leq 0.001$ ) greater weight loss than the Irreg2 group between weeks 2 and 4;  $1.0 \pm 1.5$  kg vs.  $-0.3 \pm 1.4$  kg, respectively. Civilians had a higher percentage of absences than police, 19% vs. 12%. Also, obese police had more absenteeism than non-obese police, 14% vs. 8% at program completion.

**CONCLUSION:** The police weight loss competition was effective with 86% of participants completing the program. Higher absenteeism by civilians and the more obese indicate that creative promotions directed at these groups may further enhance future program participation. Also, higher body mass and lower weight loss reported in irregular attendees supports the premise that full participation is associated with success.

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**3030 Board #302 June 1 9:30 AM - 11:00 AM**

**Health Promotion Initiative to Reduce Body Fat and Increase Fat Free Mass among Active U.S. Military and DOD Civilians**

Robert T. Gobble<sup>1</sup>, Ronald D. Williams, Jr.<sup>1</sup>, Barry P. Hunt<sup>1</sup>, Jeremy T. Barnes<sup>2</sup>, Jeremy P. Loenneke<sup>3</sup>. <sup>1</sup>Mississippi State University, MSU, MS. <sup>2</sup>Southeast Missouri State University, Cape Girardeau, MO. <sup>3</sup>University of Oklahoma, Norman, OK.

(No relationships reported)

**PURPOSE:** Recent studies have indicated that many military personnel exceed U.S. Army standards for body composition and weight. Body fat (BF) percentage is considered a critical measure for soldiers as it may impact the U.S. Army's overall mission. The purpose of this study was to test the effectiveness of a brief individualized intervention to improve the body composition of active duty U.S. Army members (AD) and Department of Defense (DOD) civilians (CV).

**METHODS:** Using the constructs of the Health Belief Model (HBM), a 12-week comprehensive health and nutrition program was designed for active military (n=20) and DOD civilians (n=15) at Area 1, United States Army Garrison, South Korea. This program utilized a combination of health education and fitness initiatives designed to increase physical activity and healthy dietary behaviors of participants. Mean (SD) age of the participants was 32.34(8.51). Mean (SD) subject characteristics for AD participants (17 male, 3 female) were age 30.15(7.45) yrs, weight 85.3(12.2) kg, and BF 23.34(7.53). Mean (SD) subject characteristics for CV participants (8 male, 7 female) were age 35.27(9.19) yrs, weight 88.1(20.0) kg, and BF 30.13(7.01).

**RESULTS:** Paired t-tests determined pair-wise differences between pre- and post-test BF and FFM measurements using a Bonferroni corrected alpha level of 0.05. Among all participants, mean BF was reduced from 24.41(8.98) to 20.99(7.78) ( $t(34)=5.678$ ,  $p \leq .001$ ), while weight decreased from 86.5(15.8) to 83.6(15.6) ( $t(34)=4.403$ ,  $p \leq .001$ ). Among AD participants, reductions occurred in both mean BF 20.91(8.67) to 18.12(6.71) ( $t(19)=3.556$ ,  $p=.002$ ) and weight 85.3(12.2) to 83.1(12.7) ( $t(19)=3.556$ ,  $p=.002$ ). Among CV participants, reductions occurred in both mean BF 27.96(7.93) to 24.18(7.71) ( $t(14)=4.339$ ,  $p=.001$ ) and weight 88.1(20.0) to 84.3(19.3) ( $t(14)=2.949$ ,  $p=.011$ ).

**CONCLUSIONS:** A brief health promotion initiative designed for military base personnel can have significant impact on overall body composition. U.S. Army health and fitness specialists could utilize the HBM to design and implement programs to improve body composition among military base personnel.

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**3031 Board #303 June 1 9:30 AM - 11:00 AM**

**The Use of Nutritional Supplements for Weight Modification by U.S. Army Soldiers**

Krista G. Austin<sup>1</sup>, Emily K. Farina<sup>1</sup>, Christina Carvey<sup>2</sup>, Harris R. Lieberman<sup>2</sup>. <sup>1</sup>Oak Ridge Institute for Science and Education; United States Army Research Inst. for Environ. Med., Natick, MA. <sup>2</sup>United States Army Research Institute for Environmental Medicine, Natick, MA.

(No relationships reported)

U.S. Army Soldiers must meet body weight and composition standards to remain in the military, and may use nutritional supplements (NS) purported to assist in weight modification (WM).

**PURPOSE:** This study investigated factors associated with Soldiers' WM goal, and examined the relationships between NS use and weight goals.

**METHODS:** Data were collected (N=990 Soldiers) at 11 Army bases. Participants completed a survey which included questions regarding WM goal (lose, gain or maintain) and NS use. Supplements were categorized as energy drinks (E), sport nutrition products (SNP) or dietary supplements (DS). DS were sub-categorized according to purported functionality as health, weight-loss, weight-gain or other DS. Logistic regression and  $\chi^2$  were used to investigate associations.

**RESULTS:** Forty-three percent of respondents desired weight loss, 38.1%±1.8 weight maintenance and 18.2%±1.4 weight gain. Former smokers (OR, 95% CI = 2.02, 1.33-3.06) and individuals with higher BMI (OR, 95% CI: overweight = 6.33, 4.16-9.62; obese = 18.13, 10.38-31.66;  $p < 0.01$ ) or age (OR, 95% CI: 30-39y = 2.72, 1.58-4.70; > 2.74, 1.44-5.24;  $p < .01$ ) were more likely to want to lose weight. Respondents desiring weight gain were more likely to be male (OR, 95% CI = 2.06, 1.0-4.27;  $p = .05$ ) and more than twice as likely to have high Army physical fitness scores (APFT; OR, 95% CI: APFT 240-289 = 2.0, 1.24-3.25; APFT 290-299 = 2.68, 1.47-4.91; APFT >300 = 2.92, 1.47-5.82;  $p < 0.01$ ). Most respondents (70.3%±1.7) consumed some form of NS; however overall NS use was not related to WM goal. Respondents who wanted to lose or maintain weight were less likely to consume E (OR, 95% CI: lose = 0.63, 0.46-0.87; maintain = 1.21, 0.88-1.65;  $p < 0.01$ ) and weight-gain DS (OR, 95% CI: lose = 0.17, 0.08-0.39; maintain = 0.99, 0.51-1.92;  $p < 0.01$ ) than respondents desiring to gain weight. No other NS categories were significantly related to weight goal.

**CONCLUSION:** WM goal is related to multiple health behaviors including tobacco use, physical fitness score and self-perception of health and eating behavior. NS are consumed in this population regardless of WM goal. Soldiers desiring to lose or maintain weight are less likely to use E and DS.

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**3032 Board #304 June 1 9:30 AM - 11:00 AM**

**Body Mass Change Patterns In A Metropolitan Police Department Weight Loss Competition**

Tyler K. Willett<sup>1</sup>, Robert W. Boyce, FACSM<sup>1</sup>, Allen R. Mullins<sup>1</sup>, Glenn R. Jones<sup>2</sup>, Edward L. Boone<sup>3</sup>. <sup>1</sup>UNC Wilmington, Wilmington, NC. <sup>2</sup>Work Physiology Associates Inc., Charlotte, NC. <sup>3</sup>Virginia Commonwealth University, Richmond, VA.

(No relationships reported)

Weight management is essential for police physical fitness programs. Documentation of weight loss patterns aid in the design of programs to encourage weight maintenance.

**PURPOSE:** To report the outcomes of a weight loss intervention and evaluate weight loss patterns in police officers over a 12 week weight loss competition with an emphasis on differences between genders and BMI categories.

**METHODS:** A police department held a 12 week weight loss competition. Teams were comprised of 5 members including civilians and sworn officers. The teams recording the most weight loss during the competition would win. For this analysis, only sworn officers were used. Comparisons between genders and among BMI categories were made related to the total amount of change and weight lost over each 2 weeks of the study. T-tests and an ANOVA with repeated measures were used.

**RESULTS:** 381 participants began the competition. 225 officers participated in all 7 weigh-ins. Mean body mass lost over 12 weeks was 5.26 kg with a starting body mass of  $101.01 \pm 20.8$  kg. Mean BMI decreased from  $32.3 \pm 5.6$  to  $30.6 \pm 5.2$ . There was a significant ( $p \leq 0.001$ ) total weight loss at each weigh-in. Females had a significantly ( $p \leq 0.001$ ) lower starting,  $81.9 \pm 15.8$  kg vs.  $105.9 \pm 19.0$  kg, and final,  $77.6 \pm 15.0$  kg vs.  $100.4 \pm 17.3$  kg, body mass than males. Females had a significantly ( $p \leq 0.001$ ) lower BMI at starting,  $29.6 \pm 6.0$  vs.  $32.9 \pm 5.3$ , and final,  $28.1 \pm 5.6$  vs.  $31.2 \pm 4.9$ , weigh-ins. Normal and overweight BMI categories had significantly ( $p \leq 0.05$ ) less body mass changes,  $1.4 \pm 2.0$  kg &  $3.8 \pm 2.9$  kg, from the 3 obese classes,  $6.1 \pm 4.1$  kg &  $6.2 \pm 4.8$  kg &  $9.4 \pm 7.9$  kg. The extreme obese category had significantly ( $p \leq 0.05$ ) greater changes than the 3 lowest BMI categories from start to final and from the first 2 weeks of the program. In weeks 2-4, only the extreme obese category lost significantly ( $p \leq 0.05$ ) greater body mass than the other categories. However, this relationship declined from weeks 4 to 12. No differences were found in the amount of change among any of the groups from weeks 6 to 12.

**CONCLUSION:** Weight loss competitions can be an effective tool to promote health and fitness programs for police. Males and females had similar weight loss patterns. Special programming may be necessary for the more obese after the initial start of the program. Physiological factors may influence this pattern.

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3033 Board #305 June 1 9:30 AM - 11:00 AM

**Using Self-efficacy to Predict Weight Loss in Overweight and Obese Individuals**

pouran D. Faghri, FACSM, Santana Galbo, Jessica Ehrentraut., Kamyar Momeni. *University of Connecticut, Storrs, CT.*

(No relationships reported)

Over the last two decades there have been significant increases in the rate of overweight and obesity in the US. Weight loss as low as 5% has been shown to reduce or eliminate disorders associated with obesity. Improving individual self-efficacy via increasing knowledge, skill and improving attitude has been shown to be a strong predictor of weight-control behavior.

**PURPOSE:** To implement a workplace weight loss program for overweight and obese employees that focused on improvement of weight loss self-efficacy (WLSE), exercise self-efficacy (ESE), and movement through the stages of change (SOC) while promoting healthy eating behaviors, and to compare its effectiveness between those who lost at least 5% of their weight and those who did not.

**Design:** Ninety-nine overweight and obese employees (BMI>25) from a healthcare organization participated in this 28-week workplace weight loss program. Mean body weight and BMI was 205+/- 4 (lb) and 34.82+/- 7, respectively. Average age was 46+/- 11 and 90 % were female. All participants received consultation with a dietitian/health educator emphasizing self-efficacy, knowledge, attitude and skill development on weight management, exercise and healthy eating practices. Weight, WLSE, ESE, HES, and movement through SOC were measured pre-post intervention and compared between those who lost at least 5% of their body weight and those who did not.

**RESULTS:** Overall, significant weight loss was observed pre-post intervention (p<0.05). Significant improvements in WLSE, ESE, SOC, and HES were observed in those who lost at least 5% of their body weight (p<0.05). Waist circumference, self-reported general health, and energy level were also improved among those who lost 5% of body weight (p<0.05).

**CONCLUSIONS:** This study incorporates constructs of behavioral theory of self-efficacy into a weight loss program. The two self-efficacy measures correlate significantly with weight loss. Results found direct relationship between losing weight and improvements in WLSE, ESE, eating habits and SOC. Using behavioral techniques to improve self-efficacy can be effective to promote weight loss in overweight and obese people and can produce better outcomes.

Supported by CDC Grant TS-1444

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3034 Board #306 June 1 9:30 AM - 11:00 AM

**Weight Management Goals and Practices at a Southeastern University**

Lauren E. Bigham, Bridget Melton, Jody Langdon, Rebecca Riggs. *Georgia Southern University, Statesboro, GA.*

(No relationships reported)

**PURPOSE:** With the high rates of obesity within the college setting, it is imperative to develop culturally appropriate lifestyle and weight management programs within the college environment. The purpose of this study was to explore gender and race in self-reported weight change/maintenance (WC/M) goals and practices of weight management at a medium sized southeastern university.

**METHODS:** Through a qualitative, cross-sectional descriptive research design, data was collected via an on-line survey from 2172 students.

**RESULTS:** Chi-square analysis revealed significant relationships between gender and WC/M goals as well as race and WC/M goals. Females were found to be more likely to want to lose weight (OR = 2.85; 95% CI = 2.40-3.41) while men were more likely to want to gain weight (OR = 5.04; 95% CI = 3.83-6.63). African Americans were more likely to want to gain weight (OR = 1.73; 95% CI = 1.33-2.25) while Latinos were more likely to want to lose weight (OR = 2.41; 95% CI = 1.40-4.17).

**RESULTS:** indicated that participants utilized the practices of dieting, exercise, diet pills, and vomiting/laxatives to lose weight or maintain body weight (39.4%, 67.7%, 7.0%, and 3.5%). Chi-square analysis demonstrated significant relationships (p < .05) between gender and dieting, exercise, and diet pills, with females being more likely to use each of these methods (OR = 2.06, 95% CI = 1.72-2.47; OR = 2.32, 95% CI = 1.93-2.79; OR = 1.48, 95% CI = 1.04-2.11).

Chi-square analysis revealed significant relationships (p < .05) between race (African American and White) and dieting, exercise, and vomiting/laxative use, with Whites being more likely to use dieting (OR = 1.68, 95% CI = 1.36-2.08), and exercise (OR = 1.46, 95% CI = 1.18-1.79). African Americans were more likely to use vomiting/laxatives (OR = 1.96, 95% CI = 1.18-3.24).

**CONCLUSION:** Significant relationships were found between both gender and race while assessing WC/M goals and weight management practices. Further research is warranted since culturally competent attitudes and behaviors cannot be effectively promoted until the possible relationship between current WC/M intentions and behavioral practices are further explored. Gaining a better understanding of gender/racial differences may aid educators in developing culturally competent curriculum and instruction.

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3035 Board #307 June 1 9:30 AM - 11:00 AM

**The Added Effect of Technology on a Behavioral Weight Loss Program in Severely Obese Individuals**

Jessica L. Unick<sup>1</sup>, Kevin O'Leary<sup>1</sup>, John M. Jakicic, FACSM<sup>2</sup>, Rena R. Wing<sup>1</sup>. <sup>1</sup>*The Miriam Hospital and Warren Alpert Medical School at Brown University, Providence, RI.* <sup>2</sup>*The University of Pittsburgh, Pittsburgh, PA.*

(No relationships reported)

Because of their BMI and low levels of physical activity (PA), severely obese individuals would benefit from weight loss (WL) programs that maximize changes in these domains.

**PURPOSE:** To collect pilot data to examine whether adding a novel technology component to a standard behavioral weight loss (SBWL+TECH) program improves WL and increases PA at 6 months compared to SBWL alone.

**METHODS:** 27 severely obese participants (42.1 ± 10.0 years; 45.1 ± 4.0 kg/m<sup>2</sup>) were randomized to SBWL (n= 13) or SBWL+TECH (n=14). Both groups were asked to attend weekly group meetings for 6 months, reduce caloric intake to 1500-1800 kcal/day, and gradually increase PA to 250 min/week. In addition, SBWL+TECH participants were provided with an armband which objectively measures energy expenditure, a digital display watch which provides real-time PA feedback, and access to a website to record food intake. Weight and PA were objectively assessed at baseline and 6 months.

**RESULTS:** Retention rates (SBWL: 92% vs. SBWL+TECH: 79%; p>0.05) and the number of group sessions attended (SBWL: 18.7 ± 4.6 vs. SBWL+TECH: 21.2 ± 3.0; p>0.05) were high in both groups. The percent change in body weight at 6 months did not differ by treatment arm in either completers analyses (SBWL: -7.8 ± 6.7% vs. SBWL+TECH: -10.0 ± 7.1%) or with baseline weight carried forward (SBWL: -7.2 ± 6.8% vs. SBWL+TECH: -7.9 ± 7.5%; p's=0.46-0.70). Changes in all PA variables at 6 months were not statistically different between groups (p>0.05). However, the increase in the number of steps per day over the 6 month period was more than double in SBWL+TECH compared to SBWL (SBWL+TECH: +2706 ± 2823 steps/day vs SBWL: +1383 ± 2030 steps/day). Similarly, SBWL+TECH increased time spent in moderate-to-vigorous intensity PA (MVPA) by 21.4 ± 31.6 min/day which was more than 3 times as great as that seen in SBWL (6.4 ± 18.8 min/day).

**CONCLUSIONS:** Methods for increasing PA in the severely obese are needed, given their lower than average PA. This study provides preliminary evidence to suggest that adding a technology component to a SBWL program, which aids in the self-regulation of PA behaviors, may assist with increasing PA in this population. Future research should examine whether the magnitude of PA change seen in this study would be similar with a larger sample size and whether PA improvements can be sustained long-term.

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## F-21 Free Communication/Poster - Body Composition I

JUNE 1, 2012 1:00 PM - 6:00 PM  
ROOM: Exhibit Hall

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3036 Board #1 June 1 2:00 PM - 3:30 PM

### Effects Of Acute Exercise On The Accuracy Of Air-displacement Plethysmography In Young Adults

Ronald Otterstetter<sup>1</sup>, Jessica Viar<sup>1</sup>, Jonathan Naylor<sup>1</sup>, Sandra Krone<sup>1</sup>, Kathryn Tessmer<sup>2</sup>. <sup>1</sup>The University of Akron, Akron, OH. <sup>2</sup>Youngstown State University, Youngstown, OH. (Sponsor: Gary H. Kamimori, FACSM)  
(No relationships reported)

**INTRODUCTION:** Air displacement plethysmography (ADP) body composition systems utilize an exact pre-test protocol that must be followed for each trial. This protocol includes no eating, drinking, or exercising at least 2 hours prior to testing. Previous research has shown that body temperature changes influence the results when using ADP as a measurement; however exercise was not the method used to increase body temperature.

**PURPOSE:** To determine the effect of post-exercise body temperature changes on body composition results using ADP.

**METHODS:** Forty two young adults (18-30 yrs) participated in the study (24 females, 18 males). Resting heart rate was measured to calculate exercise intensity. After exercise intensity was calculated, an ADP test done according to instructions outlined by the manufacturer. Upon completion of the ADP test, the subject exercised on a treadmill at moderate intensity (~65% Heart Rate Reserve) for 30 minutes to increase body temperature. Another ADP trial followed the physical activity. A chamber temperature (CT) was also measured during each of the trials using a thermistor to assess temperature changes. Fat mass (FM), Fat Free mass (FFM), percent body fat (%BF), and (CT) were compared pre and post-exercise.

**RESULTS:** Paired sample T-tests revealed significant differences ( $p < 0.05$ ) between pre-exercise %BF and post-exercise %BF ( $21.3 \pm 9.8\%$  vs  $19.6 \pm 10.2\%$ ), pre-exercise chamber temperature and post-exercise chamber temperature ( $72.9 \pm 2.1$  °F vs  $73.5 \pm 2.0$ °F), and pre-exercise FM vs post-exercise FM ( $32.9 \pm 17.3$  lbs vs  $30.5 \pm 17.7$  lbs). FFM showed no significant difference.

**DISCUSSION:** This investigation demonstrates the importance of following the manufacturer's recommended pre-test protocol as the accuracy of the ADP testing may be compromised, resulting in lower FM and %BF estimations.

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3037 Board #2 June 1 2:00 PM - 3:30 PM

### Comparison of Air-Displacement Plethysmography Results Using Predicted and Measured Lung Volumes Over Time

Rachele M. Kappler<sup>1</sup>, Megan Reinking<sup>1</sup>, Kathryn Tessmer<sup>2</sup>, Ronald Otterstetter<sup>1</sup>. <sup>1</sup>The University of Akron, Akron, OH. <sup>2</sup>Youngstown State University, Youngstown, OH. (Sponsor: Gary H. Kamimori, FACSM)  
(No relationships reported)

Rachele Kappler, Megan Reinking, Kathryn Tessmer, Ronald Otterstetter. Department of Sport Science & Wellness Education, The University of Akron, Akron Oh 44325-5103; Department of Human Performance and Exercise Science, Youngstown State University, Youngstown, OH 44555

**INTRODUCTION:** Air displacement plethysmography (ADP) body composition systems can use either measured or predicted lung volumes (LV) in their measurement. The difference in the accuracy of the predicted value and the repeatability of the measured value in each trial is an important factor in the accuracy of the test result. Tests that are done over a period of time can be significantly influenced by these measurements.

**PURPOSE:** To compare the variability and accuracy of ADP tests using predicted and measured LV over time.

**METHODS:** Twenty-four adults (18-30 yrs) participated in the study. Each subject underwent 3 ADP tests over a period of three weeks, with one week between tests. At each testing session, subjects were tested using a predicted LV protocol and a measured LV protocol. Testing order was randomized. LV and percent body fat (%BF) were compared between testing modes and between assessment times.

**RESULTS:** A two-way within-subjects ANOVA was conducted to examine the effect of the mode of lung volume assessment (measured or predicted) and time (day 1, 2, 3) on lung volume and the effect of the mode of body fat assessment (measured or predicted) and time on body fat. LV did not differ significantly ( $p > 0.05$ ) on the two modes of assessment (measured or predicted). Time also was not significant ( $p > 0.05$ ), therefore LV did not differ on the days it was assessed. Subjects responded in the same manner in both modes of assessment regardless of the time assessed. Mode is not significant ( $p > 0.05$ ), therefore % BF did not differ on the two modes of assessment. Time is also not significant ( $p > 0.05$ ), therefore %BF did not differ on the days it was assessed. Subjects responded in the same manner in both modes of assessment (measured and predicted) regardless of the time assessed.

**DISCUSSION:** This investigation demonstrates that the method used to determine LV during ADP testing does not significantly affect the final body composition result. Also, the results from tests performed over an extended period of time are not affected by LV measurement method.

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3038 Board #3 June 1 2:00 PM - 3:30 PM

### Accuracy of Air Displacement Plethysmography Body Composition Measure in Estimating Resting Metabolic Rate in Adults

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(No relationships reported)

**PURPOSE:** The purpose of this study was to determine the accuracy of an air displacement plethysmography (ADP) body composition measure in estimating resting metabolic rate (RMR). The specific aim was to quantifiably compare the estimated metabolic rate from air displacement plethysmography to the actual metabolic rate measured using indirect calorimetry via a standard metabolic cart.

**METHODS:** Fifty-eight apparently healthy (18-45 yrs) male ( $n=20$ ) and female ( $n=38$ ) subjects participated in the trial. All subjects were instructed to adhere to the following pretest instructions: 1) Fast 12 hours prior to the test 2) Avoid strenuous exercise 24 hours prior to the test 3) Wear tight fitting clothing (i.e. lycra or spandex material) and 4) refrain from nicotine and alcohol for 24 hours prior to testing. Each subject was required to lie down in a quiet room for a total of 30 minutes during the indirect calorimetry obtainment of resting metabolic rate (RMR) via the metabolic cart (MC) method. The first 15 minutes of the RMR data was discarded and the average  $\text{VO}_2$  of the following 15 minutes was used as the subjects RMR. Upon completion of the MC RMR, subjects moved directly to ADP testing following the manufacturers standardized protocol whereby an estimated RMR was obtained.

**RESULTS:** RMR measurements from the MC ( $1868.6 \pm 487.1$  kcals) and estimates from the ADP ( $1428.2 \pm 306.7$  kcals) were statistically significant ( $p \leq 0.05$ ).

**CONCLUSIONS:** Significant differences in RMR measurements were found between indirect calorimetry and the estimated value obtained from the ADP measure. This could cause confusion and be prohibitive in proper nutritional recommendations for people wanting to alter body composition.

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3039 Board #4 June 1 2:00 PM - 3:30 PM

**Ability of New Upright Bioimpedance Analyzer to Estimate Fat-Free Mass in Adults**

James J. McCormick, Jason R. Beam, Hung-Sheng Hsu, Michelle G. Kulovitz, Guillermo G. Martinez, Christine M. Mermier, Ann L. Gibson. *University of New Mexico, Albuquerque, NM.*

(No relationships reported)

A major goal of applied body composition assessment is the development of valid methods to accurately estimate fat-free mass (FFM).

**PURPOSE:** To evaluate the accuracy of a new upright analyzer (InBody 520) to estimate FFM in comparison to underwater weighing (UWW).

**METHODS:** Fifty men (29.3±13.4 yrs, 181.4±8.5 cm, 95.8±28.4 kg, 27.7±4.7 kg/m<sup>2</sup>) and fifty women (22.2±4.2 yrs, 165.8±4.7 cm, 68.0±11.9 kg, 24.6±3.7 kg/m<sup>2</sup>) volunteered to have FFM assessed using the InBody 520 and UWW. Standard pre-test guidelines for body composition assessment were followed and residual volume was measured using oxygen dilution. The constant error (CE), standard error of the estimate (SEE), and total error (TE) were determined to evaluate the accuracy of the InBody 520 when compared to UWW for men and women. Bland-Altman plots were compiled to further investigate methodologic bias between the reference and InBody 520 between men and women.

**RESULTS:** There was a significant difference (p<0.05) in FFM between UWW and the InBody 520 for men (UWW:75.52±18.17kg, InBody: 72.37±16.67kg) and women (UWW:46.16±5.76, InBody: 45.35±5.08kg). There was large individual variance in FFM between UWW and the InBody 520 for both men and women. The CE, SEE, and TE were lower in the women (0.81, 2.35, 2.30, respectively) than in the men (3.15, 4.88, 4.78, respectively). Bland-Altman plots indicated FFM was not estimated within 2SD for 6 men and 3 women.

**CONCLUSIONS:** The results of this study showed that when compared to UWW the InBody 520 underestimated FFM in both men and women. The InBody 520 was more accurate in estimating FFM in the women than in the men.

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3040 Board #5 June 1 2:00 PM - 3:30 PM

**Validity of Bioelectrical Impedance Analysis Instruments for the Measurement of Body Composition in Collegiate Gymnasts**

Jeremy T. Barnes<sup>1</sup>, Jason D. Wagganer<sup>1</sup>, Jeremy P. Loenneke<sup>2</sup>, Ronald D. Williams, Jr.<sup>3</sup>, Yugandhar Arja<sup>1</sup>, Graeme W. Kirby<sup>1</sup>, Thomas J. Pujol, FACSM<sup>1</sup>. <sup>1</sup>*Southeast Missouri State University, Cape Girardeau, MO.* <sup>2</sup>*Oklahoma University, Norman, OK.* <sup>3</sup>*Mississippi State University, Starkville, MS.*

(No relationships reported)

**PURPOSE:** The body composition of gymnasts is frequently assessed. Many different methods are used including underwater weighing, bioelectrical impedance analysis (BIA) and skinfolds (SKF). The purpose of this study was to determine the validity and of various BIA machines and SKF for estimating percent body fat (%fat) in female collegiate gymnasts.

**METHODS:** Body composition was assessed via Tanita BF-350, Tanita BF-522, Omron HBF-510W, Omron HBF-306C, SKF and estimates of %fat were compared to dual-energy X-ray absorptiometry (DXA), which served as the criterion estimate. Ten female Division I collegiate gymnasts were studied (age 19.1 (1.3) yrs, height 1.66 (0.06) m, weight 60.73 (6.44) kg, and BMI 21.98 (1.22) kg/m<sup>2</sup>).

**RESULTS:** The validity of the %fat estimates (BF-350, BF-522, HBF-510W, HBF-306C, and SKF) was based on the evaluation of each method versus the criterion value from the DXA by calculating the mean, SD, coefficient of determination (r<sup>2</sup>), and standard error of estimate (SEE) from linear regression analysis. To assess the average deviation of individual scores from the line of identity, total error (TE) was calculated for each field method. Paired t-tests determined pair-wise differences between measurements using a Bonferroni corrected alpha level of 0.01. The mean %fat results were as follows: the Tanita BF-350 = 21.67 ± 3.35, the Tanita BF-522 = 21.74 ± 3.51, the Omron HBF-510W = 26.14 (2.96), the Omron HBF-306C = 18.36 (2.07), SKF = 19.50 (3.16), and the DXA = 21.06 (3.39). Mean differences were observed with HBF-510W (p=0.002) and HBF-306C (p=0.001) when compared to DXA. The r<sup>2</sup> values ranged from 0.079 (BF-350) to 0.713 (HBF-306C); SEE values ranged from 1.92%fat (HBF-306C) to 3.44%fat (BF-350); and total error (TE) values ranged from 3.19%fat (SKF) to 5.62%fat (HBF-510W).

**CONCLUSIONS:** For female collegiate gymnasts, the Tanita BF-350, Tanita BF-522, and SKF provide the best estimates of %BF based on their acceptable TE values (<4%fat). These methods provide a valid assessment of body composition in non-laboratory settings. However, neither the Omron HBF-510W nor the Omron HBF-306C can be recommended for estimating %fat based on this preliminary analysis.

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3041 Board #6 June 1 2:00 PM - 3:30 PM

**A New BIA Equation Estimating the Body Composition of Young Non-Hispanic Black Women**

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(No relationships reported)

Obesity has dramatically increased in the past decade and is a major health concern. Several minority populations have reported greater incidence of overweight and obesity, including non-Hispanic black (NHB) women where a reported 78.0% aged 20-39 yrs are classified as overweight (OW; BMI > 25.0 < 29.9 kg/m<sup>2</sup>) or obese (OB; BMI > 30 kg/m<sup>2</sup>). To accurately assess the effectiveness of new strategies to prevent or combat obesity, valid, reliable, and sensitive methods of evaluating baseline and post-treatment measures of body composition are essential. One of the difficulties of conducting obesity research is identifying a safe, non-invasive, economical (cost and time), valid method of assessing body composition that can be used in the laboratory, clinic or field setting and is well-tolerated by subjects. Bioelectric impedance analysis (BIA) fulfills many of the requirements to be considered an optimal body composition method; however the lack of population specific equations with representative numbers of healthy weight (HW), OW and OB obese subjects can be problematic.

**PURPOSE:** To develop and cross-validate a new BIA body composition equation for young NHB women.

**METHODS:** Subjects included 89 (42 HW, 25 OW, 22 OB) young NHB women ages 18-30 yr. Using a single frequency (50 kHz) tetra-polar BIA unit and total body DXA scans as the criterion method, a BIA regression equation was developed and then cross-validated using the "leave-one-out" method.

**RESULTS:** The new equation was DXA FFM = -21.0 + 0.136(Wt) + 0.448(Ht) - 0.0296(Imp) where DXA FFM = DXA fat-free mass (kg); Wt = body weight (kg); Ht = standing height (cm); Imp = impedance (ohms). There was no significant mean difference between the DXA FFM (45.8±6.7 kg) and the new BIA equation FFM (45.9±6.2 kg). Using this equation 85.9% of the variance in DXA FFM was explained by the model. Cross-validation results demonstrated a small amount of statistical shrinkage by explaining 84.5% of the variance in DXA FFM. The 95% confidence interval for the predicted value of DXA FFM is  $y' \pm 5.054$  kg.

**CONCLUSION:** The new BIA equation will help to provide an accurate method to estimate the body composition of young NHB women in a variety of field, clinical and research settings. The use of this equation may help to identify effective intervention strategies to prevent or combat obesity in this population.

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3042 Board #7 June 1 2:00 PM - 3:30 PM

**Time Course Of Postural Fluid Shifts In A Sample Of Healthy Adults: Preliminary Data Findings**

Ann L. Gibson, Jason R. Beam, Michelle G. Kulovitz, Micah N. Zuhl, Christine M. Mermier. *UNM, Albuquerque, NM.*

(No relationships reported)

Standard body composition guidelines indicate participants should be supine for at least 10 minutes before assessment via bioelectrical impedance analysis (BIA). Little research has been found substantiating this guideline or addressing standing posture prior to assessment with new vertical BIA devices. Extracellular water (ECW) and intracellular water (ICW) from multifrequency BIA (MFBIA) are used to measure total body water (TBW) and estimate fat-free mass (FFM) and body cell mass.

**PURPOSE:** This study investigated the time required for ECW and ICW to stabilize in standing and supine positions.

**METHODS:** Forty-five healthy volunteers (36 ± 16 yrs, 169.6 ± 9.1 cm, 68.2 ± 10.2 kg) followed standard pretest guidelines for body composition assessment. ECW and ICW were measured via MFBIA (Xitron Hydra 4200) every 5 minutes for 30 minutes per position. The starting position was counterbalanced. A 2-min seated period preceded assumption of each posture. FFM was



calculated in accordance with the MFBIA analyzer manual ( $FFM = 1.106 * ECW = 1.521 * ICW$ ). A 2 (posture) x 6 (time) repeated measures ANOVA was conducted to investigate possible differences in postural fluid shifts over time. Significant main effects were further evaluated using paired samples t-tests.

**RESULTS:** There were significant within-group main effects over time for supine ECW, ICW, TBW, FFM, and standing ECW ( $p < .05$ ). There was no significant main effect for posture. Pairwise comparisons revealed significant differences between each 5-min increment (5 - 10, 10 - 15, 15 - 20, 20 - 25, 25 - 30 min) for supine ECW and ICW; supine FFM differed between 10 and 15 min ( $p < .01$ ). Standing ECW pairwise differences were found for the first three 5-min increments ( $p < .01$ ).

**CONCLUSIONS:** The results of this study indicate that waiting 5 min is sufficient for the stabilization of calculated TBW and FFM for both supine and standing positions. However, if MFBIA is used for measuring ECW and ICW, more time is needed for stabilization in the standing and supine positions.

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**3043** Board #8 June 1 2:00 PM - 3:30 PM

**Techniques for Undertaking DXA Whole Body Scans in Tall and/or Broad People**

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(No relationships reported)

**PURPOSE:** Dual energy x-ray absorptiometry (DXA) is becoming a popular tool to measure body composition in athletes, owing to its ease of operation and comprehensive analysis. However, many athletes are taller and/or broader than the active scanning area of the DXA bed. The aim of this study was to investigate the reliability of DXA measures of whole body composition summed from two or three partial scans.

**METHODS:** Physically active young adults (15 females, 15 males) underwent one whole body and 4 partial DXA scans in a single testing session under standardized conditions. The partial scanning areas were head, whole body from neck region down, right side and left side of the body. Body composition estimates from whole body were compared with the addition of partial scans simulating different techniques to accommodate tall, broad, or tall and broad subjects. Magnitude of changes in the mean of DXA estimates were assessed by standardization.

**RESULTS:** For tall, and tall and broad subjects, body composition estimates from summed partial scans that included the head scan were substantially different to body composition estimates from the whole body scan. Summing with the head scan over-estimated ~2 kg of lean and ~1 kg of fat mass. For broad subjects, the addition of right and left body scans produced no substantial difference in body composition estimates compared to whole body scan.

**CONCLUSIONS:** Strategies can be undertaken with DXA technology to accommodate subjects who are broader than the scanning bed, however, whole body composition estimates in tall, or tall and broad subjects include error. Further work is needed to develop other standardized protocols to estimate body composition in tall and very tall athletes.

This investigation was supported by funding from the Physique and Fuel Centre program of the Australian Institute of Sport (AIS) and RMIT University, and the AIS Sports Nutrition Discipline.

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**3044** Board #9 June 1 2:00 PM - 3:30 PM

**Differences in DXA Anthropometric Measurements between Female Collegiate Soccer Players and Gymnasts**

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(No relationships reported)

Engaging in weight-bearing activity has been shown to improve body composition and increase BMD. For sport specific athletes, changes in body composition and BMD are important indicators of adaptations to exercise training. Comparison of body composition across sports can be utilized as an indicator of potential health issues, such as the female athlete triad (i.e., low BMD, poor nutrition, and lack of regular menstrual cycle).

**PURPOSE:** To compare the differences in anthropometric measurements between female Division I collegiate soccer players and gymnasts utilizing Dual-Energy X-ray Absorptiometry (DXA).

**METHODS:** Eleven (20+1y) normal weight (BMI: 22.7±1.2 kg-m<sup>-2</sup>) female collegiate soccer players and eleven (20+1y) normal weight (BMI: 22.6±1.1 kg-m<sup>-2</sup>)

gymnasts were tested using DXA (GE Prodigy Series X Model 8743). Data points analyzed were weight (kg), height (m), bone mineral density (g/cm<sup>2</sup>), body fat percentage and fat free mass (kg). An independent samples t-test was used to test for statistical significance between groups. All analyses were performed using SPSS v19.0 statistical software package. Values are presented as (mean±SEM). Statistical significance was set at  $p < 0.05$

**RESULTS:** The soccer players were significantly taller than the gymnasts ( $p=0.04$ ). No statistical significance was noted for any other variable across the two groups. The mean values were as follows: BMD [1.27 vs. 1.27g-cm<sup>2</sup> ( $p=0.94$ )], Weight [62.4 vs. 59.5kg ( $p=0.33$ )], Height [1.68 vs. 1.63m ( $p=0.04$ )], body fat [26.7 vs. 23% ( $p=0.11$ )], and fat free mass [46.4 vs. 46.5kg ( $p=0.95$ )] (all data listed as soccer vs. gymnast).

**CONCLUSIONS:** Other than height differences, no other anthropometric measurements showed any significant difference when comparing female collegiate soccer players to female collegiate gymnasts. Past research has indicated the likelihood of gymnasts exhibiting low BMD and low body fat percentages; however the group of gymnasts utilized in this study exhibited healthy BMD and body compositions.

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**3045** Board #10 June 1 2:00 PM - 3:30 PM

**Comparison of Body Composition Measurement Techniques in College Wrestlers**

Jerry Mayhew<sup>1</sup>, Jana L. Arabas<sup>1</sup>, Timothy M. Schwegler<sup>1</sup>, Thomas Redman<sup>1</sup>, David Schutter<sup>1</sup>, Jody L. Clasey<sup>2</sup>. <sup>1</sup>Truman State University, Kirksville, MO. <sup>2</sup>University of Kentucky, Lexington, KY.

(No relationships reported)

Wrestling has a long history of weight-loss abuse which prompted the NCAA to enact regulations controlling the degree of weight loss based on skinfold measurements. The equation selected to predict %fat was the Lohman equation (1981) which was developed using hydrostatic weighing as the criterion. Few studies have evaluated various body composition measurement techniques against the new criterion measure of total body DXA scans for determining %fat.

**PURPOSE:** To compare selected methods of determining body fat in college wrestlers.

**METHODS:** NCAA Division II wrestlers ( $n = 23$ ;  $M \pm SD$ : age = 19.6 ± 0.8 y, weight = 78.2 ± 13.7 kg, BMI = 25.6 ± 3.8 kg/m<sup>2</sup>) were evaluated using 4 body composition techniques: DXA, hand-to-hand BIA, leg-to-leg BIA, and skinfolds. Both BIA techniques used an athletic setting and measured at a single frequency (50 kHz). Skinfolds (SKF) were measured at 9 sites and used to predict %fat using 4 athletic-specific prediction equations [Lohman (1981), Tipton-Oplinger (1984), and two Jackson-Pollock equations (1978)].

**RESULTS:** Repeated-measures ANOVA with Bonferroni *post hoc* testing revealed significant differences among the techniques. DXA %fat was significantly greater (17.1 ± 5.3%) than all other techniques. The Jackson-Pollock 7SKF equation %fat (9.4 ± 3.4%) was not significant different from the hand-to-hand BIA %fat (11.3 ± 4.9%). Hand-to-hand BIA %fat was not significantly different from the Lohman equation %fat (12.5 ± 3.8%). The Lohman equation %fat was not significantly different from the leg-to-leg BIA %fat (13.3 ± 5.8%). The Jackson-Pollock 3SKF equation %fat (8.4 ± 2.7%) and the Tipton-Oplinger equation %fat (7.7 ± 2.5%) were significantly lower than all other methods but not significantly different from each other. All techniques were highly correlated with DXA %fat ( $r = 0.93$  to  $0.95$ ), except for leg-to-leg BIA %fat ( $r = 0.57$ ) and hand-to-hand BIA %fat ( $r = 0.61$ ). Minimum wrestling weight calculated using the Lohman equation (71.6 ± 10.1 kg) would have been 5.8% greater than when calculated from DXA (67.7 ± 9.2 kg).

**CONCLUSIONS:** Measurement of %fat in college wrestlers from DXA would yield %fat values that were 3.8% to 9.4% higher than with other prediction techniques. This would result in an average of 4.8% greater body weight loss allowance than when using the Lohman equation.

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3046 Board #11 June 1 2:00 PM - 3:30 PM

**Relation of Common Field Measures of Body Composition and DXA in Older Adults**

Sarah H. Sellhorst, Keli L. Thomas, William F. Riner, Jr., FACSM. *University of South Carolina Lancaster, Lancaster, SC.*  
(No relationships reported)

Body Mass Index (BMI) is a measure of the relationship between height and weight and correlates with body fat percentage in the young and middle age adults. However, older adults experience changes in body composition that alter the relationship between BMI and body fat percentage. Excess body fat and obesity are often associated with a myriad of health problems that lead to considerable morbidity, impaired quality of life, and premature death.

**PURPOSE:** To determine a suitable, non-invasive, inexpensive method of determining body composition in older adults.

**METHODS:** Thirty-seven older adults were recruited from senior centers and senior focused programs (15M/22F, 65.98 ± 7.24 yr, 167.30±7.55cm, 76.04 ± 15.57 kg). Total body fat % (BF%) was measured by dual-energy x-ray absorptiometry (Lunar IDX). The standard Body Mass Index (BMI) calculation was used, as well as the Deurenberg et. al.(1991) equation for BF%. One paired T-test was performed (DXA BF% vs. Deurenberg BF%). Correlational analysis was performed on all variables.

**RESULTS:** No significant differences ( $\alpha = .05$ ) were found between DXA BF% and Deurenberg BF%. Correlational results are listed below:

|         | Deurenberg BF% | BMI    | W/H Ratio |
|---------|----------------|--------|-----------|
| DXA BF% | r=.801*        | r=.395 | r=.129    |

\*significant at  $p<.01$

**CONCLUSIONS:** BF% calculated by the Deurenberg et. al.(1991) equation seems to be a better field measure of body composition than BMI or W/H ratio in community dwelling older adults.

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3047 Board #12 June 1 2:00 PM - 3:30 PM

**Correlations of Body Composition Estimates Derived from Four Devices in Female Collegiate Athletes**

Morgan Tapper, M. Dot Fullwood, Lucinda Salvaggio, Annie Peck, Alicia Olsen, Buddy Macuha. *San Francisco State University, San Francisco, CA.* (Sponsor: Marialice Kern, FACSM)  
(No relationships reported)

The accurate determination of body fat in female athletes is a valuable tool used by coaches and trainers to help athletes maximize performance. Historically, hydrostatic or underwater weighing (UWW) has been used as the "gold standard" for estimating body composition, but is costly and time consuming. Using UWW as our criterion score, percent Body Fat (%BF) was derived using 3 easy and affordable assessment tools: an ImpSFB7 bioimpedance spectroscopy (BIS) device, the Bod Pod (BP), and 7-site skinfold (SKF).

**PURPOSE:** To determine which of these 3 techniques were comparable to UWW values.

**METHODS:** Fourteen female collegiate basketball players were recruited (19.2 ± 0.2 yrs; 169.7 ± 2.2 cm; 67.1 ± 3.1 kg). All subjects were asked to follow pretest guidelines and all measurements were completed in one visit. Body composition was assessed by four methods. BIS, SKF, BP and UWW. All BIS measurements were conducted with the subject lying in a supine position, with arms at their sides. SKF estimated body density by Jackson et al. (1980) equations for white and black females. Residual lung volume was estimated for UWW. Body density was converted to body fat using Siri's equation (1956)(Caucasian) and Schutte's equation (Afro-American, 1984). For the Bod Pod, thoracic lung volume was directly measured or, in 3 cases estimated when the subjects had excessive difficulty with the protocol. The data were analyzed by simple correlations using SPSS version 20.

**RESULTS:** The BIS and BP correlated with UWW with r-values of 0.872 ( $p<0.01$ ) and 0.699 ( $p<0.05$ ), respectively. No relationship was found between SKF and UWW. Stepwise regression found BIS to predict the criterion score ( $R=0.826$ ,  $p<0.002$ ), while BIA and BP together significantly predicted the criterion score ( $R=0.904$ ,  $p<0.001$ ).

**CONCLUSION:** BIS and BP were accurate in estimating %BF in female collegiate basketball players and can be used with confidence since they are less prone to operator error and take less time.

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3048 Board #13 June 1 2:00 PM - 3:30 PM

**Reliability And Validity Of The Hpi Caliper And Body Composition Formula**

Kimberly Trocio, Christopher Chavez, Jon Garcia, Lawrence A. Golding, FACSM, Judy Goldman, Paul Hafen, Audra Hannston, Stephen Harris, Michael Jarrett, Hanaa Shaheen, Greg Stalker, Antonio S. Santo. *University of Nevada, Las Vegas, Las Vegas, NV.*  
(K. Trocio: Contracted Research - Including Principle Investigator; Health Profile Institute.)

**BACKGROUND:** The Health Profile Institute (HPI) Osteo Caliper has been extensively used throughout Sweden for the past 30 years to assess body composition. Skeletal breadth measurements of the right and left wrists, knees, and ankles using the caliper, waist and hip circumference measurements, age, gender, height, weight, and exercise routine are used in a regression equation that estimates percent body fat. The advantages of the HPI caliper include its ease of use, quick obtainment of measurements, portability, and low-cost.

**PURPOSE:** The purpose of this study was to evaluate the reliability and validity of the HPI Osteo Caliper and formula as a method for estimating body composition.

**METHODS:** 64 subjects (28 females & 36 males) with a mean age, height, and weight of 33.7 ± 14.5 y, 169.3 ± 11.5 cm, and 70.6 ± 16.9 kg, respectively, completed well recognized measures of body composition during a single laboratory visit. PASW Statistics 18 software was used to analyze the data using Pearson's methodology.

**RESULTS:** Mean percent fat was 21.4 ± 9.4, 21.6 ± 8.9, 17.2 ± 7.8, and 21.4 ± 8.8 for hydrostatic weighing, Bod Pod, BIA, and the HPI Caliper formula, respectively. Statistical analysis revealed significant correlations between the percent fat determined from the Bod Pod, BIA, and the HPI formula when compared with hydrostatic weighing (.96, .83, & .93, respectively). Moreover, the percent fat determined from the HPI formula showed significant correlations with the Bod Pod, BIA, and hydrostatic weighing (.91, .83, & .93, respectively).

**CONCLUSION:** The HPI Osteo Caliper generates results comparable with other well established body composition techniques and therefore, may be a useful, alternative tool for healthcare and fitness professionals to estimate body composition in apparently healthy adults.

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3049 Board #14 June 1 2:00 PM - 3:30 PM

**Validation Of The Bodymetrix Ultrasound System For Percent Body Fat**

Jean P. Boucher, FACSM<sup>1</sup>, Gabriel Chamberland<sup>1</sup>, Mylene Aubertin-Leheudre<sup>1</sup>, David H. Jones<sup>2</sup>, Ron Rehel<sup>2</sup>, Alain S. Comtois<sup>1</sup>. <sup>1</sup>UQAM, Montreal, QC, Canada. <sup>2</sup>Concordia University, Montreal, QC, Canada.  
(No relationships reported)

The Body Metrix (BM) system (IntelaMetrix, CA) is an affordable computer based ultrasound system that provides rapid body composition assessment. We present preliminary data comparing percent body fat (%BF) as measured using the BM system and a DEXA as a reference measurement.

**PURPOSE:** To establish the validity of the BM computer based ultrasound system for the quantification of %BF.

**METHODS:** %BF was calculated on 10 university aged participants (5 females, 5 males) using the BM system with the Jackson and Pollock 7 sites equation (1978). A DEXA was also used as a reference to measure %BF on the same subjects. The Bland and Altman (1986) statistical procedure was used to determine the validity of the BM %BF.

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**RESULTS:** The level of agreement between both devices was equal to -0.6% BF. As well, no significant correlation was found between the score difference from both devices and the score average of both devices ( $r = -0.17, p=0.641$ ). The regression analysis between the BM system and the DEXA showed a significant correlation ( $r=0.71, p=0.023$ ) with a SEE of  $\pm 3.93$  %BF.

**CONCLUSIONS:** Both devices can be used interchangeably within the range of 10 to 30% BF. The data obtained on a limited number of subjects ( $n=10$ ) show good agreement and the BM system underestimates by 0.6% on average when compared to the DEXA.

**3050** Board #15 June 1 2:00 PM - 3:30 PM

**Validity Of Futrex-6100 X/L For Estimating Body Composition In Elite Male Rowers.**

Kristina L. Kendall<sup>1</sup>, David H. Fukuda<sup>1</sup>, Abbie E. Smith<sup>2</sup>, Robert P. Hetrick<sup>1</sup>, Joel T. Cramer, FACSM<sup>3</sup>, Jeffrey R. Stout<sup>1</sup>. <sup>1</sup>University of Oklahoma, Norman, OK. <sup>2</sup>University of North Carolina-Chapel Hill, Chapel Hill, NC. <sup>3</sup>Oklahoma State University, Stillwater, OK.  
(No relationships reported)

For athletes competing in weight categories, accurate measurements of body composition are important to optimize performance, and to evaluate the effectiveness of training and nutritional regimes on fat and fat-free mass during periods of weight reduction.

**PURPOSE:** The purpose of this study was to examine the validity of near-infrared interactance (NIR) estimates of percent body fat (% fat) and fat-free mass (FFM) using the Futrex 6100 X/L in elite male rowers.

**METHODS:** Twenty Olympic-caliber male oarsmen (mean age  $\pm$  SD= 24.6 $\pm$ 2 years) volunteered to serve as subjects. Body composition measurements were obtained from NIR and hydrostatic weighing (HW). The statistical analyses included constant error (CE), standard error of estimate (SEE), correlation coefficients ( $r$ ), and total error (TE).

**RESULTS:** NIR estimates of % fat were not significantly correlated to those values from HW ( $r=.023, p=0.924$ ) with a SEE of 3.2%. The Futrex 6100 X/L produced a non-significant CE (-0.54,  $p=0.604$ ); however, the TE value exceeded Lohman's recommendation of <4.0% (TE=4.5%). NIR estimates of FFM were significantly correlated to those values from HW ( $r=0.962, p<0.001$ ), with a SEE of 2.2 kilograms (kg). CE was non-significant (CE=-0.83,  $p=0.354$ ) and total error was "fairly good" according to Lohman (TE=3.9kgs).

**CONCLUSION:** The findings from the present study indicated that the Futrex-6100 X/L resulted in TE values that were too large to be of practical value for % fat, but acceptable for FFM estimates. Research suggests that FFM is a significant predictor of rowing success, therefore, the Futrex 6100 X/L may provide a quick and portable alternative to HW for estimating FFM in elite male rowers.

**3051** Board #16 June 1 2:00 PM - 3:30 PM

**Yearly Changes in the Body Composition and Body Build of Young Female Swimmers**

Robert W. Lewis Jr, Daniel A. Traylor, Haley C. Bergstrom, Terry J. Housh, FACSM, Glen O. Johnson, FACSM, Richard J. Schmidt, Dona J. Housh, FACSM. University of Nebraska, Lincoln, Lincoln, NE.  
(No relationships reported)

| Variable                    | Mean $\pm$ SD    | r vs. age | Yearly change rate |
|-----------------------------|------------------|-----------|--------------------|
| % fat (%)                   | 14.1 $\pm$ 6.1   | 0.44      | 1.0                |
| FFW (kg)                    | 36.9 $\pm$ 10.0  | 0.82      | 3.2                |
| BW (kg)                     | 43.5 $\pm$ 13.6  | 0.82      | 4.4                |
| HT (cm)                     | 149.3 $\pm$ 14.0 | 0.85      | 4.7                |
| FFW/HT (kg/cm)              | 0.2 $\pm$ .05    | 0.78      | 0.01               |
| biacromial/bi-iliac (cm/cm) | 1.2 $\pm$ 0.1    | -0.21     | -0.01              |
| Sum 4 SF (mm)               | 59.0 $\pm$ 20.0  | 0.55      | 4.3                |
| Sum 4 Dia (cm)              | 24.7 $\pm$ 17.0  | 0.65      | 0.5                |
| Sum 4 Circ (cm)             | 121.1 $\pm$ 17.0 | 0.77      | 5.1                |

Few studies have examined age-related changes in the body composition and body build of young swimmers.

**PURPOSE:** The purpose of this study was to determine the yearly rate of changes in the body composition and body build characteristics of young female swimmers.

**METHODS:** Seventy-one female swimmers (age  $\pm$  SD: 11.7  $\pm$  2.6 yr; range: 7.1-16.9 yr) served as subjects. Body composition characteristics (% fat and fat-free weight (FFW)) were determined from underwater weighing using the age-specific conversion constants of Lohman. Skinfolds (SF: triceps, scapular, suprailiac, and thigh), diameters (Diam: biacromial, bi-iliac, elbow, wrist, knee, and ankle), and circumferences (Circ: biceps extended, forearm, thigh, and calf) were measured using Lange calipers, a broad blade anthropometer, and Lufkin tape with Gullick handle, respectively. Height (HT) and body weight (BW) were determined using a wall scale with Broca plane and a physician's scale, respectively. Simple linear regression was used to examine the relationships for age versus each body composition and body build variable. The table below includes the mean ( $\pm$  SD) values for each dependent variable, the correlations ( $r$ ) with age, and the yearly change rates (slope coefficients of the linear regression models).

**RESULTS:** There were significant positive relationships for age versus all dependent variables except biacromial/bi-iliac diameters.

**CONCLUSION:** These data indicated that the yearly changes in body composition and body build characteristics in young female swimmers were consistent with those of female athletes in other sports. The age-related changes in these parameters may contribute to the improvements in performance that occur across age in swimmers.

$r=0.23, p < 0.05$

**3052** Board #17 June 1 2:00 PM - 3:30 PM

**The Relationship between Body Composition and Performance on the Army Physical Fitness Test**

Ali Lierman, David Q. Thomas, Jeff Schusler. Illinois State University, Normal, IL.  
(No relationships reported)

It is not known which parameters of body composition are the strongest predictors of physical fitness, nor is it clear whether body fat and physical fitness are related to each other, or whether they are independent risk factors. Attempts have been made to determine if body composition can be a predictor of physical performance in different populations, however the results vary.

**PURPOSE:** To determine if there is a relationship between clinical body composition assessments and performance on the Army Physical Fitness Test (APFT).

**METHODS:** Forty-one cadets (males:  $n=32$ , age: 20.5  $\pm$  1.8 years, ht: 178.9  $\pm$  6.41cm, mass: 79.1  $\pm$  7.8 kg; females:  $n=9$ , age: 20.6  $\pm$  1.5 years, ht: 163.7  $\pm$  5.2 cm, mass: 63.4  $\pm$  8.4 kg) participated in the study. Body composition assessments included height, weight, waist and hip circumferences, skinfolds and air displacement plethysmography via the Bod Pod. Skinfold sites were separated into axial (abdominal, suprailiac crest, subscapular, and mid-axillary) and appendicular (appendicular skinfolds: triceps, biceps, anterior thigh and medial calf) skinfolds. Scores from the APFT included maximum number of sit-ups performed correctly in 2 minutes, maximum number of push-ups performed correctly in 2 minutes and time to complete a 2 mile run were obtained with the cadet's consent from the Department of Military Science database.

**RESULTS:** There were no significant correlations ( $p > 0.05$ ) for males between the APFT scores and any of the body composition measurements. For the female subjects, only one significant correlation was found between sit-up score and lean mass,  $r= 0.72$  ( $p < 0.05$ ). Correlation coefficients between body composition assessments and total APFT scores ranged from  $r= -0.03$  to 0.03 for males and -0.38 to -0.08 for females.

**CONCLUSION:** The present study indicated that in a sample of ROTC cadets, who fall within the acceptable ranges for Army body composition standards, no significant correlations were found for body composition and APFT scores in the male subjects and only one significant correlation was found for females (lean mass and sit-up score). It may be assumed from this study that if cadets fall within Army body composition standards, body composition does not factor into their performance on the APFT.

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**3053** Board #18 June 1 2:00 PM - 3:30 PM

**Fat Mass: Accumulation And Distribution In Athletes And Military Personnel**

Martin E. Wennblom, William F. Brechue, FACSM. *United States Military Academy, West Point, NY.*

(No relationships reported)

Fat mass (FM) accumulation is associated with physical activity level.

**PURPOSE:** Compare FM accumulation in two populations of highly trained individuals with different performance goals.

**METHODS:** Male athletes (n=411; age: 21.2±3.3 yrs; NCAA, international, or Olympic level competitors) and United States Military Academy cadets (n=100; 20.5±1.4 yrs) were measured for body composition. BMI, W/H ratio and shape (modeled to a cylinder) were calculated.

**RESULTS:** Height, %fat, W/H, and shape were similar, while athletes had significantly greater body mass (M), FM, FFM, and BMI. FM and FFM were significantly related in athletes ( $y=0.68^{0.0384x}$ ;  $R^2=0.58$ ), but not cadets ( $y=0.12x+3.1$ ;  $R^2=0.04$ ). M is predictive of %fat in athletes ( $y=0.2785x-9.9802$ ;  $R^2=0.70$ ) not cadets ( $y=0.1833x+0.0655$ ;  $R^2=0.13$ ). Cadets (n=97) and athletes (n=333) were similar in height, %fat, FM, W/H, and shape; however, athletes had a greater M (~13 kg) and FFM (~10 kg) when controlling %fat range (6-26%). %fat, FM, FFM, BMI, W/H, and shape were similar in cadets, wrestlers and boxers; each have M restrictions and when compared to the remaining athlete population (height and weight matched), the restricted M group had greater FM (~1.5 kg) and lesser FFM (~1.8 kg) while BMI, W/H, and shape were similar.

**CONCLUSIONS:** In the same M range, cadets have a greater range of %fat. Athletes carry a greater percentage of FFM at a given FM and shape. Weight class restrictions appear to favor a slightly greater fat and lesser FFM accumulation without altering shape.

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**3054** Board #19 June 1 2:00 PM - 3:30 PM

**Anthropometry Profiles of Elite Rugby Union Players During a Competitive Season**

Michael Naylor<sup>1</sup>, Joseph B. Taylor<sup>2</sup>. <sup>1</sup>English Institute of Sport, London, United Kingdom. <sup>2</sup>English Institute of Sport, Manchester, United Kingdom.

(No relationships reported)

**PURPOSE:** To examine anthropometric measures in professional Rugby Union players during a competitive season and the changes between two preseasons.

**METHODS:** Body weight and the sum of eight skinfolds were evaluated on five occasions between two successive preseasons for positional groups of backs (fullback, wing, centre, fly half and scrum half playing positions, n = 13), front row forwards (prop and hooker playing positions, n = 9), second row forwards (n = 5) and back row forwards (n = 5). Analyses comprised two-way repeated-measures ANOVA, one-way ANOVA and paired-sample t-tests with repeated contrasts and bonferroni *post-hocs*. Statistical significance was set at  $p<0.05$  and data are reported as means with 95% confidence intervals (m, CIs).

**RESULTS:** Weight differed between playing positions ( $F(3, 28) = 37.883, p<0.01$ ) but did not vary across the season. Backs (m = 90.53 kg, CIs = 87.03 to 93.98) were lighter than all other positions (all  $p<0.01$ ) while Back Row (m = 106.49 kg, CIs = 101.17 to 112.31), Second Row (m = 115.75 kg, CIs = 110.18 to 121.31) and Front Row (m = 115.10 kg, CIs = 110.95 to 119.25) were similar ( $p>0.05$ ). The sum of eight of skinfolds differed as a function of season stage and playing position ( $F(12, 112) = 6.575, p<0.01$ ). Sum of eight skinfolds for front row players were greater than those of all other positions at each stage of the season (all  $p<0.05$ ) while all other positions were similar (all  $p>0.05$ ). The general trend within each playing position was a decrease in skinfolds from pre-season one through to the end of season one and a subsequent increase at pre-season two. However, the sum of eight skinfolds at pre-season two did not exceed those at pre-season one. Specifically, the sum of eight skinfolds decreased between pre-season one and two in backs ( $t(12)=5.704, p<0.01, m = 9.67$  mm, CIs = 5.98 to 13.36) and the front row ( $t(8)=7.837, p<0.01, m = 32.55$  mm, CIs = 22.98 to 42.14). There were non-significant decreases in the skinfolds between pre-seasons for second row ( $t(4)=1.821, p=1.43, m = 9.66$  mm, CIs = -5.07 to 24.39) and back row players ( $t(4)=2.763, p>0.05, m = 18.18$  mm, CIs = -0.89 to 36.45).

**CONCLUSIONS:** The results show the case rugby team reduced skinfolds during the season whilst maintaining body mass. The sum of eight skinfolds were also lower at pre-season two compared to pre-season one in all playing positions.

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**3055** Board #20 June 1 2:00 PM - 3:30 PM

**Handgrip Strength Enhances the Utility of Traditional Body Composition Parameters with Predicting Percent Body Fat**

James K. Taylor<sup>1</sup>, Michael R. Esco<sup>1</sup>, Henry N. Williford, FACSM<sup>1</sup>, Aindrea N. McHugh<sup>1</sup>, Barbara E. Bloomquist<sup>1</sup>, A. Jack Mahurin<sup>2</sup>. <sup>1</sup>Auburn University Montgomery, Montgomery, AL. <sup>2</sup>Montgomery Family Medicine Residency Program, Montgomery, AL.

(No relationships reported)

Body mass index (BMI) and waist circumference (WC) are two body composition parameters with important health and fitness implications. However, these markers do not distinguish between body fat mass (FM) and fat-free mass and are not accurate predictors of total body fat percentage (BF%) when used alone. Dual-hand-grip strength (HGS) is a crude indicator of total body strength and has been shown to vary through a wide range of body masses. It is not fully known if HGS can be used with BMI and WC in a model to predict BF%.

**PURPOSE:** This research study was designed to determine if BF% could be predicted with BMI, WC, and HGS in a general population of men and women.

**METHODS:** Sixty-four apparently healthy adults (37 men and 27 women) served as the subjects for test validation. Criterion BF% was determined via dual energy x-ray absorptiometry. The relationship between the independent variables (BMI, WC, HGS, and sex) and criterion BF% was determined via stepwise regression. An additional cohort of 23 subjects (16 men and 7 women) was used to cross-validate the regression model. Validity was confirmed by correlation, standard error of the estimate (SEE), and the method of Bland-Altman.

**RESULTS:** The regression analysis showed that BMI, WC, HGS, and sex were independently associated with FM. The regression equation was as follows: predicted FM (kg) = (2.095 x BMI) - (HGS x 0.077) + (WC x 0.552) + (sex x 4.730) - 50.139 ( $r = 0.96, R^2 = 0.92, p < 0.001$ ). Predicted BF% = (predicted FM / total body mass [kg]) x 100. When cross-validated, there was no significant difference between Criterion BF% (34.6% +/- 10.2%) and Predicted BF% (35.4% +/- 9.6%) ( $p = 0.34$ ). Cross-validation revealed the following statistics:  $r = 0.94, p < 0.001, SEE = 3.7\%$ . The Bland-Altman statistics indicated that the CE/Bias (predicted - criterion BF%) = 0.8% and the limits of agreement (95% confidence intervals) were -6.2% to 7.9%.

**CONCLUSIONS:** This study showed that BMI, WC, HGS, and sex could potentially be used to in a regression model to predict BF%. However, it should be noted that this was a pilot study that included fairly low sample sizes for the validation and cross-validation cohorts. Therefore, further research is needed to confirm the present results.

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**3056** Board #21 June 1 2:00 PM - 3:30 PM

**Differences in Ratings of Perceived Exertion Between Weight Classifications.**

Janelle C. r. Sester, Amanda J. Salacinski, Marilyn Looney, Matthew Stults-Kolehmainen. *Northern Illinois University, Dekalb, IL.* (Sponsor: John B. Bartholomew, FACSM)

(No relationships reported)

**PURPOSE:** The purpose of this study was to investigate OMNI ratings of perceived exertion (OMNI-RPE) among normal weight and obese individuals at each stage of the modified Balke treadmill test. A secondary purpose was to determine differences between groups for OMNI-muscle hurt, RER, heart rate (HR) and oxygen consumption ( $VO_2$ ).

**METHODS:** Participants of normal weight (BMI<25 kg/m<sup>2</sup>; n=17) and obese status (BMI<30 kg/m<sup>2</sup>; n=12) completed two days of testing. A 6-minute walk test was completed two days before the modified Balke to evaluate subject safety. A 2 x 3 mixed model ANOVA (group x stage) was used to compare all variable means for the normal weight vs. the obese group. When it was appropriate post hoc dependent t-tests were calculated when needed.

**RESULTS:** No interactions were found between group and stage for any variables with the exception of muscle hurt ( $p < .004$ ). The obese group reported higher OMNI-RPE ( $p = 0.002$ , power=0.90), higher HR ( $p = 0.003$ , power=0.88) and significantly lower  $\dot{V}O_2$  ( $p = 0.027$ , power=0.62) than the normal weight group for all stages of the Modified Balke. These data suggest that obese women perceive exercise as harder than normal weight women during an incremental treadmill test.

**CONCLUSIONS:** OMNI-RPE, HR, and  $\dot{V}O_2$  data suggest that obese women have differing physiological and perceptual responses than normal weight women at the same exercise intensity, which suggests the need for modified exercise recommendations for obese women. Further research is needed to determine if these differences may explain reduced exercise participation for obese women.

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**3057** Board #22 June 1 2:00 PM - 3:30 PM

**Lower Limb Body Composition Is Associated To Passive Knee Flexibility And Acute Mechanical Adaptations**

Tiago Neto, Sandro R. Freitas, João R. Vaz, Ana Isabel Carita, Maria João Valamatos, Pedro Mil-Homens. *Faculdade de Motricidade Humana, Oeiras, Portugal.*  
(No relationships reported)

**PURPOSE:** People vary in flexibility in terms of range of motion, resistance to stretch and acute mechanical adaptations during stretching. Several researchers have mentioned body composition (BC) as a main factor for flexibility differences. However, there is still controversies and unknown for the relation between flexibility and BC. The present study's goal was to determine how BC and anthropometric measures of lower limb associates to passive knee extension (PKE) flexibility.

**METHODS:** Twenty-five male persons ( $21.8 \pm 2.9$  years,  $73.9 \pm 8.9$  kg,  $1.75 \pm 0.1$  m) with PKE flexibility deficit were subject to an anthropometric and BC assessment (Dual-Energy X-ray Absorptiometer, DXA) and a maximal PKE protocol of 5 repetitions (velocity of 2°/s; 90 seconds in static phase; and 15 seconds rest interval) without feeling discomfort or pain. Knee passive torque - range of motion (PT-ROM), *vastus medialis* and *semitendinosus* electromyographic activity (EMG) were recorded during the protocols. All the measurements were done on the same day. Viscoelastic stress relaxation (VSR), amplitude (N-m), knee passive stiffness (KPS, in N-m<sup>0</sup>), and lower limb regional components of BC were determined. Specific MatLab<sup>®</sup> routines were used for data analysis. A critical level  $p = 0.05$  was considered for statistical analysis.

**RESULTS:** Thigh muscle and bone mass, as well as thigh perimeter, showed a moderated correlation with PT ( $r = 0.45$ ;  $r = 0.6$ ;  $r = 0.59$ , respectively), ROM ( $r = 0.46$ ;  $r = 0.5$ ;  $r = 0.5$ ), and VSR ( $r = 0.46$ ;  $r = 0.49$ ;  $r = 0.5$ ). Thigh muscle mass was also correlated with KPS ( $r = 0.42$ ). Subjects ( $n = 10$ ) with larger thigh perimeter, superior thigh muscle mass, and higher thigh bone mass showed, respectively, more 41% PT, 39% VSR, and 11% ROM, when compared to the thinnest subjects. All these differences and correlations were significant ( $p < 0.05$ ). Muscular EMG was lower than 3% of maximal voluntary contraction in all tests.

**CONCLUSIONS:** Passive knee flexibility seems to be moderately related with lower limb body composition. In particular, thigh perimeter and muscle mass are associated with passive stiffness and viscoelastic stress relaxation. More research is needed to understand what influences range of motion, resistance to stretch and acute mechanical adaptations to stretching.

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**3058** Board #23 June 1 2:00 PM - 3:30 PM

**Weight-Related Concerns & Characteristics of a Female Substance Abuse Population**

Anne R. Lindsay<sup>1</sup>, Sara Velasquez<sup>1</sup>, Cortney Warren<sup>2</sup>, Minggen Lu<sup>3</sup>. <sup>1</sup>University of Nevada Reno, Las Vegas, NV. <sup>2</sup>University of Nevada Las Vegas, Las Vegas, NV. <sup>3</sup>University of Nevada Reno, Reno, NV. (Sponsor: Melinda Manore, FACSM)  
(No relationships reported)

Research demonstrates that more women use illicit stimulant-type drugs than men due to its appealing side effects including loss of appetite, substantial weight loss and elevation of self-esteem. During substance abuse recovery, however, women often report rapid weight gain and body dissatisfaction expressing weight concerns as a trigger for relapse. Dietary restriction, energy & dietary supplements, tobacco and anorexic & bulimic practices often become the "self treatment-of-choice".

**PURPOSE:** To determine WT-related concerns of women in substance abuse treatment.

**METHODS:** 340 female participants were recruited from nine substance abuse treatment facilities in southern Nevada (outpatient and residential court-ordered, self-referral). Participants' average age was 33.75 years ( $SD = 10.75$ ). Average length of time in recovery was 12.5 months ( $SD = 39.4$ ).

Participants completed questionnaires to assess drug history and WT concerns prior to completing a health and body image program. Body Measurements (WT, height, and 4-site skinfold measurements - abdomen, ilium, tricep and thigh) were also conducted pre-intervention.

**RESULTS:** Stimulants were the most common drug of choice (61.3% of sample) followed by alcohol (17.6%), opiates (11.6%) and all others (9.5%). Average body fat was 30.48%, ( $SD = 7.37$ ); average BMI was 28.26, ( $SD = 6.31$ ). Drugs were used as a method for WT loss often, usually or always for 34.3% of the sample. Other methods used for WT loss included exercise (49.7%), caloric restriction (41.4%), diet pills (37.9%), starvation (25.5%) and energy supplements (22.4%).

The majority (70.5%) was concerned about WT gain in recovery; 43.0% had concern that gaining WT could trigger drug relapse and 28.0% had concern about using drugs to lose WT after leaving treatment. Participants' actual measured WT was significantly higher than the WT at which they felt most comfortable  $p < 0.001$ .

**CONCLUSIONS:** Females in substance abuse treatment were overly concerned about their weight and weight gain. Validating these weight concerns is critical to successful recovery. Interventions that educate and address concerns associated with weight are warranted in this population. Programs that address body image and healthy lifestyles may decrease relapse and treatment dropout, especially for women.

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**3059** Board #24 June 1 2:00 PM - 3:30 PM

**Associations Between Calf Fat And Muscle Density, Calf Soft Tissue Areas, And Total And Leg Soft Tissue Mass.**

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(No relationships reported)

Peripheral Quantitative Computed Tomography (pQCT) is becoming increasingly used for muscle and fat area assessments. Dual Energy X-ray Absorptiometry (DXA) is often added to these studies to give body composition information since data reporting the associations between pQCT- and DXA-derived soft tissue measures are scarce.

**PURPOSE:** To determine associations between pQCT-derived soft tissue density and area measures and DXA-derived soft tissue mass.

**METHODS:** Healthy men ( $n = 55$ ) and women ( $n = 59$ ) ages 20-59 had their leg and total body composition (bone-free lean body mass (BFLBM), fat mass (FM), body fat %) assessed by DXA and their calf fat and muscle cross-sectional area (FCSA and MCSA) and density (FDen and MDen) measured at 66% of tibia length. Marrow fat (MarFat) was also examined. Data are reported as mean  $\pm$  SE.

**RESULTS:** Men had significantly ( $p < 0.01$ ) greater total ( $61.3 \pm 1.0$  vs.  $40.7 \pm 1.1$  kg) and leg ( $21.0 \pm 0.4$  vs.  $14.1 \pm 0.3$  kg) BFLBM and MCSA ( $89.5 \pm 1.7$  vs.  $69.6 \pm 1.6$  cm<sup>2</sup>) than women. Women had significantly ( $p < 0.01$ ) greater leg ( $10.6 \pm 0.6$  vs.  $7.0 \pm 0.5$  kg) FM, and FCSA ( $32.9 \pm 2.1$  vs.  $16.9 \pm 2.1$  cm<sup>2</sup>) than men. FDen was significantly ( $p < 0.01$ ) higher in men ( $9.9 \pm 0.8$  vs.  $1.6 \pm 0.4$  mg/cm<sup>3</sup>), but MDen was not different between sexes. FDen was negatively correlated with FCSA, total and leg FM, and body fat % ( $r = -0.5$  -  $-0.7$ ,  $p < 0.001$ ) and positively related to MCSA, total and leg BFLBM ( $r = 0.4$ - $0.5$ ,  $p < 0.001$ ). Total FM was predicted by FCSA, wt, FDen, ht, and age ( $R^2 = 0.89$ ,  $p < 0.01$ ). FCSA, wt, sex, and FDen predicted leg FM ( $R^2 = 0.90$ ,  $p < 0.01$ ). Sex, MCSA, ht, MDen, and wt predicted total BFLBM ( $R^2 = 0.82$ ,  $p < 0.01$ ). MCSA, ht, MDen, wt, and sex predicted leg BFLBM ( $R^2 = 0.87$ ,  $p < 0.01$ ). Relative to total bone area, the proportion of 'fatty' marrow was not different between men and women ( $13.4 \pm 0.6\%$  vs.  $12.5 \pm 0.7\%$ ,  $p > 0.05$ ), but there was a trend ( $p = 0.07$ ) for the density of 'fatty' marrow to be greater in women ( $16.0 \pm 5.1$  vs.  $14.3 \pm 4.7$  mg/cm<sup>3</sup>).

**CONCLUSIONS:** Calf soft tissue area and density, along with ht, wt, and sex, strongly predict total and leg soft tissue mass. Fat density measures appear to be especially influenced by fluid content, possibly due to differences in lipid content or levels of inflammation. Further research will be needed to determine if changes in adipose cell size can be detected by changes in fat density.

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**3060** Board #25 June 1 2:00 PM - 3:30 PM  
**The Precision of Thigh Fat and Lean Mass Measures from Dual-energy X-ray Absorptiometry**

Cemal Ozemek, Matthew P. Harber, Leonard A. Kaminsky, FACSM. *Ball State University, Muncie, IN.*  
(No relationships reported)

Dual x-ray absorptiometry (DXA) is becoming an effective tool to measure total body fat and lean mass characteristics in diverse populations. Software enhancements have provided options to obtain body region assessments of clinical value such as android fat. As sarcopenia has been recognized as a serious health issue, there is a need for useful methods to quantify body mass, especially lean mass, changes in specific regions of the body.

**PURPOSE:** The purpose of this study was to assess the precision of DXA measurement of lean and fat mass of the thigh in a heterogeneous population.

**METHODS:** A total of 30 subjects (14 males and 16 females), ranging from ages 24 to 88 y (n=6 < 25 y, n=9 between 25 - 50 y, n=9 between 50 - 75 y, and 6 > 75 y) had a total body DXA scan (GE Lunar Prodigy). Subjects were measured in a supine position with legs strapped together to minimize movement during image acquisition. Scans were analyzed in triplicate with Encore Version 13.40 software to quantify fat and lean mass of the right thigh, as defined by the segment between the inferior borders of the ischial tuberosity and superior surface of the intercondyloid eminence. Coefficient of variations (CV) were calculated for the three separate analyses from the image for each subject, while a repeated measures ANOVA was used to test differences between the 3 measures.

**RESULTS:** There was a wide range of thigh fat mass (641.7 to 7498.7 g) and lean mass (2379.7 to 7629.0 g) between subjects. No significant differences existed between the 3 analyses for both fat and lean mass (p = 1.00). CV values ranged from 0.1 - 2.5% for fat and 0.1 - 2.0% for lean mass while mean CVs were 0.9% and 0.7%, respectively.

**CONCLUSION:** DXA imaging is capable of quantifying fat and lean mass of the thigh with a high level of precision. Regional DXA measures may provide a reasonable alternative for quantifying fat and lean mass of body segments compared to the gold standard of magnetic resonance imaging (MRI). Additional study of the potential for DXA to provide accurate regional fat and muscle mass measurements is warranted.

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**F-22** Free Communication/Poster - Body Image

JUNE 1, 2012 1:00 PM - 6:00 PM  
ROOM: Exhibit Hall

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**3061** Board #26 June 1 3:30 PM - 5:00 PM  
**An Investigation of the Relationship Between Body Satisfaction and Body Composition among College Students**

Cherilyn N. Hultquist, Lauren Miller, John R. McLester, FACSM, Christine Wood. *Kennesaw State University, Kennesaw, GA.*  
(No relationships reported)

Body satisfaction is influenced by self-perception and external factors, such as media images and social norms. Examining levels of body satisfaction among college students (CS) could identify the need for services on college campuses to help students achieve and maintain a healthy body fat % (BF%) and body image.

**PURPOSE:** To examine the differences between body satisfaction and BF% among CS by sex and body mass index (BMI) and to determine levels of body satisfaction before and after body fat testing and investigate the differences of self-estimated BF% and measured BF%.

**METHODS:** Participants were 208 CS (95 males, 113 females), aged  $24.4 \pm 6.2$  yrs, who volunteered to answer questionnaires, the Social Physique Anxiety Scale (SPAS), and undergo body fat testing with Dual Energy X-ray Absorptiometry (DXA).

**RESULTS:** A comparison by sex revealed a difference ( $P < 0.001$ ) on the SPAS with males and females scoring  $26.2 \pm 1.1$  and  $33.3 \pm 0.8$  respectively, indicating that males have lower levels of anxiety about their physiques. There was a difference ( $P < 0.001$ ) in SPAS scores when compared by BMI category of  $\leq 24.9 \text{ kg/m}^2$  and  $\geq 25.0 \text{ kg/m}^2$  where individuals with a BMI  $\geq 25.0 \text{ kg/m}^2$  had higher SPAS scores. There was also a decrease in levels of appearance satisfaction after BF% was assessed and test results were explained to subjects ( $P = 0.018$ ). There was no interaction by sex; both males (pre =  $5.0 \pm 0.2$ , post =  $4.9 \pm 0.2$ ) and females (pre =  $4.3 \pm 0.2$ , post =  $4.0 \pm 0.2$ ) satisfaction levels decreased but one not more than the other ( $P = 0.457$ ). Finally, self-estimated BF% compared to measured BF% revealed that all subjects underestimated their BF% ( $P < 0.001$ ).

**CONCLUSION:** Males have higher levels of body satisfaction than females and satisfaction for both sexes was negatively affected by knowledge of BF%. Physique anxiety was higher among students with a BMI above  $25.0 \text{ kg/m}^2$ , and subjects underestimated their BF% and became less satisfied with their bodies once they knew their BF%. It appears that CS do not have an accurate self-concept regarding their body image. Health and fitness classes and programs on campuses need to provide students with information about BF% and how to develop a positive self-image. An accurate measure of BF% could help inform CS about the current state of their bodies and help guide them in developing a proper diet and exercise plan.

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**3062** Board #27 June 1 3:30 PM - 5:00 PM  
**Prevalence of Eating Disorder Risk and Body Image among Collegiate Male Swimmers & Divers**

Toni M. Torres-McGehee<sup>1</sup>, Dawn M. Minton<sup>1</sup>, Eva V. Monsma<sup>1</sup>, Daniele Albert<sup>2</sup>, Jeremy R. Searson<sup>1</sup>. <sup>1</sup>University of South Carolina, Columbia, SC. <sup>2</sup>Gardner-Webb University, Boiling Springs, NC.  
(No relationships reported)

Male athletes may represent similar eating disorder (ED) risks as females and may predispose themselves to different body image (BI) issues. Discrepancy between perceived BI (PBI) and desired BI (DBI) has been associated with a variety of maladaptive thoughts and behaviors, but little is known about clothing type and BI perceptions from others (e.g., perception of what others perceive about that athlete's body).

**PURPOSE:** To estimate prevalence of ED risk characteristics and behaviors; and to investigate BI dissatisfaction associated with clothing type (daily clothing-DC, uniform-UN) and perceptions from others (peers-P, parents-PA, coaches-CO).

**METHODS:** Male collegiate swimmers (n=124) and divers (n=12) from NCAA Division I institutions (n=9) participated in an online survey. Participants self-reported height, weight, ideal weight, PBI and DBI in clothing type, and perceptions from others in DC. Eating Attitudes Test was used to estimate ED risk. Gender-base BMI silhouette was used to assess BI dissatisfaction.

**RESULTS:** Prevalence for ED risk was estimated for all males at 19.9% (swimmers = 19.4% and divers = 25.0%). All males reported bingeing (10.3%), vomiting (2.2%), using diet pills or laxatives (1.5%), and engaging in excessive exercise (8.8%) to control or lose weight. A 2 (DC, UN) x 2 (PBI, DBI) ANOVA with repeated measures on the last 2 factors indicated a significant within subjects effect  $F(1,135) = 5255.4$ ;  $p < 0.01$ ,  $\eta^2 = .98$ . An interaction for clothing  $F(1,135) = 6.82$ ;  $p = 0.01$ ,  $\eta^2 = .05$  revealed that swimmers' had overall greater BI dissatisfaction in UN compared to DC. A second 3 (P, PA, CO) x 2 (PBI, DBI) ANOVA with repeated measures on the last 2 factors indicated a significant within subjects effect  $F(1,135) = 4224.4$ ;  $p < 0.01$ ,  $\eta^2 = .97$ . An interaction for perceptions  $F(1,135) = 5.52$ ;  $p = .02$ ,  $\eta^2 = .04$  revealed that P, PA, or CO's DBI of the swimmer was larger than their PBI.

**CONCLUSION:** Male swimmers presented ED risk characteristics and behaviors along with BI dissatisfaction. Although in a normal male BMI range, swimmers wanted to be larger in their UN compared to DC. Additionally, P, PA, and CO's perceptions of what these athletes look like compared to what they should look like are implicated in BI dissatisfaction, warranting further examination as correlates of maladaptive thoughts and behaviors.

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3063 Board #28 June 1 3:30 PM - 5:00 PM

**Thin Women Display Hedonic Treadmill Tendencies Regarding Their Weight Vs. Overweight Counterpart!**

Lorena Martin<sup>1</sup>, Barbara Kahn<sup>2</sup>, Andrew Perkins<sup>3</sup>. <sup>1</sup>University of Miami, Coral Gables, FL. <sup>2</sup>University of Pennsylvania, Philadelphia, PA. <sup>3</sup>The University of Western Ontario, Ontario, ON, Canada. (Sponsor: Arlette C. Perry, FACSM)  
(No relationships reported)

**PURPOSE:** The purpose was to examine any potential differences in self-esteem, body image, and body attitude between thin and overweight women. We expected that women who self-described themselves as thin should reveal balanced identities, whilst overweight women would exhibit unbalanced identities.

**METHODS:** A series of Implicit Association Tests (IAT; Greenwald, McGhee and Schwartz 1998) were used to assess the three constructs of interest: Self-Esteem, Self-Body Association, and Body Attitude. The IAT is a well-established measure in social and cognitive psychology designed to indirectly measure the strength of association between concepts in memory using a simple computer-based categorization task.

**RESULTS:** The ANOVA analysis revealed a significant difference on the body image and body attitude IATs, such that thin participants exhibited a stronger self-association with imagery consistent with thin body size (Mthin = .63, Moverwt = 52,  $p = .037$ ) and more positive attitudes toward thin body imagery (Mthin = .51, Moverwt = .39,  $p = .044$ ), but did not reveal significant increase in self-esteem compared to overweight participants (Mthin = .49, Moverwt = .51,  $p = .65$ ). Further, thin individuals revealed a smaller current body image (Mthin = 3.4, Moverwt = 6.0,  $p < .001$ ; smaller number is thinner), a smaller ideal body image (Mthin = 2.6, Moverwt = 3.8,  $p < .001$ ), a smaller self-ideal discrepancy (Mthin = .72, Moverwt = 2.39,  $p < .001$ ), and a smaller self-society ideal discrepancy (Mthin = .80, Moverwt = 3.5,  $p < .001$ ) than the overweight individuals. Finally, correlational analysis of the thin participants revealed a negative correlation between current body size and implicit self-esteem (such that the thinner your current body size, the lower your implicit self-esteem) and a positive correlation between worry about becoming overweight and increased implicit self-esteem. None of these correlations obtained for the overweight group.

**CONCLUSION:** In light of these counterintuitive findings, overweight females revealed a balanced identity in memory, while thin participants did not.

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3064 Board #29 June 1 3:30 PM - 5:00 PM

**Coping With Weight-related Discrepancy & Impact On Self-regulation: Development Of The WEIGHT-COPE**

Mark D. Faries<sup>1</sup>, John B. Bartholomew, FACSM<sup>2</sup>. <sup>1</sup>Stephen F. Austin State University, Nacogdoches, TX. <sup>2</sup>University of Texas-Austin, Austin, TX.  
(No relationships reported)

**PURPOSE:** To develop a reliable and valid measure (WEIGHT-COPE) to assess coping responses to weight-related discrepancy in women. The decision to create such a measure stemmed from difficulties in consistent regulation of weight-related behavior.

**METHODS:** The WEIGHT-COPE and other relevant measures were completed online by 470 females ages 18-35 years from all BMI categories. Data were analyzed in an exploratory factor analysis.

**RESULTS:** The EFA revealed a 40-item measure consisting of eight coping factors: Exercise/Physical Activity, Healthy Eating, Cutting Calories/Appetite Suppression, Supplement Use, Monitor/Planning, Disengage/Denial, Camouflage, and Acceptance/Positive Reframing. All factors were internally consistent ( $\alpha = 0.71$  to  $0.89$ ), and converged with other pertinent measures of weight satisfaction, weight controllability/changeability, social physique anxiety, self-esteem, weight loss efficacy, physical activity level, dietary intake and objectified body consciousness. To test theoretical implications on future self-regulation of weight loss behavior, a structural regression model was run utilizing the resulting factors. The factors interacted in a theoretically-driven pattern, illustrating that coping responses to weight-related discrepancy may have varied impacts on weight loss behavior choice.

**CONCLUSIONS:** The present findings provide preliminary support for the WEIGHT-COPE and suggest that individuals cope with weight-related discrepancy in different ways, which may then have various impacts on future self-regulation of weight loss behavior.

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**F-23 Free Communication/Poster - Chronic Disease and Disability**

JUNE 1, 2012 1:00 PM - 6:00 PM

ROOM: Exhibit Hall

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3065 Board #30 June 1 2:00 PM - 3:30 PM

**The Effects Of Two Weeks Of Sprint Interval Training In Spinal Cord Injured (SCI) Persons**

Christopher R. Harnish<sup>1</sup>, Jonathan A. Daniels<sup>2</sup>, Jewel R. Moore<sup>2</sup>, Roy T. Sabo<sup>3</sup>, David R. Gater<sup>2</sup>. <sup>1</sup>Hunter Holmes McGuire VAMC/Virginia Commonwealth University, Richmond, VA. <sup>2</sup>Hunter Holmes McGuire VAMC, Richmond, VA. <sup>3</sup>Virginia Commonwealth University, Richmond, VA. (Sponsor: Gary Sforzo, FACSM)  
(No relationships reported)

Persons with chronic SCI exhibit a high prevalence of metabolic syndrome. The potential medicinal benefits for sprint interval training (SIT) among able-bodied individuals may have important implications for SCI, however data for arm crank ergometry (ACE) SIT are not unavailable.

**PURPOSE:** To elucidate the effects of two weeks of SIT in persons with SCI.

**METHODS:** 9 males with chronic SCI, T1-T10, completed the study that included a continuous  $VO_{2Peak}$  test and DXA to estimated body composition. Three OGTT's were completed - baseline, 2 weeks later (Pre), and 48 hrs Post training, with 24 hr dietary recall completed for each of these tests. Six SIT sessions were completed on a Monark 891E ACE over 2 weeks. Subjects cranked against 3.5% body mass for 30 sec completing 4 sprints session 1, then 5, 5, 6, 6, and finally 7 sprints in the final session. All data are presented as medians (Q1, Q3), and a Wilcoxon test ( $\alpha=0.05$ ) was used to determine pre and post changes. Area under the curve (AUC) was calculated using the trapezoidal rule and peripheral insulin sensitivity ( $S_p$ ) was estimated using ISI-Cederholm.

**RESULTS:** Men were age 47 (44, 56.8), 181.6 (168.8, 184.5) cm tall, weighed 86.8 (72.8, 94.4) kg, 34.6 (30, 37.5) %Fat, &  $VO_{2Peak}$  1.51 (1.33, 2.05)  $L \cdot min^{-1}$ . Dietary analysis indicated subjects consumed 1907 (1288, 2751) kcal, consisting of 50.5 (38.7, 57.8)% CHO and 31.0 (26.3, 37.9)% Fat. Participant's average work during sprints increased from 5.66 to 6.22 kJ (about 10%) between the first session and last. AUC changes for either glucose or insulin failed to show significant changes. ISI-Cederholm 151.6 (145.2, 176.0) baseline, 179.2 (162.7, 190.8) Pre, and 165.2 (141.0, 202.3) Post, also did not show significant changes either. Close inspection of the data show large variation between the three OGTT periods.

**CONCLUSIONS:** Persons with SCI have a high training capacity, but ACE SIT may not provide a sufficient training stimulus to overcome the metabolic changes and variability seen here. The high variability for the OGTT's within and between subjects cannot be explained by dietary analysis and support the unique metabolic environment seen among SCI. These data also suggest that the OGTT may not be a suitable test for training evaluation in SCI. More research is needed to determine the efficacy of ACE SIT for other non-SCI populations.

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3066 Board #31 June 1 2:00 PM - 3:30 PM

**Accelerometer-derived Physical Activity And Lower Extremity Functional Changes In Patients Undergoing Spinal Decompression Surgery**

Matthew P. Buman<sup>1</sup>, Ma Agnes Martinez Ith<sup>2</sup>, William L. Haskell, FACSM<sup>3</sup>, Matthew Smuck<sup>2</sup>. <sup>1</sup>Arizona State University, Phoenix, AZ. <sup>2</sup>Stanford University School of Medicine, Redwood City, CA. <sup>3</sup>Stanford University School of Medicine, Stanford, CA.

(No relationships reported)

Objective methods are needed to better quantify behavioral and functional outcomes following spine surgery. To date accelerometers have not been widely used to evaluate surgical outcomes despite their promise to detect small but meaningful changes in activity following surgery. Maintained lower extremity function in late life is known to reduce morbidity and mortality.

**PURPOSE:** To assess changes in physical activity (objective and self-report) and lower extremity function in patients with lumbar spinal stenosis undergoing spinal decompression surgery.

**METHODS:** Patients wore an accelerometer for 7 consecutive days (Actigraph GT3x+), completed a validated self-report physical activity questionnaire (CHAMPS questionnaire) and a short battery of lower extremity physical performance tests (Short Physical Performance Battery [SPPB]: gait, leg strength, and standing balance) at baseline (T0), 1-month post-operation (T1), and 3-month post-operation (T2). Moderate-vigorous physical activity (MVPA) was defined using published thresholds ( $\geq 1952$ cts/min) accelerometer data and standard metabolic equivalents ( $\geq 3.0$  METS) for reported activities. Mixed-effects models were fitted to examine within-group changes in these variables.

**RESULTS:** Patients (N=14) were 57% female, 43% Caucasian, overweight ( $27.6 \pm 5.1$  kg/m<sup>2</sup>), and of older age ( $73.4 \pm 8.1$  years). Patients wore the accelerometer for 4.8, 5.5, and 3.5 valid days (defined as  $>10$ hrs of wear time) at T0, T1, and T2, respectively. Improvements in accelerometer and self-reported MVPA were not significant ( $p > .05$ ); however, effect sizes were moderate to large for accelerometer-derived MVPA at T1 (diff=9.6mins,  $d=0.98$ ) and T2 (diff=8.0mins,  $d=0.4$ ), and small for self-reported PA at T1 (diff=5.3mins,  $d=.01$ ) and T2 (diff=99.2mins,  $d=0.3$ ). Improvements in SPPB scores were significant (F[2,19.1],  $p=.01$ ), with large effects sizes at T1 (diff=1.9,  $d=1.6$ ) and T2 (diff=1.5,  $d=0.8$ ). Sub-analyses revealed SPPB total score changes were due to gait and leg strength, but not standing balance.

**CONCLUSIONS:** Initial evidence suggests that changes in MVPA and lower extremity function following decompression surgery are detectable. Future research is needed to confirm these results in a larger sample and with longer-term follow-up.

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3067 Board #32 June 1 2:00 PM - 3:30 PM

**Eight Weeks Functional Training Improves Muscle Endurance, Balance, Power, Speed In Athletes With Disabilities**

Heather Pennington, Cynthia Schroeder, Elizabeth Feutz, Meghan Reid. Lindenwood University, St. Charles, MO.

(No relationships reported)

**PURPOSE:** The purpose of this study was to determine whether a high intensity functional training program was effective in improving athletic muscle endurance (ME), dynamic balance (DBAL), power (P), and speed (S) in athletes with various disabilities.

**METHODS:** Nine individuals (Mean age = 18, Males n = 6, Females n = 3) with disabilities varying from cerebral palsy, visual impairment, spinal cord injury, and spina bifida participated. Each athlete performed pre and post-tests which consisted of: 1 min push-up, 1 min sit-up, stabilometer, vertical jump (VJ), medicine ball throw (MBT), and 40 yard dash. Athletes participated in one 45 minute training session per week for 8 weeks. Training sessions included a dynamic warm-up, a high intensity training incorporating ladder agility drills, hurdles for balance and flexibility, sand pit for balance, bodyweight core training, muscle strength and endurance exercises, cable columns for core strength, medicine balls for power and core stability, over-speed workouts on treadmills, stability balls for balance, tennis balls for hand-eye coordination, and an appropriate cool down.

**RESULTS:** Eight weeks of functional training considerably improved ME (40.6% sit-ups, 40.0% push-ups), DBAL (178%), P (13.0% MBT), and S (10.6%).

**CONCLUSIONS:** These results indicate that an 8 week functional training program was effective in improving muscle endurance, dynamic balance, power, and speed in athletes with various disabilities.

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3068 Board #33 June 1 2:00 PM - 3:30 PM

**Amplified C-reactive Protein To Protein Glycation Ratio In The Frozen Shoulder Patients**

Wei-Hong Jean<sup>1</sup>, Li-Yuan Tsao<sup>2</sup>, Chia-Hua Kuo, FACSM<sup>3</sup>. <sup>1</sup>Far Eastern Memorial Hospital, New Taipei, Taiwan. <sup>2</sup>National Taipei College of Business, Taipei, Taiwan. <sup>3</sup>Taipei Physical Education College, Taipei, Taiwan.

(No relationships reported)

Exercise training is encouraged for all in the prevention and treatment of metabolic disorders. However, degenerative musculoskeletal disorder can be a barrier for exercise participation. Adhesive capsulitis of the shoulders result in limitation of active and passive range of motion of all directions and so called "frozen shoulder". This problem causes severe pain and affects daily activity and exercise ability. Diabetic patients have five times prevalence rate of frozen shoulder compared to general populations. Hyperglycemic protein glycation plays a critical role in low-grade chronic inflammation and may implicate degenerative joint disease in elderly.

**PURPOSE:** This cross-sectional study aimed to compare C-reactive protein (CRP) and glycosylated hemoglobin (HbA1C) ratio between normal and frozen shoulder patients.

**METHODS:** Fifty middle-aged subjects were divided into 4 groups according to the cut-off criteria of pre-diabetes: fasting glucose (FG > 100) and glycosylated hemoglobin A1C (HbA1C > 5.7%) for CRP comparison. CRP to HbA1C ratio in 3 frozen shoulder patients (aged  $54.3 \pm 1.2$  years) was measured against 12 age-matched normal subjects (aged  $54.3 \pm 1.2$  years).

**RESULTS:** Among fifty subjects, CRP levels increased with HbA1C levels, but this relationship was not linear in nature. In particular, the distribution of escape-from-the-norm values increased with HbA1C level. Relationship between both variables becomes linear when CRP variance is logarithmically compressed, suggesting that CRP increase is amplified with the magnitude of protein glycation.

**CONCLUSION:** Our data suggest that chronic inflammation amplified with protein glycation among middle-aged subjects. Frozen shoulder patients displayed an amplified CRP to HbA1C ratio (3 folds) against the normal subjects. This preliminary finding provides ground for investigating the possible metabolic origin of frozen shoulder, and the possibility of using hypoglycemic intervention as an adjuvant therapy of conventional rehabilitation modality treating degenerative joint disease.

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3069 Board #34 June 1 2:00 PM - 3:30 PM

**Hip Muscle Strength, Bilateral Ratios, Antagonistic Ratios and Single Leg Squat Performance in Persons with Low Back Pain and Controls**

Jennifer Satterfield, Ken Queliza, George J. Davies, Bryan L. Riemann. Armstrong Atlantic State University, Savannah, GA.

(No relationships reported)

Many persons suffer from lower back pain (LBP), but causes are not fully understood. Few studies have examined the hip musculature strength differences in persons with LBP history and whether it contributes to movement deviations during the single leg squat.

**PURPOSE:** To compare isometric strength, antagonistic ratios, bilateral ratios of the hip muscles and qualitative single leg squat performance between healthy and persons with a history of LBP.

**METHODS:** Fifteen men with ( $1.78 \pm 0.08$ m,  $80.7 \pm 15.6$ kg,  $21.9 \pm 3.9$  yrs, Oswestry Disability Questionnaire score =  $29.1 \pm 22.8$ ) and without ( $1.78 \pm 0.05$ m,  $72.7 \pm 11.8$ kg,  $20.2 \pm 2.5$  yrs) LBP history completed isometric strength evaluation of the hip flexor, extensor, adductor (HAD), abductor (HAB), internal rotator and external rotator using hand held dynamometry. Strength assessment order was randomly determined for each subject. Average strength values across three trials were computed and normalized to body mass. Antagonistic and bilateral strength ratios were computed. Furthermore, participants completed the National Academy of Sports Medicine (NASM) single leg squat assessment (SLSA), however only errors associated with hip musculature imbalance were considered for analysis. A pilot reliability study for the strength assessments yielded intraclass correlational coefficients (3, k) between .91 to .98. Three factor analyses of variance (ANOVA) were conducted for the strength values (group by limb by muscle action) and antagonistic ratios (group by limb by ratio). Two factor ANOVA were conducted for the bilateral ratios (group by muscle action). Chi square analyses were used to compare errors during the SLSA.



**RESULTS:** No significant ( $P > .05$ ) isolated strength or bilateral ratios differences between the groups existed. Post hoc analysis of a significant group by antagonist ratio interaction ( $P = .009$ ) for HAB:HAD revealed the LBP group to have a 19% lower ratio than the control group ( $P = .007$ ). There were no significant SLSA error differences between the groups.

**CONCLUSIONS:** Although the isometric strength and bilateral ratios did not differ between the LBP and control groups, the LBP demonstrated significantly smaller HAB:HAD ratios than the controls. This study also shows that the NASM SLSA did not detect HAB:HAD differences between LBP sufferers and non-LBP sufferer.

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**3070 Board #35 June 1 2:00 PM - 3:30 PM**  
**Reducing Injuries is NOT Enough - It Also Helps to Win**

Jeremy A. Gentles, *East Tennessee State University, Johnson City, TN.*  
(No relationships reported)

Much of the current literature related to injuries in sport has addressed the influence of a particular exercise intervention on a specific type of injury without considering changes in sport performance.

**PURPOSE:** To investigate an interdisciplinary approach to athlete development and its initial effects on injury rates and measures of performance in collegiate baseball.

**METHODS:** In October 2008, an NCAA Division I baseball team began working with a sport performance enhancement group (SPEG) which consists of a collaborative effort between sport coaches, sport medicine and sport science departments. Injury rates were calculated for each academic year from 2006/2007 through 2010/2011. As part of the athlete monitoring program provided through SPEG, peak force was measured using an isometric mid-thigh pull from 2008/2009 through 2010/2011. Team win percentage and home runs were also reported from 2003/2004 through 2010/2011.

**RESULTS:** Compared to 2006/2007 and 2007/2008, injury rates during 2008/2009 decreased 40% and 16%, 2009/2010 decreased 64% and 48%, while 2010/2011 decreased 33% and 6%. Team mean allometrically scaled isometric peak force (IPFa) increased each year from 2008/2009 through 2010/2011 (200.6 N, 229.6 N, 244.2 N). IPFa during 2009/2010 and 2010/2011 were significantly greater than 2008/2009 ( $p = .001$  and  $.002$ ). Win percentage increased from 2008/2009 through 2010/2011 (47%, 53%, 63%) and the 2010/2011 win percentage was higher than any other year since 2003/2004. Total team home runs during 2009/2010 and 2010/2011 were higher than any other season since 2003/2004.

**CONCLUSIONS:** These results seem to indicate that the collaborative efforts of SPEG were able to substantially reduce injury rates while increasing lab based and on-field performance.

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**3071 Board #36 June 1 2:00 PM - 3:30 PM**  
**Influence Of Verbal Instruction For Center Of Gravity Position And Sex On Landing Muscle Activity**

Yuji Kanoh<sup>1</sup>, Masanori Takemura<sup>2</sup>, Koji Kurita<sup>3</sup>, Mitsuharu Kaya<sup>4</sup>, Motoaki Tsuchiya<sup>5</sup>, Junzo Tsujita<sup>2</sup>. <sup>1</sup>*Reseisha College of Medicine and Sport, Osaka, Japan.* <sup>2</sup>*Hyogo College of Medicine, Nishinomiya, Japan.* <sup>3</sup>*Physical Conditioning Production, Osaka, Japan.* <sup>4</sup>*Hyogo University of Health Science, Kobe, Japan.* <sup>5</sup>*MJ Consultant, Osaka, Japan.*  
(No relationships reported)

We have reported that the verbal instruction to move a center of gravity (COG) forward was increased ankle dorsiflexion and trunk anterior tilt during landing, which resulted in decreasing of quadriceps activity and increasing of the quadriceps/hamstring co-contraction EMG ratio (H/Q ratio) in male subjects.

**PURPOSE:** To evaluate the efficacy of verbal instructions on COG position to alter landing muscle activity in female subjects, and compared with the results using male subjects.

**METHODS:** A cross-over interventional study. Seven healthy female students [mean age (SD): 19.8 (0.7) yrs] performed 3 jumping and landing tasks: normal landing (N); landing after the instruction to move a COG forward (ANT); landing after the instruction to move a COG backward (POS). Sagittal plane motion, ground reaction force and electromyography of quadriceps (the vastus medialis (VM) and vastus lateralis (VL) muscles) and hamstring (the semitendinosus (ST) and biceps femoris (BF) muscles) were recorded during the landing phase (i.e. the interval from initial round contact to peak knee flexion). The H/Q ratio was calculated as the mean activation of ST and BF to mean activation VM and VL. For statistical analysis, 3-way ANOVA was used, and multiple comparisons by LSD with all variables and tasks as within-subject variable and sex as between-subject variable.

**RESULTS:** In female subjects, the results of ankle dorsiflexions (degree) at N, ANT, and POS were 24.4 (4.26), 26.2 (2.79), and 18.7 (6.47), knee flexions were 94.1 (6.08), 94.2 (4.15), and 92.0 (7.61), hip flexions were 97.3 (5.98), 94.3 (11.50), and 101.2 (7.66), and trunk anterior tilts were 27.6 (5.68), 26.3 (12.02), and 27.9 (9.39), respectively. In female and male, ankle dorsiflexion at POS was significantly smaller at N and ANT. Between sexes, knee and hip angle, and trunk anterior tilts in female were smaller than in male. The H/Q ratios in female were 43.4 (10.08), 38.7 (22.10), and 31.3 (21.56), respectively at N, ANT, and POS. The H/Q ratio had no sex difference (in male; 33.4 (15.72), 48.4 (18.92), and 27.1 (7.68), respectively). However, the H/Q ratio at POS was lower than at ANT.

**CONCLUSION:** Sex differences were not recognized in muscles activity during landing tasks. Therefore, changing of movement during landings should be emphasized as part of ACL injury-prevention programs.

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**3072 Board #37 June 1 2:00 PM - 3:30 PM**  
**Reliability of Translation of Center of Force Using Portable Pressure Mapping Device in Older Adults**

Marjorie A. King<sup>1</sup>, Marie E. Trombulak<sup>1</sup>, William I. Eissler<sup>1</sup>, Ryan S. Kempson<sup>1</sup>, Thomas R. Boucher<sup>1</sup>, Jean P. Boucher, FACSM<sup>2</sup>, Jon D. Lurie<sup>3</sup>. <sup>1</sup>*Plymouth State University, Plymouth, NH.* <sup>2</sup>*University of Quebec, Montreal, Montreal, QC, Canada.* <sup>3</sup>*Dartmouth College, Hanover, NH.*  
(M.A. King: Contracted Research - Including Principle Investigator; Tekscan.)

Falls in the elderly are the most common cause of non-fatal injuries and hospital admissions from trauma (CDC 2011). Falls prevention screening is a critical element in the efforts to reduce these injuries. A portable testing device allows for the screen to be brought to the elderly rather than have them travel to a testing site.

**PURPOSE:** To determine the reliability of a portable measurement device, utilizing pressure mapping, for measuring translation of center of force in older adults.

**METHODS:** Forty-five (10 males; 35 females) physically active older adults ( $m = 71.8 + 4.6$  yrs.,  $m = 162.7 + 12.3$  cm,  $m = 75.6 + 17.96$  kg) participated in balance testing across three days after signing an informed consent document. Five measures across six conditions were tested within 24 to 72 hrs. of the previous test day. The variables of area, distance, variability (SD of distance), A-P and R-L excursion were computer generated under the six conditions of two-feet eyes open (2FEO), two feet eyes closed (2FEC), right foot eyes open (RFEO) and eyes closed (RFEC), left foot eyes open (LFEO) and eyes closed (LFEC). Subjects were asked to stand quietly for 30 seconds, for five trials, with arms relaxed at side, viewing an eye level target on the wall. A tracing of foot position was taken to ensure similar stance positioning within each day across trials.

**RESULTS:** ICCs (2,3) ranged from moderate (0.67 for variability 2FEO) to high (0.93 for distance 2FEC). Thirteen out of the 15 eyes open ICCs are at 0.73 or better, while all 15 eyes closed ICCs are at or over 0.71. One of the lowest ICC values (0.68) was for the LFEO condition with 41 of 45 being R foot dominant. The ICCs in all the other measurements and conditions range from good (0.71) to very good (0.93), for both eyes opened and closed.

**CONCLUSIONS:** This portable pressure mapping device provides several stable measurements for postural balance in an older adult population across days without constraining arm position. This device appears to be an appropriate tool to measure postural balance in the older adult. Future research should address validation of the variables to current clinical measures for falls risk. (NH-INBRE) NIH Grant Number 1P20RR030360-01 from the INBRE Program of the National Center for Research Resources (CFDA# 93.389)

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**3073 Board #38 June 1 2:00 PM - 3:30 PM**  
**Effect Of Topical Menthol Gel On Power Output During 30-second High Intensity Anaerobic Exercise**

Will C. Hawkins, Michael E. Rogers, FACSM, Jeremy A. Patterson, FACSM, Cali K. Simmons. *Wichita State University, Wichita, KS.*  
(No relationships reported)

Menthol-based gels have been reported to reduce acute pain and reduce inflammation. However, the effect of topically applied menthol on power output during high intensity anaerobic bouts has not been studied.

**PURPOSE:** To determine if the topical application of menthol enhances power output during a 30-second sprint.

**METHODS:** 30 participants (14 male; 16 female) aged 20-38 ( $24.4 \pm 4.8$ ) years each completed two trials, one with menthol gel and one without, with 48 hours between trials. For the trial with gel, a dose of 1ml of gel for every 200 cm<sup>2</sup> sq cm of surface area was applied bilaterally to the thigh of each participant. For both trials, following a brief (2-3 sec) unloaded acceleration period, participants pedaled as fast as possible against a load of 0.75 kg • kg<sup>-1</sup> body mass for 30 sec. Peak and average power for the 30 sec trials, average power for each 5 sec interval, and overall fatigue index were recorded.

**RESULTS:** Mean  $\pm$  SD of the two trials are provided below. There were no significant differences ( $p < 0.05$ ) in any variable between trials. Additional analyses also revealed that, although males achieved greater power outputs compared to females, there were no differences between trials when grouped by gender.

**CONCLUSION:** Many products including topical gels have been theorized to improve human performance during high intensity anaerobic exercise. Menthol-based gels have long been accepted as a chemical cryotherapy agent but this study indicates that menthol gels do not increase power output. Future studies should explore the benefits of menthol based topical gels on recovery from DOMS.

Supported by Hygenic Corporation

| Power Output (watts)          |                 |                 |
|-------------------------------|-----------------|-----------------|
|                               | With Menthol    | Without Menthol |
| Peak Power over 30 sec (W)    | 804.7 +/- 268.9 | 790.0 +/- 272.8 |
| Average power over 30 sec (W) | 561.5 +/- 159.7 | 545.7 +/- 156.8 |
| Average power 0-5 sec (W)     | 746.1 +/- 241.4 | 732.9 +/- 237.7 |
| Average power 5-10 sec (W)    | 638.5 +/- 191.6 | 634.4 +/- 189.6 |
| Average power 10-15 sec (W)   | 561.4 +/- 168.0 | 556.1 +/- 166.0 |
| Average power 15-20 sec (W)   | 505.3 +/- 148.2 | 500.2 +/- 148.8 |
| Average power 20-25 sec (W)   | 456.8 +/- 128.5 | 452.5 +/- 130.1 |
| Average power 25-30 sec (W)   | 409.6 +/- 110.4 | 406.1 +/- 112.1 |
| Fatigue Index (%)             | 50.0 +/- 0.12   | 50.0 +/- 0.14   |

**3074 Board #39 June 1 2:00 PM - 3:30 PM**

**Comparison Of Isotonic And Isokinetic Measurements Of Extension/flexion Strength And Quadriceps-hamstring Ratio.**

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(No relationships reported)

Isokinetic dynamometry assessment is the preferred choice for quantifying quadriceps-hamstring ratio (Q/H), but at significant financial cost. Isotonic strength equipment such as flexion and extension weight machines are less expensive and may be a valid alternative for assessing Q/H ratio.

**PURPOSE:** To assess the relationship between 5 RM knee extension/flexion load and maximum Q/H torque ratios assessed using isotonic and isokinetic resistance machines, respectively.

**METHODS:** 21 Division II women soccer players (Mean  $\pm$  SD Age = 19.9  $\pm$  1.1 years; Height = 165.4  $\pm$  7.2 cm; Mass = 63.1  $\pm$  7.1 kg) were assessed for strength measures of the right leg. Knee extension and flexion strength was assessed using isotonic weight machines at angles of 75 and 50 degrees, respectively. Following appropriate warm up sets and two minutes rest, a 5 RM was obtained for knee extension and flexion. A Biodex System 4.0 isokinetic dynamometer was used to assess peak torque of knee extension/flexion at 300 degrees/s. A self-selected 5 rep warm up was performed, followed by one minute rest; 10 reps were then performed at maximum. Intraclass and Pearson Correlation analyses were used to assess the relationship between isotonic and isokinetic: knee extension, flexion and Q/H ratio measures. Additionally, a Paired t-Test was used to compare the differences between Q/H ratio assessed via isotonic and isokinetic machines.

**RESULTS:** Intraclass and Pearson Correlation Coefficients were respectively 0.562 and 0.396 for flexion (mean isotonic: 49.6  $\pm$  8.21 kg & isokinetic: 58.9  $\pm$  9.5 Nm); 0.861 and 0.756 for extension (mean isotonic: 58.2  $\pm$  10.0 kg & isokinetic: 76.1  $\pm$  9.7 Nm); and 0.745 and 0.595 for the Q/H ratio. The Biodex Q/H ratio was 1.31  $\pm$  0.20 while the weight machine ratio was 1.18  $\pm$  0.19. Significant mean differences were found between isotonic and isokinetic Q/H ratios ( $p < 0.01$ ).

**CONCLUSION:** Due to a significant difference and moderate correlation between measurement protocols, isotonic weight machines cannot be used to determine Q/H ratio. Variations in speed, range of motion and number of repetitions completed may all have influenced the differences between isotonic and isokinetic measurements.

**3075 Board #40 June 1 2:00 PM - 3:30 PM**

**Adaptations In Scapular Kinematics Among Pitchers And Position Players Over The Course Of A Baseball Season**

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(No relationships reported)

Baseball pitchers have been reported to have an increased prevalence of shoulder injury compared to position players. Such injuries have been empirically linked to scapular dyskinesis.

**PURPOSE:** To determine if throwing arm scapular kinematic differences exist between baseball pitchers and position players over the course of a baseball season.

**METHODS:** Sixteen asymptomatic professional baseball pitchers and 16 position players participated. We measured scapular upward rotation at 0°, 60°, 90°, and 120° of humeral elevation, as well as forward scapular posture prior to (covariate) and at the conclusion (dependent variable) of a 140 game baseball season. We conducted separate 1-way analyses for all measurements ( $p < .01$ ).

**RESULTS:** The covariate adjusted means for position players' scapular upward rotation at 0°, 60°, 90°, and 120° of humeral elevation were 3.9°  $\pm$  4.8°, 11.6°  $\pm$  4.7°, 24.4°  $\pm$  2.36°, and 38.5°  $\pm$  2.7°. The covariate adjusted means for the pitchers' scapular upward rotation at each humeral elevation angle were 4.9°  $\pm$  2.7°, 8.7°  $\pm$  6.4°, 20.7°  $\pm$  5.0°, and 37.6°  $\pm$  3.8°. The position players had significantly greater scapular upward rotation at 60° ( $p = .007$ , between group mean difference = 2.9°, effect size = .45) and 90° ( $p = .006$ , between group mean difference = 3.6°, effect size = .73) of humeral elevation compared to the pitchers. There were no significant differences for scapular upward rotation at 0° ( $p = .93$ ) or 120° ( $p = .29$ ) of humeral elevation. The covariate adjusted means for the position players' and pitchers' forward scapular posture were 0.54mm  $\pm$  0.44mm and 0.30mm  $\pm$  0.69mm. Forward scapular posture was not significantly different between groups ( $p = .23$ ).

**CONCLUSIONS:** Our results show that position players have significant increases in scapular upward rotation at 60° and 90° of humeral elevation at the conclusion of the baseball season compared to pitchers. Due to the repetitive arm elevation required for the throwing motion over the course of a season, the increased scapular upward rotation demonstrated by position players may be beneficial in reducing their risk of injury. However, this lack of increase in pitchers may make them more susceptible to such injuries and may partially explain their higher incidence of shoulder injury compared to position players.

3076 Board #41 June 1 2:00 PM - 3:30 PM

**Electromyography Comparison Of Three Isometric Lumbar Spine Extensor Strengthening Exercises**

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<sup>1</sup>Brigham Young University, Provo, UT. <sup>2</sup>Central Utah Clinic, Provo, UT.  
(No relationships reported)

Low back pain is a common issue among adults. Muscle weakness is related to pain. During rehabilitation patients perform back strengthening exercises to help alleviate their back pain. Some patients are not able to assume a prone unsupported lumbar extension position used to strengthen back muscles. To address this issue, two new sitting lumbar extension exercises have been introduced; assessment of their efficacy is important.

**PURPOSE:** To compare 3 lumbar extensor strengthening exercises' activation of lumbar erector spinae (LES), lumbar multifidus (LM), and external oblique (EO).

**METHODS:** Eighteen healthy people (age 31 ± 13 years, weight 68.6 ± 11.7 kg, height 1.77 ± .08 m) with no back pain were recruited to participate in the study. Three EMG surface electrodes were placed on participants' right back and abdomen over the LM, EO, and LES muscles. Each participant performed three maximal voluntary isometric contraction tests in order to normalize the data for comparison. Three isometric exercises were then performed in random order; muscle activation was recorded for each of the three exercises: 1) Prone unsupported lumbar extension; 2) sitting isometric lumbar extension against a resistance band with varying direction of resistance; 3) sitting isometric lumbar extension against a weighted pulley. EMG data were analyzed using customized software in Matlab. Repeated measures ANOVA was performed (SPSS 19).

**RESULTS:** No significant differences in muscle activation were seen across exercises (p > .05 in all comparisons).

**CONCLUSIONS:** Muscle activation was comparable across the three exercises. Each of these exercises may be used to strengthen lumbar extensors.

Normalized EMG (% MVIC) comparison of three isometric lumbar strengthening exercises

|                             | Prone Unsupported Extension | Sitting Band | Sitting Pulley |
|-----------------------------|-----------------------------|--------------|----------------|
| Right Lumbar Erector Spinae | 17.2 ± 8.9                  | 18.3 ± 7.8   | 17.5 ± 7.6     |
| Right Lumbar Multifidus     | 8.4 ± 6.4                   | 11.5 ± 7.4   | 15.3 ± 9.4     |
| Right External Oblique      | 6.8 ± 4.7                   | 6.2 ± 3.6    | 10.4 ± 5.3     |

3077 Board #42 June 1 2:00 PM - 3:30 PM

**The Effects Of Sternoclavicular Joint Icing On Balance Performance Of Weight Lifting Sportsmen**

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(No relationships reported)

Weight lifting involves weight loading to the neck, potential acute or chronic neck injuries are likely.

**PURPOSE:** To evaluate the balance outcomes of the weight lifting sportsmen after the icing effects on the sternoclavicular joints.

**METHOD:** A 2x2 factorial design between group and pre-post factors was conducted. We recruited 25 weight lifting sportsmen, randomly assigned into icing group (number: 13; age, 20.3 ± 1.2 years; body height, 168.4 ± 6.9 cm; body weight, 62.1 ± 11.2 kg) and non-icing group (number: 12; age, 21.6 ± 1.2 years; body height, 167.0 ± 8.8 cm; body weight, 82.0 ± 10.1 kg). A computerized posturography, the Smart Balance Master (Neuro Com Inc., Clackamas, Oregon, USA) was selected to acquire postural stability measurement under defined conditions. After icing intervention, the boxers were measured again for their balance performance.

**RESULT:** In the sensory organization test (SOT), statistic significance was showed in conditions 1, 2, 6 and composite score of the main group effect, conditions 3, 4, 6 and composite score of the main pre-post effect, and all condition except condition 5 and composite score of the interaction effect. No statistic significance was noted in sensory analysis. In post-hoc analysis for significant interaction, significant pre-post effect occurred mainly in the icing group. No significant group difference occurred before icing, but significant group difference did after icing.

**CONCLUSION:** Icing over the sternoclavicular joints of the weight lifting sportmen may help their balance performance in terms of SOT.

3078 Board #43 June 1 2:00 PM - 3:30 PM

**Clinical Examination Of The Shoulder In A Group Of Disabled Athletes In Wheelchair**

Bruno Sesboue<sup>1</sup>, Bertrand Bouju<sup>1</sup>, Jean-Yves Guinestre<sup>1</sup>, Christophe Hulet<sup>2</sup>. <sup>1</sup>IRMS, CAEN, France. <sup>2</sup>Orthopedic Surgery, CAEN, France.  
(No relationships reported)

The prevalence of the use of a wheelchair, manual or electric, in 1999 was 62 per 10,000 inhabitants in France, about 361,000 users. The shoulder joint is the one most often complain manual wheelchair users.

**PURPOSE:** The aim of this work is to justify an assessment of the shoulder in the follow-up of the disabled to prevent the occurrence of lesions that cause a major degradation of their autonomy or, alternatively, to take charge as soon as these injuries.

**METHODS:** Twelve disabled athletes, 10 males and 2 females (yrs: 46.5 ± 11.5, weight: 71.4 ± 16.5 kg, in wheelchair since 16.4 ± 8.1 yrs) volunteered for this study and signed an informed consent. They were handbikers (9) or basketball players (3), in leisure or in competition. They were all right-handed. We have done a clinical examination and an evaluation of Constant's score and DASH (disabilities of the arm, shoulder and hand) score. We have also made an echography of the joints, always by the same operator.

**RESULTS:** Seven sportsmen reported a painful episode earlier and 6 had a current pain. 10 had signs of injury of the rotator cuff and 6 signs of impingement. The Constant's score was not different for the right arm and for the left one (99 vs 92; p > 0.05) and the DASH score was at 8.83. There was an aspect of ultrasonic lesion for 8 patients. In the literature, pain is present in 31 to 73% (50% in this study) of the subjects and rotator cuff lesions in 66% vs 92% in our sample. Functional scores seem less pertinent for disabled sportsmen likely because of their strength and of a high pain threshold.

**CONCLUSIONS:** Because of this high prevalence of shoulder pain, we think that the clinical examination of the shoulder has to be incorporated to the annual assessment of disabled sportsmen. We have also to educate sportsmen to accomplish the good movement on the wheelchair.

3079 Board #44 June 1 2:00 PM - 3:30 PM

**Benefits of Partnered Strength Training in Couples Coping with Prostate Cancer: The Exercising Together Project**

Kerri M. Winters-Stone, FACSM, Karen S. Lyons, Jessica Dobek, Lillian M. Nail, Jill A. Bennett, Tomasz M. Beer. Oregon Health & Science University, Portland, OR.  
(No relationships reported)

Prostate cancer impacts not only the patient but also the family and particularly, spouses that provide care. Physical health is compromised in prostate cancer survivors (PCS) and in spouse caregivers, but no intervention has addressed this problem in both partners simultaneously.

**PURPOSE:** To evaluate the benefits of a 6-month partnered strength-training program, Exercising Together (ET), on physical function and body composition in PCS and spouses.

**METHODS:** 64 couples, consisting of an older PCS (>60 years old) and his spouse, were randomized to the ET program or usual care (UC). Data from couples completing the study were used for preliminary analysis (ET: n=32, UC: n=27). Outcomes were upper and lower body strength measured by 1-RM bench press (BPmax; lbs) and leg press (LPmax; lbs) and timed 5-time chair rise and sit (CHAIR; sec); gait by 4m walk speed (UW; m/s); physical function by the physical performance battery (PPB); and body composition by DXA (% body fat (%BF); lean mass (LM; kg), fat mass (FM; kg). Repeated measures ANCOVA, controlling for age, tested for significant group differences over time on each outcome within patients and spouses. The impact of androgen deprivation therapy (ADT) on patient outcomes was explored by repeating analyses excluding men on ADT (n=11).

**RESULTS:** Among the full sample of PCS significant group differences were found for BPmax only (p<0.03); however, when excluding PCS on ADT, significant group differences were found for BPmax (ET: +13.0 lbs vs. UC: +6.1 lbs, p<0.03); LPmax (ET: +12.8 lbs vs. UC: +3.9 lbs, p<0.01) and %BF (ET: -0.7% vs. UC: +0.2% p=0.04). Among spouses, significant group differences were found for BPmax (ET: +8.0 lbs vs. UC: -0.2 lbs; p<0.001), LPmax (ET: +11.7 lbs vs. UC: +2.3 lbs; p<0.001), CHAIR (ET: -1.1 sec vs. UC: +0.3 sec; p<0.03), and PPB (ET: +0.5 vs. UC: -0.1; p<0.03), with near significance for LM (ET: +0.6 kg vs. UC: -0.1 kg; p=0.05).

**CONCLUSIONS:** Our preliminary analysis suggests that Exercising Together may be an effective and efficient strategy to maintain physical health in couples coping with prostate cancer.

Supported by NIH grant R21 CA137272

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**3080** Board #45 June 1 2:00 PM - 3:30 PM

**Lack of Endogenous Pain Inhibition During Exercise In People With Chronic Whiplash: An Experimental Study**

Jessica Van Oosterwijk<sup>1</sup>, Jo Nijs<sup>1</sup>, Mira Meeus<sup>1</sup>, Michel Van Loo<sup>2</sup>, Lorna Paul<sup>3</sup>. <sup>1</sup>Vrije Universiteit Brussel, Brussel, Belgium. <sup>2</sup>Red Cross, Antwerp, Belgium.

<sup>3</sup>University of Glasgow, Glasgow, United Kingdom. (Sponsor: Romain Meeusen, FACSM)

(No relationships reported)

Evidence for altered central pain processing and central sensitization in chronic whiplash associated disorders (CWAD) is accumulating. Dysfunctional descending inhibitory action is one of the major characteristics of central sensitization and has been studied during exercise in some chronic pain conditions but no data regarding the response of people with CWAD to exercise are available.

**PURPOSE:** To examine the efficacy of endogenous pain inhibitory systems during exercise and exercise response in CWAD patients during two different types of exercise.

**METHODS:** Twenty-two women with CWAD and 22 healthy sedentary

controls performed a submaximal and a self-paced, physiologically limited exercise test on a cycle ergometer on two separate occasions. The exercise tests were undertaken with cardiorespiratory monitoring. Before and after the exercise bouts, subjects filled out questionnaires to assess health status, and underwent pain pressure threshold (PPT) measurements. Throughout the study, subjects' activity levels were assessed using accelerometry in order to monitor potential influences of daily activity levels. Possible changes in any of the outcome measures in response to exercise were compared between the two groups, and between the two types of exercise, using repeated measures ANOVA.

**RESULTS:** In CWAD PPTs decreased following submaximal exercise, whereas they increased in healthy subjects. The same effect was established in response to the self-paced, physiologically limited exercise, with exception of the PPTs measured at the calf which increased. A worsening of the CWAD symptom complex was reported post-exercise. Fewer symptoms were reported in response to the self-paced, physiologically limited exercise. In addition, no differences in submaximal exercise capacity or daily physical activity were observed between people with CWAD and controls.

**CONCLUSIONS:** The present study is the first to examine and suggest an impaired descending endogenous pain inhibition during exercise in CWAD patients, and hence provides additional evidence for the presence of central sensitization in CWAD. Submaximal exercise triggers post-exertional malaise, while a self-paced and physiologically limited exercise will trigger less 'severe' symptoms, and therefore seems more appropriate for CWAD patients.

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**3081** Board #46 June 1 2:00 PM - 3:30 PM

**Objective Quantification of Forces Used with Joint Play and Manual Therapy Techniques for the Shoulder**

J. E. King<sup>1</sup>, George J. Davies<sup>1</sup>, Michael Tankovich<sup>1</sup>, Cale Jacobs<sup>2</sup>, Bryan L. Riemann<sup>1</sup>. <sup>1</sup>Armstrong Atlantic State University, Savannah, GA. <sup>2</sup>ERMI Medical Devices, Atlanta, GA. (Sponsor: T. Jeff Chandler, FACSM)

(No relationships reported)

Physical therapists regularly perform joint mobilizations on patients with glenohumeral (GH) hypomobility. Currently, no studies have measured the forces applied by clinicians during GH joint mobilizations leaving a need to objectively document the actual applied forces.

**PURPOSE:** To examine the forces applied by a clinician during passive range of motion assessments (PRMA).

**METHODS:** A hand held dynamometer (LafayetteFAB12-0380) recorded force applied during each PRMA on 30 (15 males, 15 females, age 23.4±2.3yrs) subjects. Exclusion criteria: previous shoulder surgery or injury within the last year. Dominant (D) and nondominant (ND) shoulder of each subject were tested with three repetitions of four PRMA: anterior glide (AG), posterior glide (PG), external rotation (ER), and internal rotation (IR). Testing positions were randomized and data collection was blinded from the senior author who performed all PRMA. For ER and IR PRMA, forces were multiplied by the olecranon to ulnar styloid process distance to determine resulting torques. Average forces across the three repetitions for each PRMA were computed along with correlational analyses between each PRMA with height, mass, and body mass index. Separate gender by limb ANOVA were conducted for each PRMA; statistical significance considered  $\alpha < .05$ .

**RESULTS:** No significant relationships for any of the correlational analyses ( $r = -.27$  to  $.23$ ). No significant differences between genders. No statistically significant differences between limbs for ER (D=15.3±5.0Nm, ND=14.1±3.7Nm,  $P=.072$ ) and IR (D=13.4±3.4Nm, ND=13.2±3.6 Nm,  $P=.482$ ) PRMA. For both the AG (D=124.5±15.7kg, ND=131.3±16.7,  $P=.051$ ) and PG (D=184.2±28.2 kg, ND=148.0±14.7kg  $P<.001$ ) PRMA, the ND was greater than the D, however, statistical significance was only attained for PG.

**CONCLUSION:** This study provides some objective data quantifying the forces and torques used during PRMA; however, further research is needed quantifying the forces clinicians apply, along with the forces needed to create a plastic deformation in non-contractile tissue with mobilization techniques for individuals with GH hypomobility. In addition, testing was performed on healthy active individuals; the extent to which these results reflect persons with pathological conditions is unknown.

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## F-24 Free Communication/Poster - Drug Use and Sport

JUNE 1, 2012 1:00 PM - 6:00 PM

ROOM: Exhibit Hall

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**3082** Board #47 June 1 3:30 PM - 5:00 PM

**Binge Drinking Following Resistance Exercise: Effect on Muscle Power Recovery**

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(No relationships reported)

Alcohol impairs recovery of isokinetic performance following muscle damaging resistance exercise but no knowledge exists regarding alcohol's effect on recovery of performance in explosive isotonic movements following resistance exercise that induces only limited muscle damage.

**PURPOSE:** To investigate the effect of alcohol on recovery from resistance exercise for explosive performance measures.

**METHODS:** Nine healthy men (Mean ± SD: 24.8 ± 3.2 years, 176 ± 7 cm, 86.4 ± 14.6 kg) completed 2 identical acute heavy resistance exercise tests (AHRET) separated by 1 week. The AHRET consisted of 6 sets of 10 repetitions of smith machine squats at 80% of 1-repetition maximum (1-RM) with 2 min of rest between sets. From 10-20 minutes post-AHRET participants

consumed either 190 proof grain alcohol (EtOH) equal to 1.086 g of alcohol per kg lean mass (82-122 ml total) or no alcohol (Placebo) diluted in an artificially sweetened and calorie free beverage. The participants were blinded to conditions and the order of conditions was counter-balanced. Blood alcohol concentration (BAC) was measured using a breathalyzer. Sixty-five minutes pre-exercise, participants ingested a meal replacement beverage (33.5 kJ per kg body mass). Before the AHRET (PRE) and the following morning (AM), participants performed three high pulls and three bench press throws with 30% of 1-RM, and 10 consecutive vertical jumps, all at maximal effort. Peak power was measured for all exercises. Muscle soreness was measured using analog scales at PRE and AM.

**RESULTS:** BAC peaked 60-90 min post-exercise in all participants ( $0.084 \pm 0.017$  g·dl<sup>-1</sup>) on alcohol ingestion days. No effect of alcohol was found for peak power in the high pull (EtOH, PRE:  $1658 \pm 432$  W, AM:  $1659 \pm 260$  W; Placebo, PRE:  $1599 \pm 397$  W, AM:  $1579 \pm 301$  W), bench press throw (EtOH, PRE:  $1120 \pm 276$  W, AM:  $1105 \pm 295$  W; Placebo, PRE:  $1119 \pm 202$  W, AM:  $1089 \pm 257$  W), or vertical jump (EtOH, PRE:  $52.6 \pm 13.5$  W·kg<sup>-1</sup>, AM:  $48.5 \pm 6.3$  W·kg<sup>-1</sup>; Placebo, PRE:  $52.2 \pm 9.4$  W·kg<sup>-1</sup>, AM:  $47.9 \pm 9.0$  W·kg<sup>-1</sup>). Leg soreness increased moderately from PRE to AM with no difference between conditions.

**CONCLUSION:** A moderate BAC does not appear to affect explosive upper or lower body power capability on the morning following a heavy squat session that induces only limited muscle damage.

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**3083** Board #48 June 1 3:30 PM - 5:00 PM

**Oral Nicotine Administration Affects Muscular Force and Anaerobic Performance but Not Vertical Power.**

Toby Mündel, Marine Machal. *Massey University, Palmerston North, New Zealand.* (Sponsor: Timothy Derek Mickleborough, FACSM)

(No relationships reported)

We have previously demonstrated that nicotine administration improves cycling time to exhaustion but does not influence 1h cycling time-trial performance. Nicotine remains neither a banned substance nor restricted (i.e. available over-the-counter), but since previous studies only assessed endurance exercise performance we sought to determine whether shorter duration exercise might be influenced by prior nicotine administration.

**PURPOSE:** To determine whether acute oral nicotine administration affects measures of muscle force, vertical power or anaerobic performance.

**METHODS:** Nine physically active males ( $24 \pm 3$  y;  $78 \pm 15$  kg;  $179 \pm 13$  cm) completed three trials in which 30 min prior to testing subjects chewed 2 mg (LO) or 4 mg (HI) of nicotine gum or a flavor-matched placebo (PLA) gum, the order of which was randomized. During each trial, measures of peak and average peak isometric, concentric and eccentric leg extensor force were made followed by 3 vertical counter-movement jumps and a 30 sec Wingate test. Heart rate was measured before and after administration and venous blood samples were obtained for determination of pH, HCO<sub>3</sub><sup>-</sup> and to confirm the presence of nicotine.

**RESULTS:** No order effects were observed for any performance or physiological data, whilst nicotine was confirmed ( $n = 3$ ). Peak and average peak isometric and eccentric force were significantly affected (LO > PLA; all  $p < 0.05$ ) whilst peak and average peak concentric force were similar across trials (both  $p > 0.05$ ). Counter-movement jump height was similar across trials ( $p > 0.05$ ). Peak power (LO < PLA;  $p < 0.05$ ) and anaerobic fatigue (LO & HI < PLA;  $p < 0.05$ ) during the Wingate test were significantly affected but anaerobic capacity remained similar across trials ( $p > 0.05$ ). pH and HCO<sub>3</sub><sup>-</sup> showed similar responses across trials (both  $p > 0.05$ ) although both were reduced following the Wingate (both  $p < 0.05$ ), whilst heart rate was significantly affected (LO & HI > PLA; both  $p < 0.05$ ).

**CONCLUSION:** 2 mg nicotine administration via gum 30 min prior to exercise significantly improved isometric and eccentric leg extensor force and reduced anaerobic fatigue and peak power during a 30 sec Wingate test.

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**3084** Board #49 June 1 3:30 PM - 5:00 PM

**Sports Activity And Use of Tobacco Products Among Young Males in Finland in 1999-2010**

Matti J. Mäntysaari<sup>1</sup>, Ville Mattila<sup>2</sup>, Susanna Raisamo<sup>3</sup>, Harri Pihlajamäki<sup>4</sup>, Arja Rimpelä<sup>3</sup>. <sup>1</sup>*Aeromedical Centre, Helsinki, Finland.* <sup>2</sup>*Tampere University Hospital, Tampere, Finland.* <sup>3</sup>*University of Tampere, Tampere, Finland.* <sup>4</sup>*University of Helsinki, Helsinki, Finland.*

(No relationships reported)

Certain types of sport have been suggested to explain differences in youth tobacco use, e.g. in USA smokeless tobacco has been linked to baseball.

**PURPOSE:** The association between sports activity (intensity and type of sport) and the current use of snus (Swedish snuff), cigarette smoking, and the combined use of these tobacco products (dual use) was studied among young Finnish males.

**METHODS:** 16,746 male conscripts completed a survey during the first days of their conscription during the years 1999-2010 (median age 19, response rate 95%). Main outcome measures were self-reported daily/occasional use of snus, cigarette smoking, and dual use. Logistic regression analysis was used to assess the association between sport activity, type of sport, and several socio-economic background variables.

**RESULTS:** Over the study period (1999-2010), cigarette smoking decreased from 42% to 34%, snus use increased from 5% to 12%, and dual use increased from 7% to 13% ( $p < 0.001$ ). Regular competitive sports training (defined as high-intensity sports activity) was positively associated with use of snus (odds ratio [OR] 10.2; 95% confidence interval [CI]: 7.8-13.5) and negatively with cigarette smoking (OR 0.2; 95% CI: 0.1-0.3). In multivariate models team sports were clearly associated use of snus. Ice hockey showed the strongest association with snus use (OR 1.6; 95% CI: 1.4-1.9) and dual use (OR 2.0; 95% CI 1.8-2.3), followed by other team sports for snus use (OR 1.5; 95% CI: 1.3-1.8) and dual use (OR 1.8; 95% CI: 1.6-2.0).

**CONCLUSIONS:** The intensity and type of training were clearly associated with snus use. Competitive sports training was positively associated with use of snus. Team sports were associated with increased use of snus and combined use of snus and cigarettes. These findings should be taken into account when planning and implementing preventive strategies.

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**3085** Board #50 June 1 3:30 PM - 5:00 PM

**The Effects of Momordica Charantia Supplement Diets and Endurance Training on Bone Material in Rats**

Ting-yu Lin<sup>1</sup>, Young-Yu Liang<sup>1</sup>, Tsang-Hai Huang<sup>1</sup>, Sandy S. Hsieh<sup>2</sup>, Hung-Hao Wang<sup>2</sup>. <sup>1</sup>*National Cheng Kung University, Tainan, Taiwan.* <sup>2</sup>*National Taiwan Normal University, Taipei, Taiwan.*

(No relationships reported)

Momordica charantia (MC) supplement has been verified regarding its capability in activating peroxisome proliferate-activated receptors (PPARs) downstream pathways. PPAR downstream pathways are related to skeletal homeostasis. Thus, it would be valuable to investigate MC supplement on bone metabolism. Besides, whether regular exercise interacts with MC on bone metabolism is also unknown.

**PURPOSE:** To investigate the effects of endurance exercise (EXE) and MC supplement diets on bone qualities in growing rats.

**METHODS:** Seventy-two male SD rats (7 weeks old) were randomly divided into six groups, which were the 0%MC, 5%MC, 8%MC, 0%MC+EXE, 5%MC+EXE, and 8%MC+EXE groups ( $n=12$  for each). After six-week experimental period, all animals were sacrificed. Bone samples were collected and stored for biomechanical properties analysis. Two-way (MC×EXE) ANOVA was used for statistical analysis ( $\alpha=.05$ ).

**RESULTS:** In exercise main effect, exercise groups showed significantly lower body weight (g) (EXE:  $393.0 \pm 6.6$  < non-EXE:  $422.0 \pm 6.6$ ,  $p < 0.05$ ) and lower epididymis fat tissue weight (g) (EXE:  $0.96 \pm 0.06$  < non-EXE:  $1.64 \pm 0.06$ ,  $p < 0.05$ ). In MC main effects, the MC supplement groups showed significant lower values in cortical bone thickness (mm) (8%MC:  $0.69 \pm 0.10$  & 5%MC:  $0.70 \pm 0.10$  < 0%MC:  $0.74 \pm 0.10$ ,  $p < 0.05$ ), the area of cortical bone (mm<sup>2</sup>) (8%MC:  $7.92 \pm 0.15$  & 5%MC:  $8.29 \pm 0.15$  < 0%MC:  $8.76 \pm 0.16$ ,  $p < 0.05$ ), the area of total cross section (mm<sup>2</sup>) (8%MC:  $13.65 \pm 0.32$  & 5%MC:  $14.06 \pm 0.32$  < 0%MC:  $14.99 \pm 0.33$ ,  $p < 0.05$ ), and yield load (N) (8%MC:  $117.1 \pm 2.9$  & 5%MC:  $117.7 \pm 2.9$  < 0%MC:  $128.4 \pm 3.0$ ,  $p < 0.05$ ). Regarding MC×EXE interaction, significant level was shown in fracture load (N) (*post hoc* comparison of simple main effects: 5%MC:  $130.3 \pm 30.8$  < 5%MC+EXE:  $143.5 \pm 13.1$ ; 0%MC:  $171.0 \pm 22.6$  > 5%MC:  $130.3 \pm 30.8$  & 8%MC:  $137.0 \pm 16.0$ ,  $p < 0.05$ ), stiffness (0%MC:  $300.8 \pm 75.1$  > 0%MC+EXE:  $249.3 \pm 30.0$ ; 5%MC:  $220.1 \pm 37.9$  < 5%MC+EXE:  $254.3 \pm 55.3$ ; 0%MC:  $300.8 \pm 75.1$  > 5%MC:  $220.1 \pm 37.9$  & 8%MC:  $232.5 \pm 37.0$ ,  $p < 0.05$ .) and cross-sectional moment of inertia (0%MC:  $12.35 \pm 3.10$  > 5%MC:  $9.34 \pm 1.58$  & 8%MC:  $9.17 \pm 1.93$ ,  $p < 0.05$ ).

**CONCLUSIONS:** There seemed to be negative effects of the MC supplement diets on bone materials. Endurance exercise showed modification on MC's effects in bone material.

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**3086**     *Board #51*     **June 1**     **3:30 PM - 5:00 PM**

**Stage Specific Effects Of Curcumin On Intestinal Polyp Development In ApcMin/+ Mice**

Jamie L. McClellan, Jennifer L. Steiner, Reilly Enos, J. Mark Davis, FACS, E. Angela Murphy. *University of South Carolina, Columbia, SC.*  
(No relationships reported)

Numerous pre-clinical studies argue for curcumin's chemopreventive potential in colon cancer. In fact, we recently reported that curcumin can reduce polyp size and number in the Apc<sup>Min/+</sup> mouse model of intestinal tumorigenesis. However, there is no evidence on its stage-specific effects in colon cancer.

**PURPOSE:** Our overall purpose was to conduct a prevention study (to reduce disease incidence), intervention study (to reduce disease progression in animals with incident disease), and prevention plus intervention study (to examine the prevention to progression continuum) with a 0.2% curcumin diet.

**METHODS:** Male Apc<sup>Min/+</sup> mice were randomly assigned to either placebo or 0.2% curcumin diet. Mice were further assigned to their specific treatment stage as follows: Prevention (4-11 wks), Intervention (11-18wks), or Prevention + Intervention (4-18 wks). Tissues were collected at 18 weeks of age and intestines were analyzed for polyp number and size (>2 mm, 1-2 mm, and <1 mm).

**RESULTS:** The Prevention treatment reduced overall intestinal polyps by 26% (P<0.05) that was largely attributed to a decrease in the number of medium sized polyps (52%) (P<0.05). Similarly, the Prevention + Intervention treatment reduced total polyps by 26% (P<0.05) and medium polyps by 44% (P<0.05). However, the Intervention treatment increased overall polyp number by 56% (P<0.05), medium sized polyps by 47% (P<0.06) and large sized polyps by 62% (P<0.05).

**CONCLUSION:** While curcumin's chemopreventive effects in colon cancer have been well documented there have been no studies that have examined the stage-specific responses. We show a beneficial effect of curcumin on polyp progression when administered as a Prevention or Prevention + Intervention treatment. However, administration of curcumin as an Intervention results in an increase in polyp number and size. These findings highlight the importance of examining stage-specific effects of various bioactive dietary components in order to determine appropriate timing of effective treatment.

This work was supported by a grant from the National Cancer Institute (R21 CA135377) to E.A.M.

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**3087**     *Board #52*     **June 1**     **3:30 PM - 5:00 PM**

**Prevalence of Combining ADHD Medications with Exercise Among College Students**

Jennifer M. Rivero, Kirsten Granados, Richard Viskochil, Cameron C. Carter, Barry Braun, FACS. *University of Massachusetts, Amherst, MA.*  
(No relationships reported)

Attention-deficit/hyperactivity disorder (ADHD) is commonly treated using stimulant medications. Use of these medications in combination with intense and/or prolonged exercise can elevate body temperature and blood pressure more than exercise alone. It is well documented that ADHD medications are used without a prescription on college campuses for the purposes of enhancing academic performance, frequently in conjunction with energy drinks that are typically high in caffeine. Combining exercise with ADHD medications and energy drinks may be dangerous but the scope of the potential problem is unknown.

**PURPOSE:** To determine the prevalence of college students who exercise while using ADHD medications, with or without energy drinks, on the University of Massachusetts Amherst campus.

**METHODS:** 10,000 full-time undergraduate students at the University of Massachusetts, Amherst were randomly selected from a list generated by the University's Registrar office. These students were invited (via e-mail) to participate in an online survey. The survey was composed of 5 questions regarding the use of ADHD medications and frequency with which students combined them with exercise and/or energy drinks.

**RESULTS:** 517 students (5.2%) responded to the surveys sent. 25.3% of respondents reported taking ADHD medications, of which 71.0% (18.0% of total respondents) reported taking them without a prescription. Of the 93 students who took ADHD medications without a prescription, 37 reported combining the medications with exercise and 19 of those students reported also consuming an energy drink within 3 hours of exercising.

**CONCLUSION:** Although preliminary, data from over 500 undergraduate students at UMass Amherst suggests that 7.1% (1,526 students if the sample is representative) are exercising while using ADHD medications without a prescription. With so many students using ADHD medications with no medical oversight, understanding the potential health risks of combining these medications with exercise and energy drinks is imperative.

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**3088**     *Board #53*     **June 1**     **3:30 PM - 5:00 PM**

**Erythropoietin Administration Acutely Stimulates Resting Energy Expenditure In Healthy Young Men**

Britt Christensen, Mikkel H. Vendelbo, Thomas Krusenstjerna-Hafstrom, Michael Madsen, Steen B. Pedersen, Niels Jessen, Niels Moller, Jens Otto L. Jorgensen. *Aarhus University Hospital, Aarhus C, Denmark.*  
(No relationships reported)

**PURPOSE:** Treatment with recombinant human erythropoietin (rHuEpo) improves insulin sensitivity in patients with end-stage renal disease. Furthermore, animal studies indicate that Epo increases fat oxidation. However, the metabolic effects of rHuEpo have never been experimentally studied in healthy humans. The aim was to investigate the effects of an acute rHuEpo bolus on substrate metabolism and insulin sensitivity in healthy young men.

**METHODS:** Ten healthy young men (Age: 23 ± 0.7, BMI: 23.5 ± 0.4 kg/m<sup>2</sup>, Hemoglobin: 9.5 ± 0.2 mmol/l, Hematocrit: 44.8 ± 0.6 %) were recruited after written informed consent in accordance with the declaration of Helsinki. They were studied in a single-blinded, randomized, cross-over design with a 2-week wash-out period and received 400 IU/kg rHuEpo or placebo on two separate occasions. Substrate metabolism was evaluated by indirect calorimetry and amino acid and glucose tracer infusions, insulin sensitivity with a hyperinsulinemic euglycemic clamp, and PCR and western blotting was performed on skeletal muscle biopsies measured protein expression and content, respectively.

**RESULTS:** Resting energy expenditure (REE) increased significantly after rHuEpo [Basal; 1863.3 ± 67.2 (kcal/day) (placebo) vs. 2041.6 ± 81.2 (rHuEpo) p<0.001, Clamp; 1903.9 ± 68.3 (placebo) vs. 2015.7 ± 114.4 (rHuEpo), p=0.03]. This increase in REE could not be explained by changes in mRNA levels of uncoupling protein 2 or 3. Fat oxidation in the basal state tended to be higher after rHuEpo, and the relative degree of suppression of fat oxidation during the clamp was higher during rHuEpo treatment as compared to placebo [Basal; 0.71 ± 0.06 (mg/kg/min) (placebo) vs. 0.97 ± 0.10 (rHuEpo) p=0.053, Clamp; 0.44 ± 0.07 (placebo) vs. 0.55 ± 0.10 (rHuEpo), p=0.401, Interaction: p=0.033]. These changes could not be explained by changes in mRNA levels of CPT1 and PPARα, or AMPK and ACC protein phosphorylation, all proteins involved in fat metabolism. Insulin stimulated glucose disposal, glucose metabolism, and whole-body and forearm protein metabolism did not change significantly in response to rHuEpo.

**CONCLUSIONS:** A single injection of rHuEpo acutely increases REE in healthy human subjects. This calorogenic effect is not accompanied by distinct alterations in the pattern of substrate metabolism or insulin sensitivity.

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**3089**     *Board #54*     **June 1**     **3:30 PM - 5:00 PM**

**Australian Coaches' Knowledge Of Prohibited Substances And The Wada Anti-doping Policy**

Rhonda Orr, Matthew Grassmayr, Rona Macniven, Anne Grunseit, Adrian Bauman, Cloe Cummins. *The University of Sydney, Sydney, Australia.* (Sponsor: Mike Climstein, FACS)  
(No relationships reported)

Athletes consult coaches as a trusted source of knowledge about performance enhancing and prohibited substances and anti-doping. Yet, little is documented of coaches' knowledge in these areas.

**PURPOSE:** To determine Australian coaches' knowledge of the WADA Prohibited Substances List and Anti-Doping Policy.

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**METHODS:** A psychometrically tested questionnaire with mostly close-ended questions (yes/no/not sure) (91%) was used. A list of 30 substances comprising prohibited, recreational, nutritional and therapeutic substances and methods were required to be identified as banned at all times, banned in competition only or Don't Know in accordance with the WADA Prohibited Substances List. Questions probed knowledge of the Monitoring Program, aspects of the Code and penalties for doping violations.

**RESULTS:** Participants comprised 338 coaches of athletes competing at International (32%), National (29%) or State or First Division (39%) levels across a range of 22 team and individual sports, most commonly athletics, swimming and basketball. Coaches demonstrated generally limited knowledge of the prohibited status of 30 listed substances. Overall 34% correctly identify the banned status of substances and 26% did not know. Coaches were most knowledgeable about the banned status of Anabolic Steroids, Growth Hormone, Erythropoietin, Caffeine, Alcohol and Blood Doping. More than 68% of coaches incorrectly believed that the recreational substances Amphetamines, Cocaine, Ecstasy, Heroin and Marijuana were banned at all times according to the WADA List. Poor awareness was displayed for prohibited therapeutic medications such as Diuretics, Opioids, Beta Blockers, Beta 2 Agonists and Insulin, where responses ranged from 0 to 48% correct. Seventy percent of respondents knew the penalty for doping violations in their sport, 50% believed that banned substances could be taken by an athlete if prescribed by a doctor and 31% did not know whether all substances on the Prohibited List were performance enhancing. Only 22% knew what the Monitoring Program was.

**CONCLUSION:** Coaches demonstrated limited, but variable, knowledge of the prohibited status of substances and inconsistent knowledge of aspects of the Anti-Doping Policy. It is essential that coaches also be provided with targeted educational resources in these key areas.

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## F-25 Free Communication/Poster - Exercise and Aging I

JUNE 1, 2012 1:00 PM - 6:00 PM

ROOM: Exhibit Hall

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**3090** Board #55 June 1 2:00 PM - 3:30 PM

### Accelerometer-determined Physical Activity And Lower Body Muscle Distribution In Japanese Women

Naotoshi Mitsukawa<sup>1</sup>, Madoka Ogawa<sup>2</sup>, Mark Loftin, FACSM<sup>3</sup>, Takashi Abe<sup>4</sup>. <sup>1</sup>Toyo Gakuen University, Nagareyama, Japan. <sup>2</sup>University of Tokyo, Kashiwa, Japan. <sup>3</sup>University of Mississippi, Oxford, MS. <sup>4</sup>University of Oklahoma, Norman, OK.  
(No relationships reported)

It has been reported that dual X-ray absorptiometry (DXA)-measured appendicular muscle mass is associated with daily physical activity (average step count and duration time of moderate exercise [ $>3$  METs]) in the elderly. Although age-related site-specific muscle loss was observed in the lower body, the relationship between age-related change in lower body muscle distribution and daily physical activity is unknown. **PURPOSE:** To investigate the relationship between muscle distribution of lower body and accelerometer-determined daily physical activity. **METHODS:** Fifty-one elderly women (mean age 66.0 [SD 7.1] yrs) volunteered. Muscle thickness (MTH) was measured by B-mode ultrasound at seven sites on the anterior (quadriceps [QF] 30%, 50%, and 70% of thigh length) and posterior (hamstring [HM] 50% and 70% of thigh length) aspects of the thigh and the anterior (tibialis anterior [TA] 30% of lower leg length) and posterior (triceps surae [TS] 30% of lower leg length) aspects of the lower leg. Habitual daily activities during consecutive 30 days were recorded using an accelerometer, and the exercise intensity was classified 10 graded levels from sedentary (level 0) to light (levels 1-3), moderate (levels 4-6) and vigorous (levels 7-9) exercise. Total duration time for each level of exercise intensity as well as average daily step count was calculated.

**RESULTS:** The daily step count and total duration times of light, moderate and vigorous exercise averaged 7826 (SD 3183) steps per day and 59 (SD 20), 22 (SD 17) and 2 (SD 2) min per day, respectively. Absolute MTH did not correlate ( $P>0.05$ ) to limb length. Average daily step count was positively correlated with the TA-30% MTH ( $r=0.31$ ,  $p=0.03$ ) and TS-30% MTH ( $r=0.35$ ,  $p=0.01$ ), but not the MTH of the thigh. There was no significant ( $P>0.05$ ) correlation between duration time of light exercise and MTH of the thigh and lower leg. However, duration time of moderate exercise was positively correlated ( $p<0.05$ ) with the TA-30% MTH ( $r=0.35$ ) and TS-30% MTH ( $r=0.35$ ), and vigorous exercise duration time was not only correlated ( $p<0.05$ ) with the lower leg MTH (TA-30%,  $r=0.30$ ; TS-30%,  $r=0.28$ ), but also with QF-50% MTH ( $r=0.29$ ).

**CONCLUSIONS:** Amount of daily step count and moderate/vigorous exercise duration are associated with lower leg MTH. Quadriceps MTH is only associated with vigorous exercise.

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**3091** Board #56 June 1 2:00 PM - 3:30 PM

### Effects Of Salsa Dance Training On Measures Of Balance And Muscle Power In Older Adults

Thomas Muehlbauer<sup>1</sup>, Urs Granacher<sup>1</sup>, Stephanie A. Bridenbaugh<sup>2</sup>, Madeleine Wolf<sup>3</sup>, Ralf Roth<sup>3</sup>, Yves Gschwind<sup>2</sup>, Irene Wolf<sup>2</sup>, Rui Mata<sup>3</sup>, Reto W. Kressig<sup>2</sup>. <sup>1</sup>Friedrich-Schiller-University Jena, Jena, Germany. <sup>2</sup>Basel University Hospital, Basel, Switzerland. <sup>3</sup>University of Basel, Basel, Switzerland.  
(No relationships reported)

Deficits in static and particularly dynamic postural control as well as in muscle power have frequently been associated with an increased risk of falling in older adults. Salsa dancing involves moves that are challenging for both postural control and leg muscle strength/power and may thus have great potential for the promotion of balance and muscle power in older adults.

**PURPOSE:** The objective of this study was to investigate the effects of salsa dancing on measures of static/dynamic postural control and leg extensor power in healthy seniors.

**METHODS:** Twenty-eight physically active (~12 h/week) older adults were randomly assigned to an intervention group (INT;  $n = 14$ ; age  $71.6 \pm 5.3$  years; 9 females, 5 males) that conducted an 8 week progressive salsa dancing program (2 times/week) or a control group (CON;  $n = 14$ ; age  $68.9 \pm 4.7$  years; 8 females, 6 males). Static postural control was measured during one-legged stance on a balance platform and dynamic postural control was obtained while walking on an instrumented walkway. Leg extensor power was assessed during a countermovement jump on a force plate.

**RESULTS:** Program compliance was excellent with participants of the INT group completing 92.5% of the dancing sessions. A tendency towards an improvement in selected measures of static postural control (11-13%,  $p = 0.09$ ) was observed in the INT group as compared to the CON group. Significant Group x Test interactions were found for stride velocity (11%,  $p < 0.01$ ), for stride length (6%,  $p < 0.01$ ), and for stride time (4%,  $p < 0.01$ ) in favor of the INT group. However, salsa dancing did not have significant effects on various measures of gait variability (4-11%, all  $p > 0.05$ ) and leg extensor power (12%,  $p > 0.05$ ).

**CONCLUSIONS:** Salsa dance training proved to be a safe and feasible exercise program for older adults accompanied with a high adherence rate. Age-related deficits in measures of static and particularly dynamic postural control can be mitigated by salsa dancing in older adults. Program parameters (e.g., duration/frequency of dance training) as well as the high initial physical activity level of our participants could be responsible for the non-significant findings in gait variability and leg extensor power.

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**3092** Board #57 June 1 2:00 PM - 3:30 PM

### Relationship Between The Habit Of Exercise And Sense Of Coherence Among Retired Males In Japan

Shintaro Endo, Hidetoshi Kanou, Kazuo Oishi. Rikkyo University, Niiza-shi, Japan.  
(No relationships reported)

Former studies have pointed out that retirement is a serious life event for Japanese men. The habit of exercising is one approach with potential to solve the problem. As well as its physical benefits, it is suggested that the habit may influence the improvement of elder people's quality of life (QOL), influencing elements such as purpose in life with a beneficial effect on their health. Recently, Sense of Coherence (SOC) has been examined attention as a life factor related to health. SOC is thought to exist in individuals with experience of extreme stressors that nonetheless can maintain psychophysical health. Former studies reported that strong SOC and the habit of exercising were related in older people. However, it has not been clarified what factors are associated with SOC and the habit of exercising in retired men.

**PURPOSE:** The purpose of this study was to clarify whether to the habit of exercising among retired males in Japan affects their SOC.

**METHODS:** The subjects were 260 retired Japanese males (mean age  $66.9 \pm 4.0$  years) living in metropolitan areas. The Japanese version of SOC-3 (Togari et al., 2007) was used to estimate the level of SOC. Additional questions were asked concerning the habit of exercising (e.g., "How frequently and how long have you taken part in exercising?" "What did you get from continuing to take part in exercising?").

**RESULTS:** Subjects were divided into two groups: one with the habit (HS) and the other without the habit (NS) of exercising. A Mann-Whitney test showed that the SOC score in the HS group ( $n = 182$ , mean  $\pm$  SD:  $9.0 \pm 2.1$ ) was significantly higher than that in the NS group ( $n = 78$ , mean  $\pm$  SD:  $8.3 \pm 2.1$ ) ( $U = 5696$ ,  $p < 0.05$ ). Multiple-regression analysis showed the enhancement of respondents' sense of fulfillment ( $\beta = 0.24$ ,  $p < 0.01$ ) and the improvement of their life skills ( $\beta = 0.24$ ,  $p < 0.01$ ), were positively associated with SOC ( $R^2 = 0.12$ ,  $p < 0.001$ ) individually. Therefore, these two experiments might show that SOC is enhanced by exercising.

**CONCLUSIONS:** These results suggested that successful experiences such as getting a sense of fulfillment and improved life skills through the habit of exercising enhanced SOC.

**Reference:** Togari T. et al. (2007) Development of a short version of the Sense of Coherence scale for population survey. *Journal of Epidemiology and Community Health*, 61: 921-922.

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**3093** Board #58 June 1 2:00 PM - 3:30 PM

### Effect Of Practicing Tai Chi On Postural Control Depends On Levels Of Skill Mastery

Katsuhiko Amano<sup>1</sup>, Shigenobu Yamaguchi<sup>1</sup>, Kenji Nishihata<sup>2</sup>, Kazuo Funato<sup>3</sup>, Hiroshi Fujinaga<sup>4</sup>. <sup>1</sup>Kanto Gakuen University, Ohta, Japan. <sup>2</sup>Kobe International University, Kobe, Japan. <sup>3</sup>Nippon Sport Science University, Tokyo, Japan. <sup>4</sup>Wakayama University, Wakayama, Japan.

(No relationships reported)

**PURPOSE:** It is well known that Tai Chi (TC) practice helps the elderly maintain or enhance postural control ability. In the present study we have demonstrated that such an effect does not necessarily depend on the number of years of practice, but on the level of mastery of fundamental TC movements.

**METHODS:** Thirty-six female TC practitioners (aged 55 to 74 yrs) participated in this study. They were classified into the three groups consisting of 12 experts (Ex), 12 semi-experts (sEx) and 12 non-experts (N). The experts and semi-experts have passed qualifying tests for instructorship in their TC organization. Passing the expert-level of qualifying tests requires practitioners to master the 24 fundamental TC movements and postures and to have the ability to teach them. The semi-experts are required to be able to perform the movements and postures accurately. The subjects were instructed to close their eyes and stand still for 30 seconds on a pressure-sensitive foot analysis platform (WINPOD, Medicauteurs CO., LTD., France) with one leg or two legs. The fluctuations of center of foot pressure (COP) were recorded at a frequency of 10 Hz. Detrended fluctuation analysis was used to compute a scaling exponent  $\alpha$ . The rectangular area (AREA) and the total length (LNG) of COP trajectories were calculated with the WINPOD software.

**RESULTS:** In two-leg standing, no significant correlations were found between the COP variables ( $\alpha$ , AREA, LNG) and the number of years of TC practice and no significant differences were found in the COP variables among the three groups (LNG: Ex 271mm, sEx 224mm, N 228mm, ns). On the other hand, there were significant differences in the COP variables among the three groups in one-leg standing (LNG: Ex 399mm, sEx 472mm, N 573mm,  $p < 0.05$ ). And there were significant differences in the scaling exponent  $\alpha$  between Ex and N ( $0.98 \pm 0.05$  vs  $0.83 \pm 0.07$ ,  $p < 0.05$ ).

**CONCLUSIONS:** These results suggest that (1) the beneficial effect of practicing TC on postural stability in elderly women might depend on the quality of TC training, not necessarily on years of practice and (2) a one-leg standing test provides more useful information to assess dynamic control processes of the postural system.

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**3094** Board #59 June 1 2:00 PM - 3:30 PM

### First Step To Active Health - Online Plus: Pilot Study

Nicole L. Rogers, Sahar Amini, Mindy Slimmer. *Wichita State University, Wichita, KS.* (Sponsor: Michael E. Rogers, FACSM)

(No relationships reported)

The Internet has a vast capacity for disseminating patient-oriented interventions to improve the quality of the nation's care. Web-based interventions provide inexpensive delivery of components of effective, but expensive interventions, such as personal feedback and individual goal-setting.

**PURPOSE:** The aim of this project is to implement, and demonstrate the efficacy of, a blended delivery multi-component physical activity program.

**METHODS:** The experimental group (FSAH-O) consisted of 30 male and females (age =  $68.7 \pm 5.5$  yrs). The control group ( $N = 15$ ;  $74.7 \pm 6.2$  yrs) was drawn from a similar project. The program consisted of flexibility, strength, and balance training, and cardio-respiratory activity. Participants met 1 day/week for 8 weeks for 50 minutes of exercise at a senior center while supplementing class with home exercise 2 days/week. Participants were given access to a program web site (a user-friendly, interactive, secure, online method to motivate, educate, and track activity). Program effectiveness was assessed using the Senior Fitness Test (SFT) (chair stand, arm curl, chair sit and reach, 8-foot up & go, scratch test, and 12-min walk); balance (movement velocity (MVL), endpoint excursion (EPE), maximum EPE (MXE), and directional control (DCL) for forward (F), right (R), left (L) and back (B) movements).

**RESULTS:** No baseline difference existed between groups. Repeated measures ANOVAs revealed group x time interactions ( $p < 0.05$ ) on most measures. SFT improvements were noted in the FSAH-O group: Chair Stand 10%, Arm Curl 22%; Up-&-Go 8%; 12-min Walk 18%. With respect to LOS, EPE and MXE improved in two directions (R 21%, R 8%; L 7%, L 7%). The control group did not change on any variable.

**CONCLUSIONS:** The internet-based program successfully motivated older adults to initiate and maintain a physical activity program. Participating in an 8-week blended FSAH-O program improved FF, and 2 of 4 balance measures. Improvements were noted for most functional fitness tests. EPE and MXE balance improved in the left and right direction and there was a trend for improvement in front and back directions. A longer intervention may result in greater balance improvements.

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**3095** Board #60 June 1 2:00 PM - 3:30 PM

### Effect Of Age-related Site-specific Sarcopenia On Gait Velocity And Functional Ability

Madoka Ogawa<sup>1</sup>, Naotoshi Mitsukawa<sup>2</sup>, Mark Loftin, FACSM<sup>3</sup>, Takashi Abe<sup>4</sup>. <sup>1</sup>University of Tokyo, Kashiwa, Japan. <sup>2</sup>Toyo Gakuen University, Nagareyama, Japan. <sup>3</sup>University of Mississippi, Oxford, MS. <sup>4</sup>University of Oklahoma, Norman, OK.

(No relationships reported)

Sarcopenia induced functional impairment and physical disability has been observed in both cross-sectional and longitudinal studies. Recently we reported that sarcopenia is observed as a site-specific loss of skeletal muscle mass, especially for the quadriceps and abdominal muscles. However, it is unknown whether the site-specific sarcopenia is associated with disability of gait and physical function.

**PURPOSE:** To investigate the relationship between age-related site-specific loss of thigh muscle and functional ability and gait performance.

**METHODS:** Fifty-three relatively active women aged 52-83 years (22 middle-aged [aged 52-65 years] and 31 old [aged 66-83 years]) volunteered. Muscle thickness (MTH) was measured by ultrasound at five sites on the anterior quadriceps [QF] 30%, 50%, and 70% of thigh length and posterior (hamstring [HM] 50% and 70% of thigh length) aspects of the thigh. MTH was expressed in terms relative to thigh length (MTH/L). Maximum and usual walking speeds (began walking two meters before the start line and walked to the end of a 20 meter corridor), zig-zag walking time (walked 10 meters apart with alternating right/left direction), sit-to-stand time (performed a 10 repeated sit-to-stand), climbing stair (10 steps) test time, and maximum voluntary isometric knee extension and flexion strength (Biodex System-3) were measured.

**RESULTS:** Age was inversely correlated with the QF-50% MTH/L ( $r = -0.28$ ,  $P = 0.045$ ), but not the HM-50% MTH/L ( $r = 0.10$ ,  $P = 0.47$ ). Age was also inversely correlated with the ratio of QF/HM 50% MTH ( $r = -0.33$ ,  $P = 0.02$ ), thus the site-specific muscle loss of the thigh was observed in the present sample. There were no significant correlations ( $P > 0.05$ ) between the QF/HM 50% MTH ratio and maximum ( $r = 0.03$ ) and usual ( $r = -0.07$ ) walking speeds, sit-to-stand test ( $r = -0.12$ ), and climbing stair test ( $r = 0.08$ ). However, the QF/HM 50% MTH ratio was tended to be correlated to zig-zag walking test ( $r = -0.26$ ,  $P = 0.06$ ). In addition, the QF/HM 50% MTH ratio was also correlated with isometric knee flexion strength ( $r = 0.40$ ,  $P = 0.01$ ), but not to knee extension strength ( $r = 0.25$ ).

**CONCLUSION:** Age-related site-specific loss of thigh muscle may associate with decrease in task performance requiring agility and dynamic balance such as zig-zag walking.

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3096 Board #61 June 1 2:00 PM - 3:30 PM

### Strength and Power as Predictors of Functional Fitness for Senior Adults

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(No relationships reported)

**INTRODUCTION:** There are many physiological declines that occur with aging, two of which involve muscular strength and power. Previous research indicates that muscular power may be the better predictor of functionality for this population. Additional research should be conducted to investigate this further using a variety of functional measures. This research would assist in providing evidence for the case and help health professionals understand which health component(s) to focus on when attempting to help senior adults maintain functionality.

**PURPOSE:** The purpose of this study was to determine if strength and power are predictors of functional fitness for senior adults and if so, which the better predictor is.

**METHODS:** Forty-six senior adults over the age of 75 years completed the Short Physical Performance Battery (SPPB), hand-grip (HG) assessment, the Senior Fitness Test (SFT), chair stand power test, and one-repetition maximum (1RM) testing. SPPB, HG, and SFT were utilized as functional measures. The SPPB is a survey functional assessment evaluating balance, gait, and chair stands. Handgrip was measured with a handgrip dynamometer. The maximum of each hand was averaged as the measurement. The SFT includes chair stands (CS), arm curl (AC), 8-foot Up-and-Go (UpGo), sit-and-reach (SR), back scratch (BS), and 6-Minute walk (WALK). The chair stand power test was utilized to determine average power and involved 10 explosive chair stand trials. Lastly, six 1RM tests were combined to quantify total strength. Multiple regression analyses were conducted to determine whether strength or average power was the best predictor for functional fitness.

**RESULTS:** Strength and power were indicated as significant predictors collectively for SPPB, CS, AC, UpGo, and HG ( $p = .004, p = .001, p = .011, p = .036,$  and  $p < .001$ , respectively). When comparing power and strength, power emerged as the only significant individual predictor for SPPB, CS, AC, and UpGo ( $p = .002, p = .001, p = .042, p = .002,$  and  $p = .014$ , respectively). Conversely, total strength was indicated as the significant predictor for HG ( $p < .001$ ). Neither strength nor average power was indicated as a significant predictor for WALK, BS, and SR.

**CONCLUSION:** These results suggest that average power may be a better predictor for the functional fitness of older adults than strength.

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### Sixteen Weeks of Soccer or Strength Training Improve Physical Performance in 65-75 Year-old Untrained Males

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(No relationships reported)

Participation in recreational soccer (association football) is an effective way of improving performance levels. In addition, life-long exposure to football training has been shown to preserve explosive muscle power in elderly male football players. However, the effect of soccer training on physical performance in untrained elderly has not been investigated.

**PURPOSE:** To examine the effects of 16 weeks of recreational soccer training or explosive strength training on aerobic, intermittent and strength performance in sedentary elderly men.

**METHODS:** Twenty-four healthy, sedentary elderly men (age:  $69 \pm 0.7$  yrs) were assigned to either a soccer training group (SOG; N=9), strength training group (STG; N=9) or control group (CG; N=6). Subjects in SOG and STG trained 2x60 min per week. SOG performed small-sided soccer games (4 v 4; 4x12-min game periods). STG performed heavy load leg exercises (4x8 repetition maximum). Oxygen uptake ( $VO_2$ ), heart rate (HR) and respiratory exchange ratio (RER) were determined during an exhaustive incremental cycle exercise test. Intermittent endurance capacity was examined using the Yo-Yo intermittent endurance test level 1 (Yo-Yo IE1). Isometric maximal voluntary contraction (MVC) and rate of force development (RFD) was evaluated at 70 degree knee flexion. Values are mean  $\pm$  SEM.

**RESULTS:** After 16 weeks of training, maximum oxygen uptake was increased ( $p < 0.05$ ) in SOG ( $27.5 \pm 1.8$  vs.  $32.1 \pm 1.7$  mL\*min<sup>-1</sup>\*kg<sup>-1</sup>), but not altered in STG and lowered ( $p < 0.05$ ) in CG. RER and HR at exhaustion were not different between trials in any group. Yo-Yo IE1 performance was improved ( $p < 0.05$ ) only in SOG ( $455 \pm 92$  vs.  $588 \pm 148$  m). HR at the end of Yo-Yo IE1-test did not differ between trials. Peak RFD was improved ( $p < 0.05$ ) in STG ( $1334 \pm 175$  vs.  $1674 \pm 132$  Nm/s), but not in SOG and CG. MVC was unchanged in all groups.

**CONCLUSION:** Participation in recreational football training is an effective way of improving aerobic fitness and intermittent endurance capacity in elderly males, whereas, explosive strength training is superior to soccer training in the development of neuromuscular function in elderly.

Informed consent was obtained from all subjects. The study was supported by FIFA-Medical Assessment and Research Centre (F-MARC) and The Danish Ministry of Culture. Conflicts of interest: none declared.

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### Effects of Recreational Soccer on the Cardiovascular Risk Profile in Elderly Untrained Healthy 65-75-year-old Men

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(No relationships reported)

A sedentary lifestyle increases the risk of cardiovascular diseases and physical exercise can counteract these effects. However, the effects of soccer on the cardiovascular risk profile in elderly men have not been determined.

**PURPOSE:** To determine the effects of 16 weeks of recreational soccer on the cardiovascular risk profile in elderly healthy men.

**METHODS:** Fifteen sedentary men (age  $68.6 \pm 3.5$  years) were randomized to a soccer-training group (SG; n=9) or a control group (CG; n=6). In addition, 12 master elite soccer players (age  $69.2 \pm 3.7$  years) served as an active control group (EG). SG trained twice weekly for 45-60 min (mean 1.5 times/week, average heart rate 81 %), CG had no change in sedentary lifestyle, and EG continued with the usual soccer training (2 times/week). Testing was performed at baseline and after 16 weeks with measurements of maximum oxygen uptake ( $VO_{2max}$ ), resting heart rate, blood pressure, body composition (DEXA scan), oral glucose tolerance test (OGTT), lipid profile and vascular function with peripheral arterial tonometry.

**RESULTS:** During the study period SG reduced body mass index (BMI) ( $26.1 \pm 1.3$  to  $25.5 \pm 1.2$  kg/m<sup>2</sup>;  $p < 0.01$ ), with no change in CG and a decrease in EG ( $24.2 \pm 0.6$  to  $23.9 \pm 0.5$ ;  $p < 0.05$ ). Reductions in total body fat percentage ( $28.2 \pm 2.3$  to  $26.6 \pm 2.5$ %;  $p < 0.05$ ), android fat mass ( $37.1 \pm 3.0$  to  $34.7 \pm 3.0$  kg;  $p < 0.05$ ), and gynoid fat mass ( $31.0 \pm 2.0$  to  $28.7 \pm 2.4$  kg;  $p < 0.05$ ) were observed in SG, with no change in CG and EG. Cardiovascular fitness improved in SG with a 11% reduction of resting heart rate ( $65 \pm 3.3$  to  $58 \pm 2.2$  bpm;  $p < 0.001$ ) and 17% increase in  $VO_{2max}$  ( $27.5 \pm 1.8$  to  $32.1 \pm 1.7$  ml kg<sup>-1</sup> min<sup>-1</sup>;  $p < 0.001$ ), while  $VO_{2max}$  decreased in CG ( $29.8 \pm 1.7$  to  $27.2 \pm 1.8$  ml kg<sup>-1</sup> min<sup>-1</sup>;  $p < 0.05$ ) and EG ( $35.7 \pm 0.8$  to  $33.9 \pm 0.8$  ml kg<sup>-1</sup> min<sup>-1</sup>;  $p < 0.05$ ). Two subjects in SG had impaired glucose tolerance (IGT) at baseline, which was normalized after 16 weeks of soccer. Two subjects in CG and 2 in EG developed IGT during the study period. Lean body mass, lipid profile, vascular function, and blood pressure remained unchanged in all groups.

**CONCLUSION:** Sixteen weeks of recreational soccer improves the cardiovascular risk profile in elderly sedentary men, especially with marked increase in cardio-respiratory fitness. Recreational soccer is an attractive physical intervention aimed at reduction of cardiovascular risk.

Informed consent was obtained from all subjects. The study was supported by FIFA-Medical Assessment and Research Centre (F-MARC) and the Danish Ministry of Culture.

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### Maximal Exercise Can Be Accurately And Reliably Achieved In Healthy, Sedentary Seniors

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(No relationships reported)

Maximal aerobic power ( $VO_{2max}$ ) is generally accepted as the best measure of cardiorespiratory fitness. However, there is skepticism whether a true  $VO_{2max}$  is achievable in healthy, sedentary seniors.

**PURPOSE:** 1) Determine whether an elderly population is able to achieve previously published  $VO_{2max}$  criteria, and 2) Establish test-retest reliability of maximal metabolic and hemodynamic variables in seniors.

**METHODS:** We studied 59 healthy, sedentary senior men and women (ages  $67.5 \pm 5.4$ ).  $VO_{2max}$  was measured using the Douglas Bag (DB) method during an incremental treadmill protocol where a constant speed was established and the grade was increased 2% every two minutes. DB gas fractions were measured with a mass spectrometer. DB ventilation volume and heart rate (HR) were measured via Tissot spirometry and a 12-lead ECG, respectively. Predicted maximum HR was calculated using the formula  $210 - (0.65 \times \text{age})$ . All participants completed the identical protocol on two occasions separated by a mean of  $5.4 \pm 4.8$  weeks.

**RESULTS:** Maximal values are in the table below. In 115 of the 118 total tests performed (98%), at least two of three criteria [ $RER \geq 1.10$ ,  $VO_2$  change in last two workloads  $\leq 150$ ml/min and  $HR > 85\%$  of age predicted maximum] for  $VO_{2max}$  were achieved. Typical error expressed as a coefficient of variation (%) between visits 1 and 2 maximal values for  $VO_2$ , HR and respiratory exchange ratio (RER) were 3.9, 2.2 and 4.4, respectively.

**CONCLUSION:** The present study suggests that reliable  $VO_{2max}$  measurements are achievable in healthy, non-frail seniors. This knowledge will enhance the quality of exercise prescription in older adults.

| $VO_{2max}$ acceptance criteria | Visit1 $VO_2^*$ | Visit2 $VO_2$ | Visit1 $\Delta VO_2^{**}$ | Visit2 $\Delta VO_2$ | Pred HR | Visit1 HR | Visit2 HR | Visit1 RER | Visit2 RER |
|---------------------------------|-----------------|---------------|---------------------------|----------------------|---------|-----------|-----------|------------|------------|
| Mean                            | 23.1            | 23.4          | 97.1                      | 65.1                 | 166.1   | 164.9     | 163.6     | 1.21       | 1.19       |
| SD                              | 4.8             | 4.8           | 88.7                      | 58.6                 | 3.5     | 11.3      | 11.1      | 0.08       | 0.08       |

\* $VO_2 = VO_{2max}$  (ml·kg<sup>-1</sup>·min<sup>-1</sup>)

\*\* $\Delta VO_2 =$  change in absolute  $VO_2$  between the  $VO_{2max}$  stage and the previous workload (ml/min)

3100 Board #65 June 1 2:00 PM - 3:30 PM

### Validity of USB Electronic Pedometer Using 3D Accelerometer Technology for Assessing Physical Activity Intensity

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(No relationships reported)

Pedometer was the most popular intervention tool used to promote daily walking. It has been demonstrated that walking performance (speed and distance) is highly correlated with longevity and cognitive function in elderly population. Unfortunately, traditional pedometers can only indicate total activity but not speed or physical activity (PA) intensity. An USB electronic pedometer using 3D accelerometer technology to detect and record the up-down steps was designed not only to record total PA but also walking speed (steps per minute, SPM). However, the relationship between physiological PA intensity (MET) and SPM during daily locomotion activities has not been studied.

**PURPOSE:** The purposes of this study were (1) to investigate the correlation between SPM and MET of level locomotion activity, and (2) to determine the SPM cut-points for moderate and vigorous locomotion PAs.

**METHODS:** Fourteen male college students (mean age:  $20.4 \pm 1.65$  yrs, height:  $170.3 \pm 4.78$  cm, weight:  $74.9 \pm 16.8$  kg) were recruited to perform 4 different speed level locomotion activity: normal walking (3km/hr), brisk walking (5km/hr), jogging (7km/hr), and running (8km/hr). During each activity, step frequency (SPM) was measured using an USB electronic pedometer, and physiological PA intensity ( $O_2$  consumption) was also measured using a metabolic measurement system. The SPM cut-points of the pedometer for moderate PA and vigorous PA were determined using 3MET and 6MET for each individual respectively.

**RESULTS:** The  $O_2$  consumption of 3km/hr, 5km/hr, 7km/hr, and 8km/hr were  $10.26 \pm 1.45$ ,  $15.66 \pm 1.44$ ,  $26.98 \pm 2.02$ , and  $33.61 \pm 2.53$  ml/min/kg respectively. A significant and strong correlation between SPM and MET was found ( $r=0.90$ ,  $p<0.0001$ ). The 3MET moderate PA and 6MET vigorous PA were normal walking and jogging. The SPM cut-points of the pedometer for moderate and vigorous PAs were  $95 \pm 5$  SPM and  $125 \pm 10$  SPM, respectively.

**CONCLUSION:** The correlation between SPM and MET of level locomotion activities was high. Two step frequencies,  $95 \pm 5$  SPM and  $125 \pm 10$  SPM from the USB electronic pedometer, were recommended to be moderate and vigorous PAs cut-points. The accumulated evidence herein provides ample support that the USB electronic pedometer is a valid option for assessing total PA and intensity in research and practice.

3101 Board #66 June 1 2:00 PM - 3:30 PM

### The Health-related Quality of Life Associated with Health Predictors, in Diabetic and Hypertensive Older Adults

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(No relationships reported)

The health-related quality of life has been assessed by a number of measures including the individual perception of health. The SF-36v2 questionnaire is one of the instruments widely used at population level and comprises eight measures including physical functioning (PF) and role physical (RP). Grip strength and walking ability are known to be associated with muscular functioning and activities of daily living. Any decreasing or impairment may predict disability and mobility deficits. Whether functional capacity status is related to individual perception of health in older diabetic and hypertensive adults it is not well established.

**PURPOSE:** the aim of the study was to investigate the relationship between the perception of health and health predictors, assessed as handgrip test (HandT) and 6 minutes walking test (6MW), in older diabetic (DG)/non-diabetic (nDG) and hypertensive (HTG)/non-hypertensive (nHTG).

**METHODS:** one hundred and nine (24 DG and 85 nDG; 59 HTG and 50 nHTG) older adults ( $77.0 \pm 5.3$  yrs,  $68.2 \pm 9.7$  Kg,  $1.55 \pm 0.10$  m), were recruited from local population. The subjects were tested on HandT and 6MW, and completed the SF-36v2. ANOVA was performed to detect group differences. Pearson coefficient of correlation was used to assess the relationship between PF and RP subscales, and physical fitness tests. Significance was set at  $p < 0.05$ .

**RESULTS:** Non-significant differences were found between DG and nDG in all variables. The nHTG showed high scores on fitness tests (HandT left; [F (1, 107) = 7.119,  $p < 0.01$ ], HandT right; [F (1, 107) = 5.721,  $p < 0.05$ ], and 6MW; [F (1, 107) = 3.957,  $p < 0.05$ ] than HTG, but no-significant differences were found on PF and RF. In the nDG, both the RP and PF were related with fitness tests ( $r = 0.35$  to  $0.46$ ,  $p < 0.01$ ). In the HTG the RP and PF were related with fitness tests ( $r = 0.33$  to  $0.57$ ,  $p < 0.01$ ) while in the nHTG only the PF was related with fitness test ( $r = 0.36$  to  $0.45$ ,  $p < 0.01$ ).

**CONCLUSION:** The diabetes does not appear to affect the perception of health and functional capacity. Hypertensive patients appear to influence functional capacity but do not affect their perceptions of health. The findings also indicate that low scores on perception of health status may indicate difficulties in performing activities of daily living especially within older individuals experiencing hypertension.

**3102 Board #67 June 1 2:00 PM - 3:30 PM**

**Effects Of Navy SHAPE On Fitness Parameters, Functional Movement Screening (FMS) And Self-reported Sitting Time.**

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(No relationships reported)

Evaluation of the efficacy of site-based fitness interventions to enhance health status, especially for military active duty, is costly and time consuming. Few interventions have targeted the 40+ age group in the military.

**PURPOSE:** To evaluate the effects of a supervised exercise program (SHAPE) on fitness, functional movement screening (FMS) and self-reported sitting time. **Method:** Two health fitness specialists (HFS) were placed on three Navy bases to deliver SHAPE(6 mos; personal training, group exercise, education and lifestyle physical activity encouragement) to military volunteer personnel (44.5 ± 5 y) from 2007 to 2011; n=75 assessments after 2-4 months; n=28 assessments after 4-6 months. Health status measures included sub-maximal oxygen consumption, blood pressure, weight, strength, flexibility and adiposity assessed via Polar Trifit 4.9.1 system and functional movement screening (FMS). Self-reported sitting time, reflected in % of day was also collected.

**RESULTS:** Collapsing across training site average improvements in fitness were achieved for VO2 (+7%), flexibility (+13%), strength (+5%), adiposity (-4%), and body weight (-1%) after 2-4 months. All biometric tests except for weight (-1%) at the 4-6 month reassessment continued to improve; VO2 (+9%), flexibility (+19%), strength (+9%), and adiposity (-5%) and remained significant. SBP and DBP were also significant at the 4-6 month reassessment (SBP = (-3%), DBP = (-6%), p<0.05). FMS improved at 2-4 months (p=0.012) and continued to improve at 4-6 months (p<0.01). FMS average scores were 13.7 for assessment 1; 15.1 assessment 2 and 15.5 assessment 3. A strong trend existed for reductions in sitting time at 2-4 mos (p=0.058) which continued at 4-6 mos (p=0.056) with the latter representing a reduction of 22.3% in the # of individuals who sit 75% or more of the day.

**CONCLUSION:** Site based fitness programs with active duty military participants (>40 yrs) can improve biometric fitness indices up to 4-6 months. Functional movement capacity improved and Self-reported sitting time may also be reduced in response to the intervention.

Support: Navy headquarters (CNIC) & Indiana University service contract (HDQMWR-08-C-0036)

**3103 Board #68 June 1 2:00 PM - 3:30 PM**

**Fitness Secular Trends of Shanghai Older Women and Local District Impact: 2000-2010**

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(No relationships reported)

The population of aging women in Shanghai, China, as in many other cities around the world, is rapidly increasing. While in general many older Shanghai women are concerned about their health and participate in exercise regularly, some participation difference across local districts was observed. No study has confirmed these differences using fitness outcomes.

**PURPOSE:** To examine the 2000-2010 trends of older women's physical fitness across Shanghai districts, China.

**METHODS:** The Shanghai data from the Chinese National Fitness Surveys in 2000 and 2010, including samples from six districts, were used for the analysis and only 60-69 year old females were included. The means and confidence intervals of six fitness measures were computed by year and were compared by district using ANOVA.

**RESULTS:** Means of fitness measures by district and year are summarized in the table below. Some district differences were confirmed in the fitness changes between 2000 and 2010 (\*= p<.05). For example, BMI increase was found only in one district.

| Variable/District   | Xuhui  |         | Yangpu |         | Jiading |         | Pudong |         | Songjiang |         | Fengxian |         |
|---------------------|--------|---------|--------|---------|---------|---------|--------|---------|-----------|---------|----------|---------|
| Test Year           | 2000   | 2010    | 2000   | 2010    | 2000    | 2010    | 2000   | 2010    | 2000      | 2010    | 2000     | 2010    |
| n                   | 79     | 70      | 75     | 70      | 75      | 70      | 72     | 70      | 80        | 70      | 78       | 70      |
| Age                 | 64.32  | 64.21   | 64.29  | 64.29   | 64.32   | 64.01   | 64.07  | 64.33   | 64.81     | 64.21   | 64.33    | 63.86   |
| BMI                 | 24.80  | 24.36   | 24.76  | 25.19   | 24.23   | 24.25   | 25.02  | 25.03   | 23.26     | 24.32   | 22.22    | 24.4*   |
| Grip Strength (kg)  | 22.39  | 24.56*  | 22.70  | 25.24*  | 21.97   | 24.45*  | 23.22  | 25.80*  | 20.32     | 21.56   | 21.39    | 24.51*  |
| Balance (s)         | 5.01   | 8.17*   | 6.77   | 11.43*  | 9.48    | 18.21*  | 6.10   | 9.50*   | 6.75      | 9.16    | 4.54     | 8.00*   |
| Reaction Time (s)   | 0.7897 | 0.5039* | 0.6709 | 0.5170* | 0.9747  | 0.5571* | 0.8308 | 0.5776* | 0.8683    | 0.7260* | 0.8401   | 0.7344* |
| Sit and Reach (cm)  | 5.06   | 6.48    | 7.62   | 6.94    | 8.91    | 11.23*  | 5.86   | 8.25*   | 10.33     | 9.63    | 11.57    | 9.86    |
| Vital Capacity (ml) | 1770   | 1803    | 1482   | 1667*   | 1434    | 2023*   | 1802   | 1797    | 1554      | 1959*   | 1617     | 2076*   |

**CONCLUSION:** While the older Shanghai women population maintained a good level of physical fitness during the past decade, some district differences were confirmed. Future study should explore and examine key factors that contribute to the differences and develop intervention plans accordingly.

**3104 Board #69 June 1 2:00 PM - 3:30 PM**

**Impact of Moderate Intensity Physical Activity on the Functional Fitness of Older Women**

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(No relationships reported)

As adults reach advanced ages, the purpose of physical activity shifts from disease prevention to functional fitness (FF) and mobility. Higher levels of FF contribute to the ability to live independently.

**PURPOSE:** To determine the amount of activity necessary to positively impact functional fitness, by determining cutoff points in which additional minutes in moderate/vigorous physical activity (MVPA) do not further improve functional fitness.

**METHODS:** FF was assessed by the Senior Fitness Test (Chair Stand, Arm Curl, 6 min Walk, Up-and-Go, Sit and Reach, and Back Scratch) in 125 women (73.42 ± 8.84 yrs) from 2 Midwestern communities. Participants wore an accelerometer for 7 days without altering their normal activity. Accelerometer data were downloaded, MVPA determined via proprietary filtering, and time spent in each intensity (sedentary, low, moderate, vigorous) was calculated. A 5 day average of time spent in MVPA was organized into 4 groups (see Table).

**RESULTS:** ANOVAs revealed significant differences between groups on all measures except sit and reach. Results indicate a threshold of 20 min, suggesting that engaging in more MVPA yields no additional statistical gain on the lower body strength and mobility measures of chair stand, up-and-go, and 6 min walk. With regard to upper body strength and flexibility, less than 10 min of MVPA is detrimental to performance.

Table 1. Functional Fitness

| MVPA (min)  | n  | 6 min Walk (yd) | Chair (#) | Up & Go (s) | Curl (#)  | Scratch (in) |
|-------------|----|-----------------|-----------|-------------|-----------|--------------|
| 0:00-9:59   | 58 | 462±137*        | 11±3.5*   | 7.05±2.24*  | 16.0±5.0  | 9.7±13.54    |
| 10:00-19:59 | 27 | 538±174*        | 14±3.0*   | 5.56±1.16*  | 20.0±6.0† | 6.48±8.35†   |
| 20:00-29:59 | 14 | 607±95          | 15±4.0    | 5.41±1.19   | 20.0±6.5† | 3.89±8.78†   |
| 30:00+      | 22 | 687±90          | 16±4.5    | 4.52±0.95   | 20.5±4.0† | 2.91±6.32†   |

\* different from 20:00min (p < .05) † different from 0:00 (p < .05)

**CONCLUSIONS:** A threshold of 20 min of MVPA per day is recommended to assist in the maintenance of lower body function in older women. While ACSM recommends that to maintain health all adults accumulate at least 30 minutes of MVPA 5 days/wk, our data suggest that at least 20 min may be sufficient to maintain lower body function in older women.

### 3105 Board #70 June 1 2:00 PM - 3:30 PM

#### Evaluation of Countermovement Jump in Old Women: Are Center of Mass Position Requirements Met?

Cristina Cortis, PhD<sup>1</sup>, Pietro Picerno, PhD<sup>2</sup>, Michela Cavallucci<sup>3</sup>, Caterina Pesce, PhD<sup>4</sup>, Laura Capranica<sup>3</sup>. <sup>1</sup>University of Cassino, Cassino, Italy. <sup>2</sup>Sensorize Motion Sensing Technology, Rome, Italy. <sup>3</sup>University of Rome "Foro Italico", Rome, Italy. <sup>4</sup>University of Rome, Rome, Italy. (Sponsor: Carl Foster, FACSM)  
(No relationships reported)

Considered representative of functional ability in old individuals, muscle power of lower limbs is routinely evaluated from estimates of countermovement jump (CMJ) height. In field studies optical cells and contact mats are widely used, assuming that the height of the center of mass at take-off and landing coincide. For this reason, individuals are required to maintain a vertical alignment during the jump and to land with their lower limbs fully extended. However, no study investigated if older individuals actually meet these criteria.

**PURPOSE:** To investigate the relationship between CMJ parameters of older individuals in field settings.

**METHODS:** After a familiarization trial, 22 old women (age: 70±7 years; body mass: 60.6±10.1 kg; height: 160.1±6.1 cm; BMI: 23.8±3.6) were instructed to perform a fast downward movement immediately followed by a fast upward moment and to jump as high as possible keeping their hand on the hips and landing with their legs fully extended. During the execution of the CMJ, instantaneous vertical acceleration, velocity, and displacement of the centre of mass were recorded by means of a wireless 3D inertial measurement unit (FreePower, Sensorize, Italy) positioned on the trunk at the L5 level. Peak velocity (Vpeak), force (Fpeak), and power (Wpeak) were recorded, and differences between the height of the center of mass at take-off and landing (DeltaHCM) were calculated. Finally, jump height was estimated from flight time. A correlation analysis (p<0.05) was used to verify the relationship between CMJ parameters.

**RESULTS:** Jump height (10.9±3.5 cm) significantly (p<0.0001) related with Vpeak (r=0.9; 1.3±0.2 m/s), Wpeak (r=0.8; 19.2±4.2 W/kg), and DeltaHCM (r=0.8; 6.4±2.6 cm), whereas no correlation emerged with respect to Fpeak (9.6±2.9 N/kg).

**CONCLUSIONS:** Findings indicate that peak force may not be the best measure to assess vertical jump performance of older individuals, who strongly rely on their capability to coordinate fast and powerful muscle contractions. Furthermore, DeltaHCM highlighted the presence of knee flexions at landing, which increase flight time and lead to overestimates of jump heights. Therefore, evaluations of CMJ performances in older individuals should not rely solely on flight time estimates.

### 3106 Board #71 June 1 2:00 PM - 3:30 PM

#### Changes in Health-related Physical Physique Measures of Shanghai Older Males between 2000 and 2010

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(No relationships reported)

Little is known of the Chinese older male' health-related physical physiques.

**PURPOSE:** To examine the status and changes of Shanghai older males' physical physique between 2000 and 2010.

**METHODS:** The data of Shanghai older adults (60 yr. or above) from the Chinese National Fitness Surveys in Year 2000 (n=467, mean age = 64.69 yr.), 2005 (n=420, 64.40 yr.), and 2010 (n=421, 64.29 yr.) were used for the study. The means and confidence intervals of Height, Weight, BMI, Chest circumference, Waist, Hip, Waist-to-hip ratio (WHR) were computed by year and were compared across years using ANOVA. In addition, status of BMI (<18.5 = Under Weight [UW], 18.5≤BMI<24 = Normal Weight [NW], 24≤BMI<28 = Over Weight [OW], & BMI≥28 = Obese [OB]) were computed.

**RESULTS:** Mean differences across years (later years minus earlier years) of the physique measures are summarized below. (\*= p<.05)

|             | Height (cm) | Weight (kg) | BMI (kg/cm2) | Chest circumference (cm) | Waist (cm) | Hip (cm) | WHR    |
|-------------|-------------|-------------|--------------|--------------------------|------------|----------|--------|
| 2005 - 2000 | 0.86*       | 2.27*       | 0.63*        | 0.94*                    | 1.69*      | 0.39     | 0.016* |
| 2010 - 2005 | 0.78        | 2.41*       | 0.66*        | 3.26*                    | 3.19*      | 1.22*    | 0.023* |
| 2010 - 2000 | 1.64*       | 4.68*       | 1.29*        | 4.2*                     | 4.88*      | 1.61*    | 0.039* |

It was also found more older males in Shanghai became overweight or obese during the past decade.

| Test Year/BMI | UW    | NW     | OW     | OB     |
|---------------|-------|--------|--------|--------|
| 2000          | 8.78% | 56.10% | 28.48% | 6.64%  |
| 2005          | 4.05% | 52.86% | 35.48% | 7.62%  |
| 2010          | 2.38% | 40.62% | 46.56% | 10.45% |

**CONCLUSION:** Several keys health related physical physiques of Shanghai older males showed a negative change during the past decade. Actions to stop and revise the negative change trend are urgently needed.

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3107 Board #72 June 1 2:00 PM - 3:30 PM

**Over-ground Vs. Treadmill Walking In Older Adults: Comparison Of Accelerometry Counts And Metabolic Demands**

Nancy W. Glynn<sup>1</sup>, Adam J. Santanasto<sup>1</sup>, Mark A. Newman<sup>1</sup>, Christopher A. Taylor<sup>2</sup>, Anne B. Newman<sup>1</sup>, Bret H. Goodpaster<sup>1</sup>. <sup>1</sup>University of Pittsburgh, Pittsburgh, PA. <sup>2</sup>Centers for Disease Control, Atlanta, GA.  
(No relationships reported)

Mechanics between treadmill and over-ground walking may be different potentially due to gait. Differences in metabolic costs and energy expenditure associated with these bouts of activity are largely unknown for older adults.

**PURPOSE:** To compare metabolic demands, accelerometry counts, energy expenditure and physiologic parameters associated with treadmill and over-ground walking in older adults.

**METHODS:** Ten people (mean±SD age 70.6 ± 6.4 years) participated in a physical activity (150 min/wk of treadmill walking) and weight loss intervention. The short physical performance battery (SPPB) measured physical function. Mean oxygen consumption (COSMED K4b<sup>2</sup>), accelerometry counts (GT1M, ActiGraph, Pensacola, FL) and age-predicted heart rate (APHR) were measured concurrently during two walking bouts: usual pace 40m over-ground walk (mean gait speed 1.1 m/s, range 0.9 - 1.3 m/s) and usual pace 2 minute treadmill walk at the same gait speed. Energy expenditure in metabolic equivalents (METs) was obtained from averaging breath-by-breath COSMED samples for each bout.

**RESULTS:** Participants were high-functioning with mean SPPB scores of 10.4 ± 1.6 out of 12. A separate treadmill protocol measured mean VO<sub>2peak</sub> (27.3, range 21.5 - 38.3 ml/kg/min). At the same gait speed, mean VO<sub>2</sub> was 15% higher during the treadmill bout (10.0 ± 2.6 ml/kg/min) compared to over-ground walking (8.7 ± 1.1 ml/kg/min). Further, energy demand was 16% higher (mean 2.9, range 1.5 - 3.7 vs 2.5, range 1.8 - 3.1 METs) and activity counts were 20% higher (mean 1375, range 540 - 2496 vs 1147, range 504 - 1588 counts/min), for treadmill and over-ground walking, respectively. Participants reached an average of 68% (range 57 - 84%) of APHR during the treadmill compared to 57% (range 37% - 72%) for over-ground walking. All results are p<.10.

**CONCLUSION:** Preliminary findings suggest that metabolic cost, accelerometry counts, energy expenditure and physiologic parameters related to treadmill walking are higher at the same gait speed, potentially due to biomechanical differences. Using a treadmill for exercise testing or training in older adults may lead to premature fatigue or undesirable physiologic challenge. This may be of particular concern for those with low fitness or impaired mobility.

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3108 Board #73 June 1 2:00 PM - 3:30 PM

**Jump Test Performance and Sarcopenia Status in Older Men and Women**

Michael Bemben, FACSM, Harshvardhan Singh, Daeyool Kim, Eonho Kim, Debra Bemben, FACSM. University of Oklahoma, Norman, OK.  
(No relationships reported)

Jumping mechanography uses maximal countermovement jumps to test measures such as jump power (JPow). Recently, it has been shown to be a safe method for assessing muscle function in older adults, however, little is known about the relationships between JPow, muscle strength, and sarcopenia status.

**PURPOSE:** To investigate the relationships between jump performance variables, muscle strength, and sarcopenia status in older men (n=27) and women (n=33) (55-75 years).

**METHODS:** Body composition was measured by a total body DXA scan to obtain appendicular skeletal muscle mass (ASM), bone free lean body mass (BFLBM) and relative skeletal muscle mass index (RSMI). Subjects were classified as sarcopenic if they had a RSMI < 7.26 kg/ht<sup>2</sup> for men and < 5.45 kg/ht<sup>2</sup> for women. Three vertical jumps on a jump mat were performed to assess JPow, jump velocity (Jvel), and jump height (JHt). Leg strength was measured by 1-RM testing for leg press (LP), right (RHAb) and left hip abduction (LHAb) isotonic resistance exercises.

**RESULTS:** Sarcopenia was found in 20% of the subjects; 24% of women and 14% of men. Sarcopenia (n=12) and normal (n=48) groups did not differ in age, or in physical activity levels. There was a significant group difference (p<0.01) in JPow, which was about 24% lower in sarcopenia group compared to the normal group (651.1 ± 41.7 watts vs. 851.0 ± 27.4 watts). JPow, Jvel, and JHt were significantly (p<0.01) positively correlated with ASM and BFLBM. There also were significant (p<0.01) positive correlations (r = .43 to .71) between jump test variables (JPow, Jvel, JHt) and leg strength measures (LP, RHAb, LHAb).

**CONCLUSION:** Jump test variables, especially jump power and jump height, were correlated with lean tissue and leg strength in older adults. The large difference in jump power between sarcopenic and normal subjects suggests this test may be useful for muscle function screening in aging populations.

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3109 Board #74 June 1 2:00 PM - 3:30 PM

**Does Exercise Experience Affect Physical Function and Body Composition in PMW After Intervention?**

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(No relationships reported)

**PURPOSE:** To explore the effects of group-based step aerobic (GBSA) intervention on physical function and body composition in postmenopausal women (PMW) with or without exercise experience (EE).

**METHODS:** 45 healthy PMW (age 58.7±3.7 years) were recruited in the study and randomly assigned to either an exercise group (EG, n=30) or control group (CG, n=15). EG were further divided into 2 groups with or without EE. Subjects in EG with EE (EGE, n=14) accept progressive high-intermediate intensity (75-85% maximal HR reserved, HRR) GBSA exercise for 10 weeks before this study, 3 days/week, 60-90 minutes/day, and following a 6-week detraining. Subjects in EG without EE (EGN, n=16) did not have EE before this study. EG (EGE and EGN) participated in high-intermediate intensity GBSA intervention for another 15 weeks, 75-85%HRR, 3 days/week, and 60-90 minutes/day. CG did not attend regular exercise. All subjects were asked to measure physical function (chair stand and 2 km walk test), and body composition (lean body mass percentage, fat percentage, whole body bone mineral density) by dual-energy X-ray absorptiometry at baseline and after 15 weeks. All data were analyzed by a two-way ANOVA (group×time). Significant level was set at α=.05.

**RESULT:** Performances in EGE after 15 weeks intervention were significantly better than those in CG in chair stand (33.6±6.5 vs. 27.3±6.1 times/30sec, p=.01) and 2 km walk (108.1±56.6 vs. 76.7±22.4 indexes, p=.02); whereas no significant differences among groups after intervention were found in body composition.

**CONCLUSION:** A 15-week GBSA significantly improves physical function in PMW. However, exercise experience does not appear to significantly affect physical function and body composition in PMW.

This study was granted by National Council of Science (NSC 100-2410-H-320-014).

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3110 Board #75 June 1 2:00 PM - 3:30 PM

**A Portable 4-Step Stair Climb Task is a Valid Method to Determine Muscle Power and Function in the Elderly**

Amy Rolston, Petra Martins, Lucinda Salvaggio, Taylor Marcell. California State University Stanislaus, Turlock, CA.  
(No relationships reported)

**PURPOSE:** Stair climbing is an increasingly difficult task of daily living for older adults that is dependent upon many factors of fitness and performance such as muscular strength, power, agility, and balance of the lower body. The purpose of this study was to validate a portable 4-step stair climb task as a functional measure of muscular power in a group of community dwelling older adults.

**METHODS:** 36 participants (23 women & 13 men) with an average (± SD) age of 75.1 ± 7.3 yrs and a BMI of 26.6 ± 3.8 kg/m<sup>2</sup> have completed a health screening and senior fitness test including 1-RM seated isotonic leg-press, isotonic leg-press power at 70% 1-RM, balance (Romberg, unipedal, foam stance), gait, and 4-step stair climb task.

**RESULTS:** For the men, their 1-RM lower-body strength was  $258.1 \pm 94.6$  lbs and measured power was  $338.1 \pm 160.3$  W or  $3.7 \pm 1.5$  W/kg. For the women, their 1-RM lower-body strength was  $172.4 \pm 44.8$  lbs and measured power was  $145.7 \pm 74.7$  W or  $2.2 \pm 1.1$  W/kg. The calculated power during stair climbing was  $335.2 \pm 94.8$  W or  $3.7 \pm 1.0$  W/kg for the men and  $198.9 \pm 59.3$  W or  $3.1 \pm 0.9$  W/kg in the women. Normal gait speed was  $1.14 \pm 0.22$  m/s in men and  $1.22 \pm 0.29$  m/s in the women. Stair climb power was correlated with measured power ( $r = 0.74$ ,  $p = 0.001$ ), gait ( $r = 0.57$ ,  $p = 0.001$ ), balance ( $r = 0.68$ ,  $p = 0.001$ ), and age ( $r = -0.55$ ,  $p = .001$ ) in the whole group.

**CONCLUSIONS(S):** These data suggest that a portable 4-step stair climb task is a valid measure of lower body power and muscle function in the elderly and that this task appears to require greater than 70% of maximal effort.

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**3111 Board #76 June 1 2:00 PM - 3:30 PM**  
**Relationship of Body Composition and Muscular Strength in Young And Middle-Aged Women**

Pamela D. Swan, FACSM, Robin De Weese. *Arizona State University, Phoenix, AZ*  
(No relationships reported)

Absolute strength generally increases with body size but decreases with age. It is unknown whether body size or body composition influences the relationship of age on peak muscular strength or fatigue.

**PURPOSE:** To determine the relationship of fat mass (FM), fat free mass (FFM), and body size (BMI) to knee extensor peak torque (PT) and muscular fatigue in young (Y) and middle-aged (MA) women.

**METHODS:** 132 women from two age cohorts (Y: 18-33 yrs,  $n = 70$  and MA: 45-65 yrs,  $n = 62$ ) participated. Subjects with musculoskeletal problems and those who had participated in strength training in the previous three months were excluded. Body composition was estimated by bioelectrical impedance analysis. Isokinetic PT of the knee extensors was assessed at  $60^\circ/\text{sec}$  and the fatigue index (FI) was calculated as the percent decline of PT during 50 maximal repetitions at  $240^\circ/\text{sec}$ . Data were assessed for normality and appropriate correlation techniques were used to compute relationships between PT and FI with body composition variables. Differences in PT between age and BMI groups (normal, N: 18-24 kg/M<sup>2</sup>; overweight, OW: 25-29 kg/M<sup>2</sup>; obese, O: 30+ kg/M<sup>2</sup>) were assessed by ANOVA.

**RESULTS:** Both cohorts were similar ( $p > 0.05$ ) in body weight (Y:  $68.1 \pm 18.6$  kg; MA:  $70.6 \pm 13.0$  kg) and FFM (Y:  $45.9 \pm 5.2$  kg; MA:  $45.1 \pm 3.9$  kg) but MA had significantly ( $p < 0.05$ ) higher FM (Y:  $22.2 \pm 13.8$ ; MA:  $25.5 \pm 10.0$ ). In Y, FFM was strongly correlated with PT ( $r = 0.63$ ;  $p < .000$ ). There were no significant correlations between FFM or FM and PT in MA. PT was correlated with FI in the combined groups ( $r = 0.18$ ;  $p = .04$ ) but FI was significantly lower (greater endurance) in MA than Y. PT normalized for body mass or FFM was similar between age groups. Relative PT significantly decreased with increasing BMI categories: (N: 1.2 ft-lb/kg; OW: 1.05 ft-lb/kg; O: 0.8 ft-lb/kg;  $p < .000$ ).

**CONCLUSION:** MA women have less PT but greater muscular endurance than Y. Higher FM was not detrimental to absolute PT in Y or MA, but was detrimental to relative PT in both groups. As women get larger, their strength relative to their body weight decreases. FM may attenuate the relationship between PT and body mass in both Y and MA women, but may enhance muscular endurance in MA women.

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**3112 Board #77 June 1 2:00 PM - 3:30 PM**  
**Self-paced Walking Is Predicted By Leg Strength And VO<sub>2</sub>max And Not The Ventilatory Threshold.**

Konstantina Katsoulis<sup>1</sup>, Catherine E. Amara<sup>1</sup>, Bradley C. Hansen<sup>2</sup>, Liza Stathokostas<sup>2</sup>, John J. Koval<sup>2</sup>, Donald H. Paterson, FACSM<sup>2</sup>, David A. Cunningham, FACSM<sup>2</sup>. <sup>1</sup>University of Toronto, Toronto, ON, Canada. <sup>2</sup>University of Western Ontario, London, ON, Canada.  
(No relationships reported)

Walking speeds decrease with advancing age. However, given the variation in duration, distance covered and determination of pace in currently used walking assessments, it is not clear what physiological measure(s) of the aging process they reflect.

**PURPOSE:** To determine the key factors predicting self-paced walking (SPW) speeds in a large random survey of healthy and independently living men and women aged 55 to 86 years.

**METHODS:** Older men ( $70.5y \pm 8.8$ ;  $n = 208$ ) and women ( $71.5y \pm 8.4$ ;  $n = 231$ ) performed 4 X 20 metre indoor walk at the following self-selected paces: slow, normal, fast and very fast with time being recorded to the nearest second and averaged among trials. In addition, maximum aerobic power (VO<sub>2</sub>max) was determined on a treadmill with subsequent determination of the ventilatory threshold (T<sub>VE</sub>). Measures of other potential walking pace predictors included, plantar flexion (PF) strength, hip flexion, height, body mass and symptom of anxiety and depression scale score. Multiple linear regression analyses were used to determine key predictors ( $p < 0.05$ ) of walking speeds.

**RESULTS:** SPW at slow speed was significantly related to anxiety/depression ( $r^2 = .150$  and  $.107$  for male and females, respectively); this factor did not enter the regression at any other speed. The major contributors to SPW were VO<sub>2</sub>max ( $r^2 = 0.171$  and  $0.396$  in normal and very fast walking, respectively), PF strength ( $r^2 = 0.416$  in very fast walking) and BMI ( $r^2 = 0.228$  and  $0.437$  in normal and very fast walking, respectively) in men, while in women the strongest predictor of normal pace was VO<sub>2</sub>max ( $r^2 = 0.237$ ) and VO<sub>2</sub>max and PF strength ( $r^2 = 0.518$  and  $0.534$ , respectively) for very fast walking. VO<sub>2</sub>max was correlated with T<sub>VE</sub> ( $r = .84$  and  $.83$  for men and women, respectively), but in the presence of VO<sub>2</sub>max, T<sub>VE</sub> was not a significant determinant of SPW.

**CONCLUSIONS:** VO<sub>2</sub>max is a stronger predictor of SPW speeds than T<sub>VE</sub>, accounting for a greater portion of the variance with increasing speeds. PF strength further improves the prediction of walking performance at very fast speeds. Together, these results suggest that the amount and quality of muscle are important determinants of self-selected speeds of walking.

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**3113 Board #78 June 1 2:00 PM - 3:30 PM**  
**Resting Metabolic Rate Changes in Women Following Different Exercise Training Programs**

Trista Manikowske, Donna J. Terbizan, FACSM, John Schuna, Jared Tucker, Bryan Christensen, Ardrith Brunt, Yeong Rhee. *North Dakota State University, Fargo, ND*  
(No relationships reported)

Research examining changes in resting metabolic rate (RMR) following an exercise training program has shown inconsistent results. While evidence suggests resistance training (RT) increases fat-free mass (FFM) and subsequently RMR, results of some studies have suggested that FFM increases in women may not elicit increases in RMR. Additional research in women is needed to explore the effects of RT, and combined resistance and aerobic training (COM) on FFM and RMR.

**PURPOSE:** The purpose of this study was to evaluate FFM and RMR changes in women after a 12 week RT or COM program.

**METHODS:** Eighteen women aged 38-61 years were randomized to a RT or COM group, with training occurring three times per week. Both groups participated in resistance workouts which included 30 min of upper and lower body exercises where fatigue occurred between 8-12 repetitions. The COM group then participated in 30 min of moderate intensity cardiovascular exercise during each training session. Pre- and post-test RMR data was collected in a fasted state, following 30 min of rest, for a minimum of 20 min. FFM was calculated by subtracting fat mass from total body mass, where fat mass was derived by multiplying total body mass by percent body fat measured via the Jackson-Pollock skinfold technique. Two-factor (group x time) repeated measures analysis of variance (ANOVA) was used to evaluate group differences and time-related changes in FFM and RMR. The relationship between FFM and RMR change scores was evaluated using a Pearson correlation. Alpha was set  $< .05$  for all analyses.

**RESULTS:** Significant increases (mean  $\pm$  SE) in FFM ( $+1.5 \pm .7$  kg,  $p = .045$ ) and RMR ( $+77.4 \pm 26.1$  kcal,  $p = .01$ ) were found for the entire sample from pre- to post-test. No significant differences in FFM (RT =  $54.1 \pm 2.2$  kg, COM =  $50.9 \pm 2.0$  kg,  $p = .30$ ) or RMR (RT =  $1477.5 \pm 73.1$  kcal $\cdot$ day<sup>-1</sup>, COM =  $1427.9 \pm 65.4$  kcal $\cdot$ day<sup>-1</sup>,  $p = .62$ ) were found between the RT and COM groups. In addition, no significant group x time interactions were found for the FFM ( $p = .85$ ) and RMR ( $p = .41$ ) analyses. FFM and RMR change scores were highly correlated ( $r = .68$ ,  $p < .01$ ).

**CONCLUSIONS:** Results indicate that FFM and RMR significantly increased among women in this sample after 12 weeks in a RT or COM exercise program. Neither training modality (RT or COM) proved superior in eliciting RMR or FFM changes in this study.

**3114 Board #79 June 1 2:00 PM - 3:30 PM**  
**The Portable 4-step Stair Climb Task Is a Valid Measure of Muscle Power and Function in Community Living Older Adults**

Petra Martins, Amy Rolston, Lucinda Salvaggio, Taylor Marcell. *California State University Stanislaus, Turlock, CA.*  
(No relationships reported)

**PURPOSE:** Falls in the elderly are often caused by frailty and have been shown to be a leading cause of mortality and morbidity. Stair climbing is an essential task of daily living and may be a useful measure in the evaluation of frailty in older adults. The purpose of this study was to evaluate the reliability of using the portable 4-step stair climb task as a quick assessment of muscle power and its relationship to measures of health and balance in a large group of community living older adults.

**METHODS:** Subjects consisted of 219 women with an average ( $\pm$  SD) age of  $70.6 \pm 8.5$  yrs, height  $160.4 \pm 7.9$  cm, weight  $73.0 \pm 16.7$  kg, and BMI of  $28.4 \pm 6.1$  kg/m<sup>2</sup>; there were also 91 men with an average age of  $75.5 \pm 7.7$  yrs, height  $174.8 \pm 9.5$  cm, weight  $84.9 \pm 14.8$  kg, and BMI of  $27.7 \pm 4.5$  kg/m<sup>2</sup>. Subjects participated in community based health fairs held in the Central Valley of California; they performed the Fullerton Senior Fitness Battery, a standardized balance assessment, gait analysis, and timed 4-step stair ascent. Stair climbing power was calculated using body weight (kg), vertical distance climbed (m), and time (sec). For data analysis, subjects were divided by age-groups and sex and the data compared using 2 x 3 ANOVA (IBM SPSS v 19).

**RESULTS:** Stair climb power was correlated with age ( $r = -0.27$ ,  $p = 0.001$ ), unipedal balance ( $r = 0.34$ ,  $p = 0.001$ ), balance summary score ( $r = 0.27$ ,  $p = 0.001$ ), functional reach ( $r = 0.16$ ,  $p = 0.03$ ), grip strength ( $r = 0.39$ ,  $p = 0.001$ ), chair stands ( $r = 0.30$ ,  $p = 0.001$ ), gait speed ( $r = 0.46$ ,  $p = 0.001$ ), and the 8' timed up and go test ( $r = -0.57$ ,  $p = 0.001$ ). Significant sex differences were observed for body weight ( $84.6 \pm 13.2$  men &  $71.4 \pm 15.4$  women), body fat ( $31.3 \pm 4.6\%$  men &  $39.3 \pm 6.6\%$  women), and grip strength ( $80.2 \pm 20.1$  lb men &  $49.6 \pm 13.9$  lb women), however there were no sex differences in balance, flexibility, chair stands (#), or the TUG. Stair ascent power was greater in men in both absolute ( $244.9 \pm 106.6$  W men &  $172.0 \pm 68.8$  W women) and relative ( $2.89 \pm 1.12$  W/kg men &  $2.42 \pm 0.87$  W/kg women) terms. These power values also decreased between the seventh and ninth decades in both men and women.

**CONCLUSION(S):** The portable 4-step stair climb task appears to be both a reliable and valid measure of muscle power as it is highly correlated with common measures of function in community-dwelling older adults.

**3115 Board #80 June 1 2:00 PM - 3:30 PM**  
**Influence Of Age-Related Skeletal Muscle Mass Loss On Serum Lipid/Lipoprotein Profiles And Blood Pressure In Healthy Japanese Men**

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(No relationships reported)

It has been postulated that age-related skeletal muscle loss (Sarcopenia) contributes to metabolic and cardiovascular diseases, although these relationships have not been confirmed by published research.

**PURPOSE:** We investigated the relationships between skeletal muscle mass (SMM) and serum lipid and lipoprotein concentrations and resting blood pressure in healthy Japanese men.

**METHODS:** Six hundred eighty-seven men were screened with those exhibiting clinically relevant diseases (mostly hypertension and diabetes) excluded. As a result, 414 healthy men aged 40-76 years (239 middle-aged [aged 40-59 years] and 175 older [aged 60-76 years]) were used for data analyses. Muscle thickness (MTH) and subcutaneous fat thickness (FTH) were measured by ultrasound at nine sites on the anterior and posterior aspects of the body. FTH was used to estimate the body density, from which fat mass and fat-free mass (FFM) was calculated, and MTH was used to estimate the whole body and thigh SMM. Serum total (TC) and high-density lipoprotein cholesterol (HDL) concentrations were measured using overnight fasting samples. Resting systolic (SBP) and diastolic (DBP) blood pressures were also measured.

**RESULTS:** Percent body fat (%Fat) was similar ( $P > 0.05$ ) between middle-aged ( $16.9$  [SD  $3.0$ ] %) and older ( $16.3$  [SD  $3.2$ ] %) groups, while percent SMM (whole body SMM divided by body weight) was lower in the older group ( $32.6$  [SD  $3.3$ ] %) than in the middle-aged group ( $34.1$  [SD  $2.8$ ] %). Whole body and thigh SMM were lower ( $P < 0.01$ ) in the older group ( $17.8$  [SD  $3.0$ ] kg and  $6.4$  [SD  $1.2$ ] kg, respectively) than in the middle-aged group ( $20.7$  [SD  $2.8$ ] kg and  $7.5$  [SD  $1.2$ ] kg). %Fat was directly correlated with TC ( $r = 0.327$ ,  $P < 0.01$ ), SBP ( $r = 0.098$ ,  $P = 0.046$ ) and DBP ( $r = 0.183$ ,  $P < 0.01$ ), and inversely correlated with HDL ( $r = -0.333$ ,  $P < 0.01$ ) and HDL/TC ( $r = -0.487$ ,  $P < 0.01$ ). Percent SMM was directly correlated ( $P < 0.01$ ) with HDL ( $r = 0.170$ ) and HDL/TC ( $r = 0.147$ ), and inversely correlated with SBP ( $r = -0.106$ ,  $P = 0.03$ ). However, there were inverse correlations between absolute SMM as well as SMM index (divided by height square) and HDL or HDL/TC.

**CONCLUSIONS:** Age-related SMM loss appears to be associated with lower risk profiles. Percent SMM as well as %Fat is a good predictor of measured risk factors.

**3116 Board #81 June 1 2:00 PM - 3:30 PM**  
**Muscle Quality Measurement Techniques: Changes Among Age-Stratified Elderly Adults**

Abbie E. Smith<sup>1</sup>, Jeffrey R. Stout<sup>2</sup>, Kristina L. Kendall<sup>2</sup>, David H. Fukuda<sup>2</sup>, Joel T. Cramer, FACSM<sup>3</sup>, Jordan R. Moon<sup>4</sup>. <sup>1</sup>University of North Carolina Chapel Hill, Chapel Hill, NC. <sup>2</sup>University of Oklahoma, Norman, OK. <sup>3</sup>Oklahoma State University, Stillwater, OK. <sup>4</sup>United States Sports Academy, Daphne, AL.  
(No relationships reported)

Muscle quality (MQ) is muscle strength expressed relative to segmental muscle mass and may be important for identifying early onset sarcopenia. **PURPOSES:** To evaluate upper- and lower-body MQ measurements and body composition [fat mass (FM); muscle mass (MM); percent fat (%Fat)] using dual-energy x-ray absorptiometry (DEXA) and segmental bioelectrical impedance spectroscopy (BIS) across age cohorts.

**METHODS:** 93 elderly men and women (Mean SD; age:  $72.5 \pm 6.0$  yrs; Ht:  $168.4 \pm 8.9$  cm; Wt:  $72.6 \pm 13.8$  kg) were stratified by age (65-67 yrs = Grp 1; 68-71 = Grp 2; 72-75 = Grp 3; 76-79 = Grp 4; 80-89 = Grp 5). Body composition, arm, and leg MM was measured with DEXA and BIS, while upper- and lower-body muscle strength was assessed with handgrip dynamometry (GRIP) and maximal concentric isokinetic leg extensions (EXT  $60^\circ\text{s}^{-1}$ ), respectively. MQ was calculated for DEXA and BIS-derived MM for upper- [GRIP (kg)/MM (kg)] and lower-body [EXT  $60^\circ\text{s}^{-1}$  (Nm)/MM (kg)].

**RESULTS:** For upper- and lower-body BIS MQ, Grp 1>5, Grp 2>5, and Grp 3>5 ( $p < 0.05$ ). For lower-body DEXA MQ, Grp 1>5, Grp 2>5, and Grp 4>5 ( $p < 0.05$ ). There were no differences among age groups for upper-body DEXA MQ ( $p > 0.05$ ). When collapsed across age, BIS over-predicted MM compared to DEXA for upper- ( $19.2 \pm 9.5$  kg vs.  $11.7 \pm 2.1$  kg;  $p < 0.05$ ) and under-predicted lower-body ( $6.9 \pm 2.7$  kg vs.  $8.1 \pm 2.4$  kg;  $p < 0.05$ ). There were no differences among measurement techniques or age groups for FM ( $p = 0.055$ - $0.866$ ).

**CONCLUSION:** MQ may be a good indicator of early-onset sarcopenia when changes in MM are too small to quantify with BIS or DEXA alone. Based on stronger correlation coefficients, DEXA may be better for upper-body MQ, while both BIS and DEXA methods are suitable for lower-body MQ measurements. Future studies are needed to establish normative MQ and changes in MQ with strength training. Study sponsored by Abbott Nutrition, Columbus, Ohio

**3117 Board #82 June 1 2:00 PM - 3:30 PM**  
**Vitamin D Status is Not Associated with Muscle Mass or Physical Function in Older Adults**

Chad Straight<sup>1</sup>, Christie Ward<sup>1</sup>, Mina Mojtahedi<sup>2</sup>, Rudy Valentine<sup>2</sup>, Mary Ann Johnson<sup>1</sup>, Ellen Evans, FACSM<sup>1</sup>. <sup>1</sup>University of Georgia, Athens, GA. <sup>2</sup>University of Illinois, Urbana-Champaign, IL.  
(No relationships reported)

Low vitamin D concentrations have been implicated in the age-related decline in muscle mass and physical function evident in older adults. However, the relationship between vitamin D status and physical function remains incompletely characterized.

**PURPOSE:** Therefore, the aim of this study was to investigate the association between vitamin D status, lean mass, and indices of lower-extremity physical function (LEPF) in older adults.

**METHODS:** Community-dwelling older adults ( $n = 139$ , 73 male;  $69.3 \pm 6.6$  years) underwent assessments for vitamin D status, body composition and LEPF. Serum concentrations of 25-hydroxyvitamin D [25(OH)D] were ascertained via ELISA and low vitamin D was defined as serum 25(OH)D  $< 20$  ng/ml. Whole-body and regional soft tissue composition was assessed via dual-energy X-ray absorptiometry. Muscle quality (MQ) was calculated as maximal voluntary contraction of the quadriceps muscle normalized for mineral-free lean mass (MFLM) of the upper leg. LEPF was measured via the timed up-and-go test (UPGO), 400-m walk, and 30-second chair stand test. Partial correlations controlled for sex and month of blood draw were performed to

examine the association of vitamin D concentration with body composition and LEPP. Analysis of covariance adjusted for sex and month of blood draw was conducted to analyze differences in MQ, MFLM and LEPP between those with low vitamin D and those with serum 25(OH)D  $\geq$  20 ng/ml.

**RESULTS:** Approximately 64.0% of the cohort had low serum 25(OH)D concentrations (serum 25(OH)D < 20 ng/ml). Vitamin D levels were not significantly associated with upper leg MQ or MFLM of the total or upper leg. Likewise, there was no association between 25(OH)D and UPGO time, 400-m walk time, or performance on the 30-second chair stand test. There were no differences in upper leg MQ or total leg MFLM between those with low serum 25(OH)D and those with serum 25(OH)D  $\geq$  20 ng/ml (both  $p > 0.05$ ). Moreover, there were no differences between groups in UPGO time, 400-m walk time, or 30-second chair stand performance (all  $p > 0.05$ ).

**CONCLUSION:** These data suggest that vitamin D status is not associated with measures of body composition or LEPP in older men and women. Further research should attempt to elucidate the role of potential mediators of the relationship between vitamin D and physical function in older adults.

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**3118** Board #83 June 1 2:00 PM - 3:30 PM

**Predicting 8-foot Up Go From Exercise Self-efficacy, Balance Confidence, Depressive Symptoms, And Life Satisfaction**

Zac Geary. University of Central Oklahoma, Edmond, OK.

(No relationships reported)

Zac Geary<sup>1</sup>, Kelsey Hubble<sup>1</sup>, Pam Farris<sup>1</sup>, Justin Steffy<sup>1</sup>, Dalton Delaney<sup>1</sup>, Simon Smith, Tyler Karnes<sup>1</sup>, Blake Hamill<sup>1</sup>, Taniqua Ward<sup>1</sup>, Kayla Garver<sup>1</sup>, Paul House<sup>1</sup>, Melissa Powers<sup>1</sup>, and Michelle Gray<sup>2</sup>. University of Central Oklahoma, Edmond, OK<sup>1</sup>, University of Arkansas, Fayetteville, AR<sup>2</sup>

In order to initiate programs to prevent or reverse the deterioration in functional fitness which can be found in an aging population, it is important to have effective screening tools that can help determine the functional fitness levels in this population. Screening surveys are easy to administer and can be conducted from remote locations which allows more individuals to be screened quickly.

**PURPOSE:** The purpose of this study was to determine if exercise self-efficacy, balance confidence, depressive symptoms, and life satisfaction can predict performance on the 8-foot Up-and-Go (UpGo) test. **METHOD:** Thirty-six senior adults over the age of 75 years who volunteered to participate in an exercise program completed the following surveys: Exercise Self-Efficacy (ESE), Activities-Specific Balance Confidence (ABC), Center for Epidemiological Studies Depression Scale (CESD), and Satisfaction with Life Scale (SLS). Participants also completed the UpGo test which is a measure of functional dynamic balance and agility and is part of the Senior Fitness Test developed by Rikli and Jones (1999). A multiple regression analysis was conducted to examine the aforementioned predictive variables on the UpGo.

**RESULTS:** Overall, 67% of the variability in UpGo performance can be attributed to ESE, ABC, CESD, and SLS. In this model, ABC, CESD, and SLS were indicated as significant predictors of UpGo ( $p = .000$ ,  $p = .038$ ,  $p = .033$ , respectively). The ESE was not a significant predictor for the UpGo ( $p = .319$ ), while the ABC was the strongest predictor for the UpGo with a partial correlation of  $-.761$  ( $p < .001$ ).

**CONCLUSION:** These results indicate that the ABC, CESD, and SLS surveys are effective in predicting functional fitness levels in a senior population. Utilizing these surveys allow health-care professionals to identify elders at-risk for functional limitations and to recommend programs designed to improved functionality. This early intervention can possibly help reduce the need for assistance and loss of independence.

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**3119** Board #84 June 1 2:00 PM - 3:30 PM

**The Association Between Incidental Physical Activity and Cardiorespiratory Fitness**

Trevor O'Neill, Morgan Craig-Broadwith, Robert Ross, FACSM. Queen's University, Kingston, ON, Canada.

(No relationships reported)

Cardiorespiratory fitness (CRF) is a strong predictor of cardiovascular disease and mortality. The association between structured physical activity (activity that meets consensus guidelines) and CRF is well established. Yet, the association between incidental physical activity (IPA; sporadic, unstructured physical activity that does not meet consensus guidelines) and CRF remains less clear.

**PURPOSE:** The primary objective of this study was to determine whether the duration and the expenditure of objectively measured IPA were associated with CRF in abdominally obese, adult men and women. A secondary objective was to determine whether sporadic moderate physical activity (MPA; accrued in bouts less than 10 min) was associated with CRF.

**METHODS:** Participants were abdominally obese (waist circumference >102 cm in men and >88 cm in women), self-reported inactive and weight-stable men ( $n=26$ ) and women ( $n=62$ ). IPA encompassed light physical activity (LPA; 1-2.99 METs), sporadic MPA (3-5.99 METs) and sporadic vigorous physical activity (VPA;  $\geq 6$  METs). IPA was measured using the SenseWear Pro Armband (SWA) collected over a period of 7 days, and was categorized into duration (min/day) and expenditure (MET-min/day). CRF, measured as peak oxygen consumption per unit of time (peak  $\text{VO}_2$ ), was assessed using a graded treadmill test.

**RESULTS:** Participants accumulated an average of  $318.6 \pm 125.2$  min of IPA per day, which was composed of  $277.3 \pm 117.3$  min of LPA and  $40.8 \pm 16.8$  min of MPA. Both duration ( $r^2=0.45$ ,  $p<0.05$ ) and expenditure ( $r^2=0.44$ ,  $p<0.05$ ) of IPA were significantly associated with CRF independent of sex, however upon further control for body mass index (BMI) and age neither association remained significant ( $p>0.10$ ). Both duration ( $r^2=0.65$ ,  $p<0.05$ ) and expenditure ( $r^2=0.66$ ,  $p<0.05$ ) of sporadic MPA were significantly associated with CRF after control for covariates.

**CONCLUSIONS:** The principle finding is that IPA is not associated with CRF after control for BMI; however, sporadic MPA remains an independent predictor of CRF in abdominally obese adults. This finding suggests that while intensity of physical activity is important for improvement in CRF, benefits are not restricted to MPA that conforms to consensus guidelines. These initial findings have important public health implications.

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**3120** Board #85 June 1 2:00 PM - 3:30 PM

**Functional Outcomes of Exercise Progression Models in the Elderly**

Jason D. Allen<sup>1</sup>, Jennifer L. Robbins<sup>1</sup>, Neil Johanssen<sup>2</sup>, Mitch VanBruggen<sup>1</sup>, Daniel Credeur, FACSM<sup>3</sup>, Brandon Hollis<sup>3</sup>, Johanna L. Johnson<sup>1</sup>, Timothy Church<sup>2</sup>, William E. Kraus, FACSM<sup>1</sup>, Eric Ravussin<sup>2</sup>, Conrad Earnest<sup>2</sup>, Katherine L. Ham<sup>1</sup>, Carl Pieper<sup>1</sup>, Michael A. Welsch, FACSM<sup>3</sup>. <sup>1</sup>Duke University Medical Center, Durham, NC.

<sup>2</sup>Pennington Biomedical Research Center, Baton Rouge, LA. <sup>3</sup>Louisiana State University, Baton Rouge, LA.

(No relationships reported)

A challenge for our aging nation is to define interventions that can abate the decline in functional capacity and prevent a loss of independence.

**PURPOSE:** To determine differences between; (A) 4 weeks of a regionally specific training stimulus (RSTS) versus standard aerobic exercise training (AET); and (B) the effects of subsequent 8 weeks of progressive whole-body training protocol; on  $\text{VO}_{2\text{peak}}$  and combined 1RM strength (CIRM); and (2).

**METHODS:** Subjects over 70yr, who scored between 218-490yards on a 6MWT were randomized to AET or RSTS for the first 4 weeks (Phase 1). AET consisted of walking/biking at 40-60% of HRR. RSTS consisted of specific muscle group exercises focused on the calf, thigh, buttocks, arms, shoulders, and torso. Each exercise was performed for 3 to 5mins, at ~40-70% of the MVC of the primary muscle group of interest. Subjects in both groups exercised for 60mins 3days per week and were progressed as tolerated. Subsequently, all subjects were advanced to a well-rounded, whole-body exercise program using established ACSM guidelines (Phase 2).

**RESULTS:** Both groups included 54 subjects, age =  $76 \pm 5$  yrs. After adjustment for baseline, there was a group by time effect in favor of RSTS for  $\text{VO}_{2\text{peak}}$  following phase 2 (see fig). Additionally, RSTS showed greater gains than AET in CIRM following both phase 1 ( $+40$ lbs vs.  $+17$ lbs,  $p<0.01$ ) and phase 2 ( $+35$ lbs vs.  $+19$ lbs,  $p<0.01$ ).

**CONCLUSION:** The gains in aerobic capacity and maximal strength at the end of phase 2 were superior in those who used RSTS during phase 1. These results suggest RSTS may serve as a physiological primer able to remove peripheral barriers that limit functional capacity, in the elderly.

Supported by IRC1AG035822-01 and the Duke University Claude D. Pepper OAIC (AG0287) to JDA



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## F-26 Free Communication/Poster - Exercise Immunology (General)

JUNE 1, 2012 1:00 PM - 6:00 PM  
ROOM: Exhibit Hall

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### 3121 Board #86 June 1 3:30 PM - 5:00 PM

#### Effects of Acute Exercise on Expressions of Natural Killer Cell Receptors

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(No relationships reported)

**PURPOSE:** Mobilization and cytotoxicity of natural killer (NK) cells are regulated by cell surface receptors such as adhesion molecules, chemokine receptors and activating/inhibitory receptors. In this study, we examined the effects of acute exercise on the expression of these various cell surface molecules and receptors.

**METHODS:** Six healthy male college students (20.7 ± 1.2 yrs olds) exercised on the cycle ergometer for 30 min at intensities depending on individual onset of blood lactate accumulation level (70-85%VO<sub>2</sub>max). Venous blood samples were collected at rest (PRE), just before the end of exercise (END) and 30 (POST 30), 60 (POST 60), 120 (POST 120) and 180 (POST 180) min after exercise. The phenotype and density of CD16, CD56, CD44, CD62L, CD159a, CD197, CD212, CD226, CD314, CD335 and CX<sub>3</sub>CR<sub>1</sub> on CD56<sup>dim</sup> NK cells were determined by flow cytometry. Cytotoxicity was measured using a <sup>51</sup>Cr release assay.

**RESULTS:** With regard to adhesion molecules, the percentage of CD62L (L-selectin)<sup>negative</sup> cells in total CD56<sup>dim</sup> NK cells significantly increased at END (p=0.0217) and returned to PRE values at POST 30. These changes induced a decreased expression of CD62L at END. We also observed decreased expression of CD44 (HCAM, p=0.0002) and CX<sub>3</sub>CR<sub>1</sub> (Fractalkine Receptor, p=0.0167) at END. On the other hand, regarding to the NK cell activating receptors, the expressions of CD335 (NKp46) increased at END (p=0.0073), and then decreased to below PRE values at POST 120 (p=0.0362) and POST 180 (p=0.0019). The expressions of CD226 (DNAM-1, p=0.0495) and CD212 (IL-12R, p=0.0063) were also decreased at POST. Expression of CD16 (Fc gamma-R1II) decreased at END (p=0.0146) but returned to PRE levels at POST 30. Total cytotoxicity (E/T=20/1) increased at END (p=0.046) and decreased during the recovery period (p=0.0006-0.0153), but lytic units per NK cell remained unchanged throughout the experiment.

**CONCLUSION:** These results suggest that changes in adhesion molecules expression contribute to NK cell mobilization. Acute exercise also influenced the expression of other NK cell activating receptors but these changes do not directly related to per cell cytotoxicity.

This study was supported by the Grant-in-Aid for Scientific Research (B), Japan Society for the Promotion of Science, No. 21300257.

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### 3122 Board #87 June 1 3:30 PM - 5:00 PM

#### The Effect Of The Training-competition Phases In Immune Response In Triathlon

Blanca R. Rangel-Colmenero<sup>1</sup>, Germán Hernández-Cruz<sup>1</sup>, Fernando Ochoa-Ahmed<sup>1</sup>, Adrián J. Rosas-Taraco<sup>2</sup>, Jeanette M. Lopez-Walle<sup>1</sup>, Oscar Salas-Fraire<sup>2</sup>.  
<sup>1</sup>Facultad de Organización Deportiva UANL, Monterrey, Mexico. <sup>2</sup>Facultad de Medicina, UANL, Monterrey, Mexico.  
(No relationships reported)

**PURPOSE:** The immune response was analyzed during the pre-competition and competition training periods for Master triathlon athletes of Monterrey, Mexico to establish the physiological bases for Mexican athletes as the main objective and as result, to apply personalized training programs.

**METHODS:** The sample was composed of 12 male triathlon athletes, with ages between 28 to 45 years, all signed an informed consent, blood samples were taken, for the quantification of the immune response cells, trough spectrophotometric techniques in reference laboratory. The blood samples were taken weekly early in the morning before the athlete begun their physical activity during a five week training phase, during the competition phase, the blood samples were taken: immediately after competition, two hours after competition, forty eight hours and seven days after competition. During the week after competition the athletes performed light physical activity for recovery.

**RESULTS:** All the analyzed variables presented a high significance difference (P<0.01) between takes, the leucocytes and neutrophils showed a normal level behavior during the pre competition phase, immediately after they finished their competition and two hours after competition, a high significance increment was observed (takes 6 and 7) to return to normal levels during the one week post competition recovery phase. The eosinophils, basophils, lymphocytes and monocytes, showed a contrary behavior to the phenomena described before, during the pre competition phase they did not show significant changes, but right after the competition was over, the cell concentration diminished in high significance way and they acquire their normal level after the one week post competition recovery phase.

**CONCLUSIONS:** The immune response reflected a change in the number of blood cells of the athletes after performing exhausting physical activity, these cells acquire their normal levels after a week recovery period. It is important to emphasize that in an individual way each athlete showed a different response to training. The results presented in this study were an average, in some cases the athletes showed higher or lower values concluding that integral physical personalized training is strictly necessary for triathlon as a sport and also to avoid over training.

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### 3123 Board #88 June 1 3:30 PM - 5:00 PM

#### Effect Of Ultra-Endurance Exercise On Markers Of Inflammation, Hemolysis, And Hepcidin

Renate M. Leithauser<sup>1</sup>, Heinz J. Roth<sup>2</sup>, Michael Doppelmayr<sup>3</sup>, Holger Finkemagel<sup>4</sup>, Serge P. von Duvillard, FACSM<sup>3</sup>, Lawrence A. Golding, FACSM<sup>5</sup>, Ralph Beneke, FACSM<sup>6</sup>. <sup>1</sup>University of Essex, Colchester, United Kingdom. <sup>2</sup>Laboratory Limbach, Heidelberg, Germany. <sup>3</sup>University of Salzburg, Salzburg, Austria. <sup>4</sup>Performance Testing Unit, Bad Berleburg, Germany. <sup>5</sup>University of Nevada, Las Vegas, NV. <sup>6</sup>Phillips University, Marburg, Germany.  
(No relationships reported)

Endurance exercise such as marathon running has been shown to induce immunological responses similar to those seen in inflammation. It has also been identified as potentially leading to hemolysis. Hepcidin, recently recognized as a key regulator of systemic iron metabolism, has been found to be increased following a marathon race possibly induced by an exercise related increase in interleukin-6 (IL-6), a marker known to induce an acute phase response. It remains unknown whether ultra-endurance exercise leads to a more pronounced hepcidin response due to a cumulative effect of hemolysis and acute phase response.

**PURPOSE:** To investigate the effect of a 216-km run on leukocyte count and hemoglobin (hb), plasma concentrations of IL-6, C-reactive protein (CRP), haptoglobin and hepcidin in experienced endurance runners.

**METHODS:** Venous blood samples were obtained from seven highly-trained male athletes (mean (SD): 52.0 (10.6) yrs, 176.6 (9.4) cm, 75.9 (7.8) kg) before the start of the race, after 42 km and after termination of the race for the analysis of the above listed markers.

**RESULTS:** Hb did not change significantly during the race (g/dl: 14.3 (0.6); 14.8 (1.0); 14.0 (1.2), p>0.05). Leukocytes and CRP at test termination (11.7 (2.1) x10<sup>9</sup>/l and 33.2 (22.4) mg/l) were higher (p<0.05) compared to pre-run (6.0 (1.3) x10<sup>9</sup>/l and 1.0 (0.6) mg/l) and 42 km (8.4 (2.4) x10<sup>9</sup>/l and 1.0 (0.5) mg/l). Haptoglobin was decreased at 42 km (g/l: 0.60 (0.16) vs. 0.83 (0.22) pre-run, p<0.001) with no significant change thereafter (0.68 (0.29) g/l). IL-6, below detection level (< 2 ng/l) at km0, showed a significant increase at 42 km (8.8 (3.9) ng/l, p<0.001). The further increase at test termination (17.2 (16.7) ng/l) did not reach statistical significance. Hepcidin levels did not change significantly during the race (µg/l: 183.4 (59.7); 182.6 (70.2); 167.4 (49.0), p>0.05).

**CONCLUSIONS:** The clear increases in leukocytes and CRP throughout the race indicate inflammation probably induced by the increase of IL-6 in the early phase of the race. The haptoglobin decrease after 42 km demonstrates some hemolysis during the same period. Although inflammation has been described previously to stimulate hepcidin production, hepcidin remained unchanged during this ultramarathon in non-anemic males.

Supported by Limbach Laboratory, Heidelberg, Germany

**3124 Board #89 June 1 3:30 PM - 5:00 PM**  
**Chronic Changes In Serum IL-6 And TNF- $\alpha$  Following 12 Weeks Of Concurrent Resistance And Aerobic Exercise Are Dependent On Exercise Mode And May Affect Adaptation.**

Brad S. Lambert, Justin P. Dobson, Dr. Stephen F. Crouse, FACSM. *Texas A&M University, College Station, TX.*  
*(No relationships reported)*

**PURPOSE:** To examine physiological responses to concurrent resistance and land treadmill training (RT-LTM) compared to concurrent resistance and aquatic treadmill training (RT-ATM) and the chronic effect of each on serum TNF- $\alpha$  and IL-6 (cytokines associated with chronic inflammation, CVD, and skeletal muscle metabolism).

**METHODS:** Twenty-six untrained subjects (M: n=13, 98.6 $\pm$ 17.1kg, 182.2 $\pm$ 6.2cm, 34 $\pm$ 11yrs, F: n=13, 78.9 $\pm$ 14.0kg, 165.1 $\pm$ 5.1cm, 38 $\pm$ 11yrs) were screened to assess VO<sub>2max</sub>, Bcomp (DEXA), and strength (Lifts: leg press, chest press, leg curl, lat pull, leg ext, triceps push-down, biceps curl). Subjects were then randomized into 2 groups (RT-LTM<sup>m=6, f=7</sup> | RT-ATM<sup>m=7, f=6</sup>). Each performed progressive RT (2/wk, 3 x 8-12 @ 60%-->80% 1RM) for 12 wks. Both groups also performed 12 wks of aerobic LTM or ATM (60-->85%VO<sub>2max</sub>) respectively. ATM or LTM occurred immediately following RT sessions and in isolation on a 3<sup>rd</sup> day during the wk. Kcal/session: Wk 1-6 = 250-->500 kcal/session, Wk 6-12 = 500 kcal/session. Baseline tests were re-performed at wk 6 and after training. Blood samples were obtained in the rested state before and after training. Serum TNF- $\alpha$  and IL-6 was analyzed using a multiplex assay kit (Luminex®, Millipore®). A 2x2 Mixed Model ANOVA w/ repeated measures was used to examine absolute and relative changes in the independent variables listed in the table.

**RESULTS:**

| INDEP. VAR.  | Lean Mass (kg)                  | Fat Mass (kg)                    | %Body Fat (%)                    | VO <sub>2max</sub> (ml/kg/min)   | Total Strength (lbs)              | IL-6 (pg/dl)                       | TNF- $\alpha$ (pg/dl)             |
|--|---------------------------------|----------------------------------|----------------------------------|----------------------------------|-----------------------------------|------------------------------------|-----------------------------------|
| BASELINE MEASUREMENTS  |                                 |                                  |                                  |                                  |                                   |                                    |                                   |
| RT-LTM   | 49.85 $\pm$ 3.65                | 35.91 $\pm$ 3.13                 | 42.08 $\pm$ 2.48                 | 29.90 $\pm$ 1.99                 | 1457.42 $\pm$ 135.12              | 4.62 $\pm$ 1.57                    | 7.07 $\pm$ 1.87                   |
| RT-ATM   | 53.12 $\pm$ 3.98                | 31.09 $\pm$ 2.78                 | 37.04 $\pm$ 2.32                 | 32.13 $\pm$ 1.63                 | 1552.83 $\pm$ 145.91              | 4.64 $\pm$ 1.58                    | 7.86 $\pm$ 1.48                   |
| POST TRAINING MEASUREMENTS   |                                 |                                  |                                  |                                  |                                   |                                    |                                   |
| RT-LTM   | 51.03 $\pm$ 4.67 <sup>†</sup>   | 34.13 $\pm$ 2.68 <sup>†</sup>    | 40.13 $\pm$ 3.6 <sup>†</sup>     | 35.84 $\pm$ 2.94 <sup>†</sup>    | 1843.42 $\pm$ 201.07 <sup>†</sup> | 7.12 $\pm$ 1.57 <sup>†</sup>       | 6.80 $\pm$ 0.51                   |
| RT-ATM   | 55.75 $\pm$ 4.62 <sup>†</sup>   | 30.32 $\pm$ 3.101                | 35.60 $\pm$ 2.36 <sup>†</sup>    | 35.79 $\pm$ 2.25 <sup>†</sup>    | 2193.56 $\pm$ 251.28 <sup>†</sup> | 5.08 $\pm$ 2.66                    | 6.65 $\pm$ 1.03 <sup>†</sup>      |
| % $\Delta$ = Calculated From Each Individual Subjects Change From Baseline |                                 |                                  |                                  |                                  |                                   |                                    |                                   |
| RT-LTM   | 2.56% $\pm$ 1.39 <sup>†,a</sup> | -6.49% $\pm$ 2.38 <sup>†,a</sup> | -5.78% $\pm$ 1.80 <sup>†,a</sup> | 14.06% $\pm$ 2.34 <sup>†,a</sup> | 21.29% $\pm$ 1.13 <sup>†,a</sup>  | 125.92% $\pm$ 36.56 <sup>†,a</sup> | -1.82% $\pm$ 5.99 <sup>a</sup>    |
| RT-ATM   | 4.20% $\pm$ 0.93 <sup>†,b</sup> | -2.14% $\pm$ 1.55 <sup>b</sup>   | -4.10% $\pm$ 1.49 <sup>†,a</sup> | 4.51% $\pm$ 3.04 <sup>†,b</sup>  | 27.07% $\pm$ 1.74 <sup>†,b</sup>  | 28.05% $\pm$ 34.69 <sup>b</sup>    | -13.04% $\pm$ 5.40 <sup>†,b</sup> |

Values are means  $\pm$  SE. % $\Delta$  = Individual change from baseline. Like letters = not significantly different between groups, <sup>†</sup>=Significant change from baseline ( $\alpha \leq 0.05$ ).

**CONCLUSION:** Chronic RT-LTM and RT-ATM training elicit different effects on markers of chronic inflammation which may be related to differing health and fitness outcomes observed between our groups.

**3125 Board #90 June 1 3:30 PM - 5:00 PM**  
**Effects of Exercise Training on Inflammatory and Hypoxic Gene Expression in White Adipose Tissue**

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*(No relationships reported)*

Obesity contributes to the development of inflammation and lifestyle related diseases, such as type II diabetes mellitus. Exercise training can have anti-inflammatory effects but it is unclear if it is a potent enough stimulus to positively affect white adipose tissue (WAT) and glucose regulation in the presence of an obesigenic diet.

**PURPOSE:** To determine the effect of 12 weeks of a very high fat (VHF) diet and/or exercise training (EX) on glucose regulation and inflammatory and hypoxic gene expression within white adipose tissue.

**METHODS:** Male C57BL/6J mice (n=39) were randomized into four groups: low-fat (LF)/sedentary (SED), LF/EX, VHF/SED, and VHF/EX. The VHF and LF diets were 60% and 10% fat, respectively. The mice were placed on the diet and exercise intervention concomitantly. Exercise training consisted of treadmill running 5 d/wk at 12 m/min, 5% incline, 40 min/d for 12 weeks. A subset of mice had intraperitoneal glucose tolerance tests (IPGTT). Quantitative real-time PCR was used to determine gene expression of inflammatory and hypoxia markers within white adipose tissue.

**RESULTS:** Animals given the VHF diet gained more weight than mice on the LF diet (p<0.05) but weight gain was partially attenuated by exercise training (p<0.05). The VHF diet also increased epididymal fat pad weight relative to total body mass (p<0.05). Animals on the VHF diet had impaired glucose tolerance as indicated by increased area under the glucose curve (p<0.05), with exercise training having no effect (p>0.05). The VHF diet increased gene expression markers of inflammation, tumor necrosis factor alpha, interleukin-1 receptor antagonist (IL-1ra), interleukin-6 (IL-6), and interleukin 10 (IL-10) (p<0.05), within the WAT. Exercise was able to reduce the expression IL-1ra in animals on a VHF diet (p<0.05). The VHF diet increased hypoxia inducible factor 1(HIF-1) but exercise training did not attenuated HIF-1 gene expression in the VHF diet fed animals (p>0.05).

**CONCLUSION:** Concomitant exposure to moderate exercise training for 12 weeks may help reduce body weight but does not show robust effects in stemming inflammation within the WAT. Supported by University of Illinois Research Board seed grant.

**3126 Board #91 June 1 3:30 PM - 5:00 PM**  
**Effects of Exercise Training in Mice Models of Graft Versus Host Disease**

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*(No relationships reported)*

**PURPOSE:** Graft vs. host disease (GVHD) is a major complication of hematopoietic stem cell transplantation (HSCT), with a morbimortality of 30-40%. We evaluated the effects of post-HSCT aerobic training on several aspects of GVHD in a murine acute (cytotoxic, C57BL/6J) and chronic model (inflammatory, BALB/C): clinical course, post-HSCT immune cell reconstitution and cytokine profile.

**METHODS:** Twenty C57BL/6J (H-2<sup>b</sup>) and twenty-eight BALB/C (H-2<sup>d</sup>) female adult recipient mice (age: 8-12wk) were assigned to an exercise (EX; n=11 C57BL/6J mice, and n=15 BALB/C) or sedentary control group (CONT; n=9 C57BL/6J, n=13 BALB/C). All mice were adapted to treadmill running 3d before completing a maximal test; thereafter they were total-body irradiated before HSCT. All mice were transplanted through the tail vein (with donor bone marrow cells (10x10<sup>6</sup>/mouse) and donor splenocytes (20x10<sup>6</sup>/mouse<sub>C57BL/6J</sub> and 10x10<sup>6</sup>/mouse<sub>BALB/C</sub>)). The exercise program started 2d after HSCT, lasted 11wk (5 sessions/wk), and ended with a second maximal test; running speed and inclination, and exercise duration were gradually increased over time. GVHD was monitored daily with a severity score that incorporates (individually and in combination) 5 clinical parameters: weight loss, posture (hunching), activity, fur texture, and

skin integrity. Before HSCT, 21d and 54d post-HSCT, and in the day of death, we collected blood samples for immune cell reconstitution (B220, CD3, CD4, CD8, Mac1 subpopulations) and cytokine analysis (IL2, IL4, IL6, IL17A, TNF- $\alpha$  and INF $\gamma$ ).

**RESULTS:** In C57BL/6J, physical capacity significantly increased in EX and decreased in CONT whereas in BALB/C, the decline in physical capacity was attenuated in EX ( $P=0.001$  and  $P=0.021$  for the between-group comparison, respectively). We found a significant group\*time interaction effect for total clinical score ( $P=0.002$ ) and mice hair ( $P<0.001$ ) in C57BL/6J, and for activity ( $P<0.001$ ) and hunching ( $P=0.045$ ) in BALB/C, all reflecting a beneficial effect of exercise. The exercise benefits were not accompanied by significant improvements in immune cell reconstitution or inflammatory profile ( $P>0.05$  for interaction effects).

**CONCLUSIONS:** Aerobic exercise seems to have a beneficial effect on the clinical course of GVHD, especially in its less severe model

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**3127** Board #92 June 1 3:30 PM - 5:00 PM

#### Changes Of Tlr4 Signaling-mediated Protein Expression With Endurance Exercise In Rats

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(No relationships reported)

The innate immune response is the first line of defence against infectious disease. A group of proteins that comprise Toll or Toll-like family of receptors (TLRs) has been suggested as one of the markers associated with immune and inflammatory responses. TLR4 among the TLRs produces a response by lipopolysaccharide (LPS) and controls inflammatory responses.

**PURPOSE:** This study was performed to demonstrate the change of TLR4 signaling-mediated protein expressions in skeletal muscle during the recovery of intensive endurance exercise.

**METHODS:** Sprague-Dawley rats (12weeks,  $n=35$ ) were randomly divided into five groups ( $n=7$  each) to time period of the exercise (pre, post 0 h, 30min, 1 h and 6 h). The rats ran on the rodent treadmill for 1 hour at the level of 75–80%  $VO_{2max}$  (28m/min). The change of TLR4, MyD88 protein expression and NF $\kappa$ Bp65 DNA binding activity were analyzed by western blotting in Extensor Digitorum Longus (EDL) muscle.

**RESULTS:** TLR4 protein expression was significantly decreased by 41% ( $p=0.036$ ) with the intensive endurance exercise, whereas MyD88 was not changed. NF $\kappa$ B significantly increased by 51% ( $p=0.014$ ) at 1h of recovery, but returned to the resting level 6 h post exercise.

**CONCLUSIONS:** These results suggest an interaction between TLR4 and NF $\kappa$ B suggesting that exercise-induced change of TLR4 expression may serve as a messenger molecules to defence inflammatory response in rat skeletal muscle.

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**3128** Board #93 June 1 3:30 PM - 5:00 PM

#### Lymphocyte Apoptosis And TNF- $\alpha$ In Smokers And Non-smokers Following Different Intensity Of Exercises

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(No relationships reported)

Chronic smokers have an antioxidant imbalance and suppressed immunity, which may make them more susceptible to post exercise immune suppression. It is possible that the concentration of inflammatory cytokines may be differentially altered after exercise in smokers vs. non-smokers.

**PURPOSE:** The purpose of the study was to examine changes in inflammatory cytokines and lymphocyte apoptosis after exercise in smokers compared to non-smokers.

**METHODS:** Fourteen physically inactive smokers (SM,  $\geq 1$  pack year,  $n=7$ ) and non-smokers (NS,  $n=7$ ) aged 18 to 26 (SM:  $20.67 \pm 0.96$  vs. NS:  $20.17 \pm 0.26$ , *Mean* $\pm$ *SE*) were recruited. Each subject completed three treadmill runs at different intensities in a random order (60%, 70%, and 80% of  $VO_{2max}$ ). Running distance for all three runs was equivalent to 30-min run at 70%  $VO_{2max}$ . Lymphocyte apoptosis and levels of inflammatory cytokines (TNF- $\alpha$ , IL-4,6,10) were analyzed at rest (PRE), immediately after (POST), and 1 h following (1H) each run. Data was analyzed using two-way repeated measures ANOVA with  $P<0.05$ .

**RESULTS:** Lymphocyte apoptosis increased following all three running trials in dose dependent manner to exercise intensity ( $P=0.01$ ). SM had greater lymphocyte apoptosis than NS at POST following 60% ( $12.5 \pm 0.62\%$  vs.  $9.97 \pm 0.51$ ,  $P=0.008$ ) and 70% trials ( $17.53 \pm 0.57\%$  vs.  $15.6 \pm 0.41$ ,  $P=0.018$ ). There was no significant difference for lymphocyte apoptosis for either SM or NS at Post following 80%  $VO_{2max}$  run. SM showed higher level of TNF- $\alpha$  as compared to NS ( $47.0 \pm 4.3$  pg/ml vs.  $30.4 \pm 4.7$ ,  $P=0.025$ ) and TNF- $\alpha$  at Post was significantly higher in both SM ( $55.5 \pm 5.1$ ,  $P=0.023$ ) and NS ( $34.0 \pm 5.5$ ,  $P<0.023$ ) than Pre (SM:  $41.3 \pm 4.3$ , NS:  $29.5 \pm 4.7$ ) and 1h post (SM:  $44.2 \pm 4.1$ , NS:  $27.7 \pm 4.4$ ).

**CONCLUSIONS:** Smokers had greater lymphocyte apoptosis compared to non-smokers following runs at 60% and 70%  $VO_{2max}$ , but not following a run at 80%  $VO_{2max}$ ; however, changes in TNF- $\alpha$  did not appear to explain this effect. More research is needed to understand the mechanisms that contribute to the apoptosis following exercise in smokers.

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**3129** Board #94 June 1 3:30 PM - 5:00 PM

#### Circulating TWEAK Is Affected By High-intensity Intermittent Exercise In Healthy Children

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(No relationships reported)

Tumor necrosis factor related weak inducer of apoptosis (TWEAK) is a potent muscle degrading cytokine. In children, the rate of muscle growth is greatest around the age of peak height velocity (PHV). While physical activity is considered a biological requisite for healthy growth and development, the mechanisms translating exercise into healthy growth during childhood are not well understood.

**PURPOSE:** To examine the effects of moderate-intensity continuous exercise (MICE) and high-intensity intermittent exercise (HIIE) on TWEAK in healthy children at different stages of growth.

**METHODS:** Twenty-five healthy children (mean age:  $13.6 \pm 2.4$  years, 5 females) had their peak aerobic mechanical power (PMP) determined using an incremental cycling test. MICE, consisting of 2 x 30-min bouts of cycling at 50% PMP, and HIIE, consisting of 6 sets of 4 x 15-sec bouts of cycling at 100% PMP, were performed one week apart. Venous blood was drawn at rest (REST), at end of exercise (EX-END) and after 60 min of recovery (REC). Serum was analyzed for TWEAK using ELISA. Comparisons were done between children at the age of PHV ( $n=7$ , 2 females) and children who were either before or after the age of PHV using repeated measures two-way ANOVA.

**RESULTS:** In response to HIIE, TWEAK decreased at EX-END ( $718.8 \pm 136.7$  pg/ml,  $p<0.05$ ) compared to REST ( $1144.3 \pm 534.5$  pg/ml,  $p<0.05$ ) in children at the age of PHV. TWEAK at EX-END was lower in children at the age of PHV ( $718.8 \pm 136.7$  pg/ml) compared to children who were not ( $1112.8 \pm 389.4$  pg/ml,  $p<0.05$ ). In addition, the change from rest was greater for children at the age of PHV ( $-407.5 \pm 486.6$  pg/ml) than children who were not ( $-13.5 \pm 342.8$  pg/ml,  $p<0.05$ ) for HIIE (Main effect for group,  $p<0.05$ ). MICE had no effect on TWEAK.

**CONCLUSIONS:** The muscle degrading cytokine, TWEAK, was decreased by HIIE in children who are in a phase of rapid growth. The reduced TWEAK levels may be a mechanism by which exercise reflecting children's natural physical activity patterns helps promote growth.

Supported by the Natural Sciences and Engineering Research Council of Canada

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**3130** Board #95 June 1 3:30 PM - 5:00 PM

#### Circus Physical Exercise Decrease Partially Excessive Activation Of T Lymphocytes In Overweight Children

Cesar Miguel Momesso<sup>1</sup>, Silvia Guirado<sup>1</sup>, Kim Caçula<sup>1</sup>, Fabio Takeo<sup>2</sup>, Cristina Cassoni<sup>1</sup>, Cristiane Borges<sup>1</sup>, Vinicius Coneglian<sup>2</sup>, Tania Pithon-Curi<sup>1</sup>, Rui Curi<sup>2</sup>, Renata Gorjão<sup>1</sup>. <sup>1</sup>UNICSUL, São Paulo, Brazil. <sup>2</sup>USP, São Paulo, Brazil.

(No relationships reported)

Obesity associated with sedentary lifestyle can lead to changes in the immune system function, resulting in the development of inflammatory diseases. The occurrence of these diseases may be related to a change in the primary control exerted by T lymphocytes

**PURPOSE:** The aim of this study was to evaluate the mechanisms of lymphocyte activation in overweight children, when performing or not circus physical exercises.

**METHODS:** The studied group was composed by 60 children, pubescent, divided in four subgroups: Overweight Children (OWC) (10.67 ±0.90 years old and BMI 23.02 ±2.74); Overweight Exercise (OWE) (10.00 ±1.41 years old and BMI 24.64 ± 3.03); Eutrophic Children (EC) (11.00 ±1.24 years old and BMI 17.51 ±1.98); and Eutrophic Exercise (EE) (10.60 ±1.06 years old and BMI 16.80 ±2.53). OWE group practiced circus activities twice a week, during six months. CD95 and CD25 expression in CD4+ lymphocytes and T regulatory cells (Treg) percentage were evaluated by flow cytometry; proliferative capacity by incorporation of thymidine and lymphocyte mRNA expression of IL-35, TGF-beta, IL-2 and IL-10 was determined by real time PCR.

**RESULTS:** A higher lymphocyte proliferative capacity was observed in OWC and OWE groups when compared to EC (3509 ±887.2; 2694 ±560.4 and 1768 ±208.2 cpm, respectively). The same was observed in comparison to EE (2313 ±111 cpm) groups. In the CD95 expression, EC (953.9 ±101.2) and EE groups (736.7 ±194.6) showed higher values than the OWC group (522.1 ±125) and OWE group (551.6 ± 144.5). The percentage of Treg was lower in OWC than in EC and EE groups. mRNA expression of IL-35 and IL-10 was lower in OWC and OWE groups in relation to EC and EE. Plasma cytokine concentration was not altered in any group. These results indicate that an imbalance in lymphocyte regulation occurs in overweight children. These cells are involved in the suppression of excessive activation of peripheral lymphocytes evidenced by proliferation assay. In addition, a lower expression of CD95 is related to a fail in the inhibition of excessive lymphocyte proliferation.

**CONCLUSIONS:** These alterations indicate that overweight children are more prone to develop diseases related to immune system function and circus exercises partially revert these factors.

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3131 Board #96 June 1 3:30 PM - 5:00 PM

**The Time Course For Changes In Leukocyte Count In Response To Exercising In A Hot Environment**

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(No relationships reported)

Exercising in a hot environment is associated with a multitude of cardiovascular alterations such as an increase in core temperature, dehydration and cardiac drift. However, there is minimal research investigating the time course of changes in leukocytes in response to exercise and thermal stress. Additionally, it is not known whether there is a critical point in core temperature for alterations in leukocytes.

**PURPOSE:** To investigate the time course of changes in blood leukocyte relative to core temperature during and following endurance exercise in a hot environment.

**METHODS:** Eight recreational cyclists (age=30.9±2.2 yrs; height=177.9±4.1 cm; mass=74.5±4.5 kg) completed a VO<sub>2</sub>max in hot conditions (35°C, 70% RH) to determine 60% of peak power output. One week later the participants returned to the laboratory and cycled at this intensity until they reached a core temperature of 38.5°C. Blood was sampled before, during, and after (0, 10, 25, 35, 45, post 10 and post 20 mins) exercise. Statistical analysis was completed using marginal models with a level of significance set at P<0.05.

**RESULTS:** Cycling at 60% of peak power output until core temperature reached 38.5°C showed an effect of time on circulating numbers of neutrophils (F=22.1, P<0.001), lymphocytes (F=8.3, P<0.001), monocytes (F=8.1, P<0.001) and eosinophils (F=4.5, P=0.002). However, these alterations in leukocytes were not related to changes in core temperature during exercise and recovery.

**CONCLUSION:** Changes in leukocytes appear to be more sensitive to the exercise duration rather than changes in core temperature. Furthermore, these data showed that there was no critical core temperature for change in leukocyte count.

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3132 Board #97 June 1 3:30 PM - 5:00 PM

**Heat Potentiates Epinephrine-induced Interleukin-6 In C2c12 Cells**

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(No relationships reported)

Circulating IL-6 is elevated in conditions such as hyperthermia and exercise. Skeletal muscle (SM) is a known producer of IL-6 in a variety of conditions and it may play a role in the whole body immune response. Furthermore, SMs are known for their heat generating capability. Previously, we have identified heat as a unique stimulus of IL-6 in SM in both cell culture, *in vitro*, and *in vivo* mouse muscle.

**PURPOSE:** Objectives of this study: 1) to determine if C2C12 cells produce more IL-6 in response to epinephrine (EPI) when combined with an acute heat stimulus, 2) to compare the response of myoblasts and myotubes to these combined stimuli, and 3) to investigate the pattern of secreted cytokines and chemokines that are up-regulated in response to EPI alone and in combination with heat.

**METHODS:** C2C12 cells were grown to 80% confluence, then supplemented with EPI (100 ng/ml) and simultaneously exposed to 37 °C or 42°C for 1 hr. Cells were then harvested or allowed to recover at 37°C for 1 and 2 hr. In a separate experiment, cells were treated with varying doses of EPI (0.1, 1, 10, and 100 ng/mL) and kept at 37°C for 6 hr or treated at 42°C for 1 hr and allowed to recover for 5 hr, post-heat. The cellular supernatant was sampled and analyzed for protein(s) using both ELISA and Luminex.

**RESULTS:** Significant up regulation of IL-6 mRNA was seen in myoblasts and myotubes in response to EPI (P<.05). In myoblasts the addition of heat to the EPI stimulus potentiated the increase of IL-6 when compared to EPI alone (P<0.05); the amplification of the IL-6 mRNA response spanned 3 hr. In contrast, with myotubes, heat-potentiated IL-6 mRNA was not seen until 2 hr. In addition to the IL-6 signal, multiple cytokines and chemokines were up regulated in response to EPI and potentiated when co-stimulated with heat.

**CONCLUSION:** These results further demonstrate that hyperthermia is a functional stimulus for IL-6 mRNA and protein in SM. Furthermore, the results suggest that the myoblast phenotype is more responsive to heat as a co-stimulus than myotubes. The influence of muscle derived cytokines on the systemic immune response is still poorly understood. Our results suggest that SM produces more IL-6 when temperature is up-regulated. We speculate that SM may play a role in the elevations of circulating IL-6 seen in exercise, hyperthermia, and other stressors.

AHA #11GRNT7990119

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3133 Board #98 June 1 3:30 PM - 5:00 PM

**Six-minute Walk Test And Physical Activity Are Associated With Hs-crp In Community Dwelling Older Adults**

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(No relationships reported)

Increase physical activity (PA) and fitness is recommended for health promotion and disease prevention in adults but there is conflicting evidence regarding the extent to which high levels of PA and aerobic fitness prevented low-grade chronic inflammation in older adults.

**PURPOSE:** This study aimed to observe the correlates and associations between aerobic fitness and daily physical activity with biomarkers of inflammation.

**METHODS:** Eighty-five old individuals (21 men, 68.0±5.5years, BMI = 28.3±4.5 kg/m<sup>2</sup>) were analyzed: aerobic fitness (six-minute walk test; 6MWT), objectively assessed PA (accelerometers, counts/min), body composition (DXA), interleukin (IL) 6 (IL-6) and 10 (IL-10), Tumor necrosis alpha (TNF-alpha), interferon-gamma (IFN-gamma) and high-sensitive C-reactive protein (hs-CRP) were assessed. Pearson correlation analysis was used to assess the relationship between 6MWT, PA and inflammatory biomarkers. To examine the shared variance between 6MWT, PA and biomarkers, linear regression analyses were employed.

**RESULTS:** Inverse associations were observed between 6MWT and hs-CRP ( $r = -0.359$ ;  $p < 0.01$ ) as well as between PA and hs-CRP ( $r = -0.311$ ;  $p < 0.05$ ). Data from linear regression reinforced that 6MWT ( $p < 0.01$ ) as well as PA ( $p < 0.01$ ) were significantly associated with hs-CRP even when models were adjusted to trunk fat, inserting this covariable in models increased from 11.7 to 22.6% ( $p < 0.01$ ) and from 8.3 to 22.2% the hs-CRP variance explained by the models (6MWT and PA, respectively).

**CONCLUSION:** Our study reinforces the idea that lower fitness and PA levels are related with low-grade chronic inflammation as assessed by hs-CRP. Supported by the Portuguese Foundation for Science and Technology (grants number, PTDC/DES/108780/2008 and SFRH/BD/33124/2007)

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3134 Board #99 June 1 3:30 PM - 5:00 PM

**Effects of 12-weeks Walking Program on Oxidative Stress Markers in Older Adults**

Masaki TAKAHASHI, Masashi Miyashita, Jong-Hwan Park, Noriaki Kawanishi, Harumi Hayashida, Hyun-Shik Kim, Yoshio Nakamura, Shizuo Sakamoto, Katsuhiko Suzuki. *Waseda University, Tokorozawa, Japan., Saitama, Japan.*  
(No relationships reported)

Oxidative stress is associated with the increased risk of atherosclerosis and cardiovascular disease. Oxidative stress or chronic inflammation increase with advancing age and regular exercise exerts anti-oxidant/inflammatory effects. However, it remains unclear whether exercise at an amount lower than currently recommended confers such anti-oxidant/inflammatory effects in older adults.

**PURPOSE:** The purpose of this study was to investigate the effects of 12 weeks of supervised walking program below the current recommended amount of exercise on oxidative stress and antioxidant capacity in older adults.

**METHODS:** Twenty-eight older adults (65-78 yr) were assigned into either control (N = 14) or exercise (N = 14) group. Exercise program consisted of walking 30-60 min/session on 2 days of the week for 12 weeks. Blood samples were taken at baseline and after 12 weeks in both groups. Fasting plasma concentration of reactive oxygen metabolites (d-ROMs), advanced oxidation protein products (AOPP), thiobarbituric acid reactive substances (TBARS), myeloperoxidase (MPO), biological antioxidant potential (BAP), thioredoxin (TRX) and activity of superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPX) were measured.

**RESULTS:** Plasma d-ROMs concentrations tended to be decreased only in the exercise group after 12 weeks compared with the baseline values (P=0.05). Compared with the control group, there was a significant decrease in plasma AOPP concentrations after 12-weeks walking program (P<0.05). Plasma BAP, TRX concentrations and GPX activity were significantly increased only in the exercise group after 12 weeks compared with the baseline values (P<0.05). Plasma CAT activity was significantly decreased only in the exercise group after 12 weeks compared with the baseline values (P<0.05). Plasma TBARS, MPO concentrations and SOD activity did not change significantly in both groups after 12 weeks. **CONCLUSIONS:** These findings demonstrate that a 12 week of walking program equivalent to an amount of exercise below the current minimum recommendation in older adults may attenuate basal oxidative stress and increase protection against oxidative stress by increasing antioxidant capacity.

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3135 Board #100 June 1 3:30 PM - 5:00 PM

**Physical Exercise And Immunosenescence: Can We Play For Healthy Ageing?**

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(No relationships reported)

Ageing is accompanied by the modification and the progressive dysfunction of systemic immunity. High and moderate intensity dynamic exercise can affect gene expression profiles of human white blood cells even after a single bout of exercise. However, it is not clear how the genes implied in immune system modulation may be regulated in response to physical exercise and whether the immune cells of elderly people can be responsive to the "exercise stimulus".

**PURPOSE:** To characterize the interplay of ageing and physical activity in the process of immunosenescence by using a large-scale approach based on microarray analysis.

**METHODS:** We evaluated the transcriptional profile of whole blood cells (WBCs) produced by single bouts of exercise of different intensities. Experiments have been carried out on two groups of 10 healthy men of different age (50±5 and 70±5 yy) recruited locally. Both groups performed in two different occasions 30 min of constant workload cycling exercise corresponding to 80% and 60% of V'O<sub>2max</sub>. RNA-stabilized blood samples were obtained 30 min before and 1hr after each constant load tests. Gene expression of WBCs was evaluated using whole genome microarray expression analysis with Affymetrix Human Gene 1.0 ST arrays.

**RESULTS:** Results from Gene Set Enrichment Analysis highlighted age-related differences at the baseline connected to immune response, stress response, cellular metabolic pathways and cell death. In both groups the exercise performed at different intensities brought about slightly different signature, and the observed patterns differed as a function of age. Several known gene pathways related to cell proliferation, cellular metabolism, cytokine regulation, inflammation and cellular differentiation were modified.

**CONCLUSIONS:** Ageing alters gene expression profile of immunocompetent cells. A single bout of physical exercise can modulate the activity and the interactions of immunocompetent cells and blood cells composition.

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3136 Board #101 June 1 3:30 PM - 5:00 PM

**Lymphocyte Subset Response To An Acute Bout Of Exercise Following A Night Of Sleep Disruption**

Lesley Ingram<sup>1</sup>, Richard Simpson<sup>2</sup>, Eva Malone<sup>1</sup>, Geraint Florida-James<sup>1</sup>. <sup>1</sup>Edinburgh Napier University, Edinburgh, United Kingdom. <sup>2</sup>University Of Houston, Houston, TX.  
(No relationships reported)

Lymphocyte subsets that demonstrate high cytotoxic capabilities (Natural Killers (NK) cells, KLRG1+/CD8+ T-cells) are highly responsive to acute exercise, which may suggest a role for cytotoxic T-cells during post-exercise immune surveillance. Sleep disruption (DS) is known to alter biological rhythms and catecholamine responses to acute stress. As the mobilisation of cytotoxic lymphocytes with exercise is governed by β<sup>2</sup> adrenergic receptors and catecholamines, DS could alter lymphocyte trafficking in response to exercise.

**PURPOSE:** To determine if a night of DS alters cytotoxic lymphocyte mobilisation and extravasation in response to acute exercise.

**METHODS:** Ten male cyclists (age (27 ± 8 years), height (176 ± 7 cm), mass (74 ± 8 kg) performed a 40k TT on a cycle ergometer. Using a randomised cross-over experimental design, participants completed two further trials cycling for 1hour at 90% of the mean wattage obtained from the 40km TT, following either a night of DS (woken every hour of the night over an 8 hour period) or a night of undisturbed sleep (US) (left undisturbed for an 8hour period). Heart rate (HR) was recorded and the Epworth Sleepiness Scale (ESS) was completed during trials. Blood lymphocytes were isolated before, immediately after, and 1 h post exercise and assessed for cell surface expression of CD45RA, CD45RO, γδ TCR and KLRG1, and lymphocyte subset markers (CD3, CD4, CD8, CD56) by 4-colour flow cytometry.

**RESULTS:** Following the DS trial, sleepiness and rating of perceived exertion (RPE) was significantly elevated, whereas average HR was lowered during exercise. Numbers of all lymphocyte subsets (CD3+, CD3+/CD4+, CD3+/CD8+, CD3-/CD56+) increased with exercise. Baseline lymphocyte counts and lymphocyte subset counts were unaffected by DS, however total lymphocytes and CD3-/CD56+ NK-cells were mobilized in greater numbers in response to exercise following DS compared to US. Cortisol, epinephrine and norepinephrine were also unaffected by DS.

**CONCLUSION:** One night of sleep disruption lowers the heart rate response and amplifies the mobilisation of NK-cells in response to acute exercise. These data indicate that altered sleep patterns could interfere with the trafficking of cytotoxic lymphocytes in response to acute exercise and might play a role in athlete infection susceptibility.

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3137 Board #102 June 1 3:30 PM - 5:00 PM

**The Effect of Tai Chi Chuan on Th1 / Th2 Balance in Middle-aged and Older Women**

Beibei Luo, Ru Wang, Yajun Zhang, Peijie Chen. *Shanghai University of Sport, Shanghai, China.*  
(No relationships reported)

**PURPOSE:** Tai Chi Chuan (TCC) exercise improves cellular immune function by increasing the ratio of interferon-γ (IFN-γ) and interleukin-4 (IL-4). And regulatory T cell (Treg) may play a role in regulating T helper (Th) cell differentiation. However, the gene level changes of Treg and Th cells under TCC exercise remains to be determined. Therefore, this study investigated the effect of TCC exercise on cytokines and co-stimulatory molecules mRNA expression of Th and Treg cells in middle-aged and older women, to explore the possible mechanism that TCC exercise promotes Th1/Th2 balance under Treg's regulation.

**METHODS:** 34 middle-aged and older women were assigned to TCC group (TCC: 16, age: 59.23±2.49) and control group (CON: 18, age: 59.68±3.01). All subjects had no experience of TCC. Before (PRE) and after (POST) the TCC exercise, we used real-time polymerase chain reaction to test the mRNA expression of Th and Treg cytokines and co-stimulatory molecule:

transforming growth factor- $\beta$  (TGF- $\beta$ ), interleukin-10(IL-10), cytotoxic T lymphocyte antigen 4 (CTLA-4), IL-4 and IFN- $\gamma$ , normalized by GAPDH. And CD4+CD25+CD127low Treg cells in peripheral blood were detected by flow cytometry.

**RESULTS:** Before TCC exercise program, there were no significant differences between TCC group and CON group in mRNA expression of cytokines and co-stimulatory molecules, or the percentage of Treg cells in CD4+ T cells. After TCC exercise, the mRNA expression of IFN- $\gamma$  (TCC: 2.60 $\pm$ 0.46, CON: 1.08 $\pm$ 0.22,  $p$ <0.01) and IFN- $\gamma$ /IL-4 ratio were significantly increased in TCC group (TCC: 5.12 $\pm$ 1.15, CON: 3.38 $\pm$ 0.22,  $p$ <0.05). The percentage of Treg cells in CD4+ T cells in TCC group was higher than control group (TCC: 10.77 $\pm$ 0.80, CON: 7.22 $\pm$ 0.28,  $p$ <0.01). In addition, we found an increasing on mRNA expression of TGF- $\beta$  (PRE: 4.48 $\pm$ 0.46, POST: 1.46 $\pm$ 0.53,  $p$ <0.01), CTLA-4 (PRE: 55.46 $\pm$ 6.03, POST: 208.27 $\pm$ 26.31,  $p$ <0.01) and IL-10 (PRE: 68.23 $\pm$ 7.30, POST: 102.60 $\pm$ 17.18,  $p$ <0.01) in TCC group after 32-week exercise. It indicates that Treg cells mediators negatively affect the Th2 cytokines mRNA expression, therefore increase Th1 cytokines mRNA expression.

**CONCLUSIONS:** Long-term TCC exercise enhances the number of Treg cells and the mRNA expression of Treg cells mediators that helps to improve Th1/Th2 balance in middle-aged and older women.

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**3138** Board #103 June 1 3:30 PM - 5:00 PM

**Inflammatory Response Induced By Treadmill Exercise To Fatigue In Mice**

Albená Nunes-Silva, Priscila Teles Toledo, Bárbara Maximino Rezende, Fernando Lopes, Elisa Couto Gomes, Mauro Martins Teixeira, Vanessa Pinho. *Universidade Federal de Minas Gerais (UFMG), Belo Horizonte, Brazil.*

(No relationships reported)

Researches show that during an acute bout of exercise there is an activation and mobilization of immune cells into circulation, a change in pro-inflammatory cytokine production an increase in neutrophil count and in ROS production through oxidative burst process. These indicate changes in biologic redox state and onset of an extremely potent inflammatory process in response to exercise. Nevertheless, the kinetics of inflammatory markers on blood and muscular tissue immediately and hours after an exercise bout is not fully elucidated.

**PURPOSE:** The aim of this study is, thus, to investigate the kinetics in exercise-induced inflammatory markers in mice running to fatigue.

**METHODS:** C57/BL6 animals performed exercise to fatigue in a treadmill. Blood and muscle tissue samples were collected. Creatine kinase (CK) was assessed by CK-NAC kit. Leukocyte recruitment was assessed by intravital microscopy and cytokines by ELISA.

**RESULTS:** Preliminary results show an enhancement (4 $\pm$ 1 to 5.9 $\pm$ 1.4 mMol/dL) in plasma lactate concentration immediately after exercise. CK increased from basal levels (300 $\pm$ 55.3 U/L) at 6h (720 $\pm$ 182.6 U/L) and 12h (691 $\pm$ 114.6 U/L) after exercise to fatigue. There was an increase leukocyte rolling from basal level (10.2 $\pm$ 2.6 cells) at 3h (75.4 $\pm$ 27.7 cells), 6h (98.7 $\pm$ 16.6 cells), 12h (129.5 $\pm$ 20.20 cells) and 24h (51.7 $\pm$ 19.5 cells) after exercise. The adhesion cell was increased 6h (5.4 $\pm$ 5.8 cells) when compared with control group (0.5 $\pm$ 0.5 cells). Treatment with apocynin (NADPH oxidase inhibitor) 30min before exercise completely reduced this cell recruitment. An increase in IL-10 concentration was observed 6h post-exercise (57.3 $\pm$ 22.2 to 104.4 $\pm$ 42.8 pg/100mg muscle tissue) when compared with control group (without apocynin), but there were no changes, at any time-point, in the other analysed cytokines (IL-6, TNF- $\alpha$ , KC, MIP-2 e IL-1 $\beta$ ). In addition, the total number of cells in the blood increased 12h (71.0 $\pm$ 28.5  $\times$ 10<sup>5</sup>/ml) and 24h (80.2  $\pm$  12.5  $\times$ 10<sup>5</sup>/ml) after exercise when compared with control group (28.6 $\pm$ 10.8  $\times$ 10<sup>5</sup>/ml). The number of neutrophils and lymphocytes also increased 12h and 24h after exercise when compared with control group.

**CONCLUSIONS:** These findings suggest that exercise to fatigue leads to a cross-talk between immune system and muscular tissue.

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**3139** Board #104 June 1 3:30 PM - 5:00 PM

**Estradiol  $\beta$  Receptor Expression on Human B-lymphocytes in Response to Acute Heavy Resistance Exercise**

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(No relationships reported)

Estradiol has previously been attributed for mediating gender differences in physiological responses to tissue damage. Since the neuro-endocrine and immune systems coordinate the body's response to such stress, we hypothesized that estradiol  $\beta$ -receptors (ER) on b-lymphocytes may coordinate such communications and explain the protective responses previously reported in women.

**PURPOSE:** The purpose of this investigation was to examine ER expression on circulating b-lymphocytes in response to an acute bout of heavy resistance exercise in men and women.

**METHODS:** Using a within subject design, fifteen resistance trained women (n=7; age= 22 $\pm$ 3 y) and men (n=8; age= 25 $\pm$ 5 y) performed a heavy resistance exercise squat protocol (6 sets of 5 reps at 90% 1RM) (EX) and a control test (CON) in a balanced, randomized order. Blood samples were collected before, during and after the exercise and control trials. ER expression on circulating lymphocytes was evaluated with flow cytometry and serum estradiol was assayed by ELISA.

**RESULTS:** Serum estradiol did not significantly differ between men (CON=48.0 $\pm$ 22.3 pg $\cdot$ ml<sup>-1</sup>) and women (CON=86.5  $\pm$  60.5 pg $\cdot$ ml<sup>-1</sup>) nor change during recovery to the exercise stress in men (6 HR POST-EX = 49.7 $\pm$ 13.6 pg $\cdot$ ml<sup>-1</sup>; 24 HR POST-EX=60.1  $\pm$  15.1 pg $\cdot$ ml<sup>-1</sup>) or women (6 HR POST-EX = 73.9 $\pm$ 35.8 pg $\cdot$ ml<sup>-1</sup>; 24 HR POST-EX=105.4  $\pm$  66.9 pg $\cdot$ ml<sup>-1</sup>). ER on b-lymphocytes showed large inter-individual variations before exercise (relative fluorescence = 22.3 - 28.8) and trends for differences at 6-hours post-exercise (relative fluorescence = 32.1 - 54.4). However, no significant gender differences or changes in response to the exercise protocol were observed.

**CONCLUSIONS:** Present findings reveal that estradiol- $\beta$  receptors on b-lymphocytes unlikely explain gender differences in physiological responses to tissue damage elicited by acute heavy resistance exercise. It is possible that interactions may occur beyond the recovery period measured in the present study or it may be that ER on muscle tissue, rather than b-lymphocytes, dictate the protective effects of estradiol previously reported in women.

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**3140** Board #105 June 1 3:30 PM - 5:00 PM

**Men and Women Differ in Antimicrobial Protein Expression**

Trevor Gillum, Tara Holguin, Layla Riley. *California Baptist University, Riverside, CA.*

(No relationships reported)

Antimicrobial proteins (AMP) potentially serve as a defense against upper respiratory tract infections (URTI) and may be altered by exercise. Limited data is available regarding the role of moderate exercise intensity and AMP expression. In addition, no studies have addressed potential sex and menstrual phase differences in AMP expression after moderate exercise.

**PURPOSE:** To quantify sex and menstrual phase differences in AMP expression before and after treadmill running.

**METHODS:** 19 healthy, college age men and women (9 men: 11.5 $\pm$ 4.2 %BF, 63.0 $\pm$ 5.4 ml-1kg FFM-1min-1; 10 women: 18.7 $\pm$ 3.8 %BF, 62.6 $\pm$ 9.4 ml-1kg FFM-1min-1) completed 2 bouts of treadmill running at 70% VO<sub>2</sub>pk for 45 min. Exercise sessions were separated by 14.9 $\pm$ 2.7 days. Women were counterbalanced to be tested in the follicular (day 4.1 $\pm$ 1.1) and luteal (day 20.2 $\pm$ 1.0) phase. Saliva was collected pre, post, and 1 hr post exercise in the morning after an overnight fast. Saliva was analyzed for lactoferrin (Lac), lysozyme (Lys), and immunoglobulin A (IgA) using ELISA.

**RESULTS:** Lac Osm: $\mu$ g was higher in follicular (165 $\pm$ 97) compared to luteal (148 $\pm$  117)( $p$ <0.05), but was not affected by exercise. Lac concentration (pre: 11012 $\pm$ 903 ng/ml, post: 20729 $\pm$ 16833 ng/ml) secretion rate (pre: 6122 $\pm$ 5943 ug/min, post: 12374 $\pm$ 11492 ug/min) and Osm: $\mu$ g (pre: 142 $\pm$ 115, post: 226 $\pm$ 166) increased from pre to post exercise ( $p$ <0.05), but was not different between sexes. IgA concentration (243 $\pm$ 219 ug/ml; 194 $\pm$ 93 ug/ml) and Osm: $\mu$ g (3.1 $\pm$ 1.5; 2.4 $\pm$ 0.9) was higher in women compared to men ( $p$ <0.05), but did not change after exercise. Lys concentration (56539 $\pm$ 21903 ug/min, 22954 $\pm$ 14766 ug/min) secretion rate (36300 $\pm$ 25698 ug/min, 17090 $\pm$ 15391 ug/min), and Osm: $\mu$ g (817 $\pm$ 391, 309 $\pm$ 201) was higher in men compared to women ( $p$ <0.05), but did not change with exercise.

**CONCLUSIONS:** Previous reports suggest that individuals who habitually exercise experience fewer URTI, and this has been related to AMPs. Since Lys and IgA were unaffected by moderate exercise, Lac may be a more sensitive marker of immune function after aerobic exercise and thus warrants future research. Additionally, women may experience more URTI than men, and this could be explained by the menstrual and sex differences shown in AMP expression.

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## F-27 Free Communication/Poster - Fat Metabolism

JUNE 1, 2012 1:00 PM - 6:00 PM  
ROOM: Exhibit Hall

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### 3141 Board #106 June 1 2:00 PM - 3:30 PM

#### Acute Responses of Lipoprotein Fractions Following a Single Bout of Exercise in Postmenopausal Women with Hypercholesterolemia

Yunsuk Koh, Allen Sexton, Kavya Chelikani, Daniel Chilek, Douglas Boatwright, Rick Carter, FACSM. *Lamar University, Beaumont, TX.*

(No relationships reported)

Abnormal lipoprotein fractions are associated with accelerated atherosclerosis and premature cardiovascular disease (CVD). Sedentary postmenopausal women, in particular, have elevated risk factors for CVD than premenopausal or male counterparts. Aerobic exercise at moderate intensity may positively modify the lipoprotein profiles, yet there is only limited research examining how a single bout of aerobic exercise can affect the serum lipoprotein fractions in hypercholesterolemic postmenopausal women.

**PURPOSE:** To examine the acute responses of serum lipoprotein fractions ( $\alpha$ , pre- $\beta$ , and  $\beta$ ) over the 48-hour period following a single bout of moderate intensity aerobic exercise in hypercholesterolemic postmenopausal women.

**METHODS:** Thirteen sedentary, hypercholesterolemic (defined as TC > 200 mg/dl; average TC = 241.7 mg/dl) postmenopausal women (age = 57.4 years), who were not on hormone replacement therapy or lipid lowering medications, volunteered for the study. Participants performed both exercise and rest trials in random order. For the exercise trial, participants performed a single bout of aerobic exercise at 60% of heart rate reserve on the treadmill until 400 kcal were expended. Participants came to the laboratory for blood draws only during the rest trial. Serum samples were collected at pre (0), 24, and 48 hours after each trial (exercise or rest) to analyze the lipoprotein fractions using electrophoresis.

**RESULTS:** A 2 X 3 [trial (exercise and rest) X time (0, 24, and 48 hours)] repeated measures ANOVA revealed that the  $\alpha$ -lipoprotein fraction in the exercise trial (35.67%) was significantly higher ( $p = 0.006$ ) than the rest trial (34.85%), while the  $\beta$ -lipoprotein fraction in the exercise trial (56.79%) was significantly lower ( $p = 0.001$ ) than the rest trial (57.63%). As for the main effect for time, the  $\beta$ -lipoprotein fraction at 24 hours (56.27%) was significantly ( $p = 0.008$ ) lower than 0 (57.83%) or 48 hours (57.53%). However, there was no trial X time interaction in changes in the  $\beta$ -lipoprotein fraction. The pre- $\beta$  fraction remained unchanged.

**CONCLUSION:** A single bout of aerobic exercise requiring 400 kcal can positively modify the serum  $\alpha$ - and  $\beta$ -lipoprotein fractions in postmenopausal women with hypercholesterolemia.

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### 3142 Board #107 June 1 2:00 PM - 3:30 PM

#### Exercise Energy Expenditure and Postprandial Lipaemia in Girls

Keith Tolfrey, Alex Engstrom, Caoileann Murphy, Alice Thackray, Robert Weaver, Laura Barrett. *Loughborough University, Loughborough, United Kingdom.*

(Sponsor: Keith George, FACSM)

(No relationships reported)

Acute bouts of exercise attenuate postprandial lipaemia in adolescent boys compared with rest although not in a dose-dependent manner. However, it is not clear if these findings apply to girls as their postprandial triacylglycerol (TAG) response to exercise has not been examined previously.

**PURPOSE:** To examine the effect of 30 and 60 min of moderate intensity treadmill walking on postprandial [TAG] in healthy girls.

**METHODS:** Fourteen 10 to 14 year old girls completed three, 2 day trials in a counter-balanced crossover design separated by 14 days. On day one, they rested (CON), or completed 30 min (EX30) or 60 min (EX60) of intermittent treadmill exercise at 56% peak VO<sub>2</sub> inducing energy expenditures of 752 and 1487 kJ respectively. On day two, after a 12-h fast, a capillary blood sample was taken for fasting [TAG] before a high-fat milkshake (80 kJ·kg<sup>-1</sup> body mass) was consumed. Further blood samples were taken hourly over a 6-h postprandial rest period for [TAG].

**RESULTS:** Differences in fasting [TAG] were small across the conditions (Effect Size (ES) = 0.08,  $P = 0.07$ ), with a trend for lower [TAG] in EX60 compared with CON ( $P = 0.05$ ). Postprandial [TAG] was lower during EX30 and EX60 compared with CON (ES = 0.41,  $P = 0.01$ ). The total area under the [TAG] versus time curve was lower by 17% in EX30 (95% confidence interval (CI) -33 to 2%,  $P = 0.05$ ) and by 29% in EX60 (95% CI -48 to -4%,  $P = 0.04$ ) compared with CON; EX30 and EX60 were not different from each other (14%; 95% CI: -34 to 11%,  $P = 0.21$ ).

**CONCLUSION:** This study demonstrates for the first time that both 30 and 60 min of walking, with energy expenditures of 752 and 1487 kJ, attenuated postprandial [TAG] in girls. However, the difference between EX30 and EX60 did not support a dose-response change in postprandial lipaemia.

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### 3143 Board #108 June 1 2:00 PM - 3:30 PM

#### Low Rip140 Expression Uncovers The Central Role Of The Akt-pkc $\zeta$ Axis In The Regulation Of Insulin-mediated Fatty Acid Oxidation In Skeletal Muscle Cells

Silvana Constantinescu, Lorraine P. Turcotte, FACSM. *University of Southern California, Los Angeles, CA.*

(No relationships reported)

Receptor interacting protein 140 (RIP140) is a well-known negative regulator of oxidative capacity and prior data from our lab has shown that low expression of this transcription factor increases insulin-mediated FA oxidation in skeletal muscle cells.

**PURPOSE:** To provide mechanistic insights for this metabolic shift, we measured the effects of low RIP140 expression on the mRNA and protein expression of proteins and signaling intermediates implicated in the regulation of FA oxidation (COX4, PGC-1 $\alpha$ , (FAT)/CD36, FATP1, CPT1, MCAD, AKT, PKC- $\zeta$ ).

**METHODS:** L6 myotubes were treated with siRNA sequences for either RIP140 (RIP140) or a negative control (control) and incubated with insulin.

**RESULTS:** Treatment with RIP140 siRNA sequences significantly ( $P < 0.05$ ) reduced RIP140 mRNA (47%) and protein (54%) content and significantly ( $P < 0.05$ ) increased COX4 (98%) and PGC-1 $\alpha$  (77%) mRNA expression indicating that, as expected, oxidative capacity was increased in RIP140 siRNA-treated cells. Down-regulation of RIP140 increased ( $P < 0.05$ ) FATP1 (317%), (FAT)/CD36 (51%) and CPT1 (84%) mRNA expression but unexpectedly decreased ( $P < 0.05$ ) MCAD mRNA expression (34%). Interestingly, at the protein level, RIP140 down-regulation did not affect ( $P > 0.05$ ) protein content of CPT1 and FATP1 but it decreased ( $P < 0.05$ ) total (38%) and plasma membrane (50%) (FAT)/CD36 protein content. Down-regulation of RIP140 decreased AKT<sup>ser473</sup> (23%) and PKC- $\zeta$ <sup>Thr403/410</sup> (56%) phosphorylation but did not affect AKT<sup>thr308</sup> phosphorylation.

**CONCLUSION:** Our data suggest that the high rates of insulin-mediated FA oxidation that accompany low RIP140 expression are mediated by a reduction in AKT and PKC- $\zeta$  signaling.

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### 3144 Board #109 June 1 2:00 PM - 3:30 PM

#### Comparison Of Fat Oxidation And Total Energy Expenditure During Interval And Continuous Training Sessions

Ken J. Hetlelid, Karianne V. Brovold, Stephen Seiler, FACSM. *University of Agder, Kristiansand, Norway.*

(No relationships reported)

This study was conducted to quantify fat metabolism among endurance-trained men during high-intensity interval running.

**PURPOSE:** We: 1) quantified the total energy expenditure and substrate oxidation among well-trained men during a high-intensity interval session and a continuous session matched for average workload, 2) compared relative fat oxidation during a high-intensity interval session and a continuous session to the maximal fat oxidation rate identified by fatmax protocol and 3) compared the energy expenditure after a high-intensity interval session and a continuous session, based on EPOC.

**METHODS:** Nine well-trained male runners (VO<sub>2</sub>max: 68.1  $\pm$  3.6 ml.kg<sup>-1</sup>.min<sup>-1</sup>) completed preliminary testing followed by an interval session and a continuous session in randomised order. Blood lactate (La-) and blood gasses were quantified throughout. The sessions lasted 48 minutes and were performed at a 1.7% incline. Individual running velocities were calculated

corresponding to 40% (rest periods), 65% (continuous session) and 90% (work periods) of VO<sub>2</sub>max. Interval bouts consisted of 6 x 4 minutes work periods separated by 4 minutes rest periods. Substrate oxidation was calculated from gas exchange with corrections for RER >1.0.

**RESULTS:** Despite identical work, a significant difference was found in energy expenditure between the interval session and the continuous session, 3207 ± 325 kJ vs 2962 ± 309 kJ, (p < 0.001). Fat oxidation tended to be higher during the continuous session (755 ± 440 kJ) compared with interval exercise (533 ± 219 kJ), but the difference was not significant (p = 0.170). Fatmax occurred at 65 ± 8% of VO<sub>2</sub>max (0.55 ± 0.17 g·min<sup>-1</sup>), while fat oxidation accounted for 25 ± 14% (0.39 ± 0.22 g·min<sup>-1</sup>) and 17 ± 8% (0.27 ± 0.11 g·min<sup>-1</sup>) during continuous and interval sessions respectively. Blood pH and [HCO<sub>3</sub><sup>-</sup>] stabilized from work bout one to six, (from 7.35 ± 0.03 to 7.35 ± 0.05) and (from 20.8 ± 1.9 to 19.4 ± 3.5 mmol·L<sup>-1</sup>) respectively. We found no difference in energy expenditure based on 15 min EPOC between the continuous session (25 ± 28 kJ) and interval session (27 ± 28 kJ).

**CONCLUSION:** Well-trained runners oxidized significant amounts of fat during high-intensity exercise, equal to ~50% of fat oxidation achieved at fatmax.

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**3145 Board #110 June 1 2:00 PM - 3:30 PM**

**Physical Training Reduces Serum Leptin In Rats, But Not Adiponectin**

Emidio -. Matos-Neto, Michele Trindade, Francisco Torres-Leal, Lucas Pantaleão, Miriam Fonseca-Alaniz, Marcelo Rogero, Julio Tirapegui. *University of São Paulo, São Paulo, Brazil.*

(No relationships reported)

**Physical training reduces serum leptin in rats, but not adiponectin**

1Emidio M. Matos-Neto, 1Michele C.C. Trindade, 2 Francisco L. Torres-Leal, 1Lucas C. Pantaleão, 3Miriam H. Fonseca-Alaniz, 4Marcelo M. Rogero, 1Julio Tirapegui. 1Faculty of Pharmaceutical Sciences, 2Institute of Biomedical Sciences, 3 Heart Institute, University of Sao Paulo 4School of Public Health, University of Sao Paulo, Sao Paulo/SP.

Physical training (PT) is an effective intervention in reducing the risk and in the treatment of chronic diseases associated with low-grade systemic inflammation. In this regard, studies show that this effect may be mediated via body fat reduction, with decreased release of proinflammatory adipokines and increased synthesis and release of anti-inflammatory adipokines.

**PURPOSE:** To investigate the effects of PT on body composition and serum concentrations of leptin and adiponectin in rats.

**METHODS:** Fifteen male adult Wistar rats (259.42 ± 1.27 g), under standard experimental conditions, received AIN-93M diet and water *ad libitum*. Animals with similar weights were distributed into two groups: trained group (TG) (n = 8) and sedentary group (SG) (n = 7). TG underwent PT on a treadmill for 8 weeks in the dark cycle. For morphometric analysis, aliquots of cell suspension were assessed under an optical microscope with graduated scale in order to evaluate adipocyte volume. Serum leptin and adiponectin levels were assessed by multiplex immunoassay using commercial kits.

**RESULTS:** Food intake was 107.4 ± 2.99 g/week for TG and 93.69 ± 4.83 g/week for SG. There was no significant difference in body mass changes between SG and TG (364.5 ± 19 g and 340.1 ± 3.96 g, respectively, p = 0.15). TG animals showed significant fat reduction (32.57 ± 2.22%) compared to SG (74.79% ± 16.14). We found that the adipocyte volume in the TG was significantly reduced (258.7 ± 27.74 pL), compared to SG (604.2 ± 138.3 pL) (p = 0.01). Serum leptin levels of TG animals were significantly reduced (8.68 ± 0.78 ng / mL (TG) vs. 19.2 ± 2.3 ng / mL (SG), p = 0.001), but there was no significant difference in the adiponectin levels ( 33.07 ± 3.89 pg / mL (TG) vs. 34.16 ± 1.14 pg / mL (SG), p = 0.830).

**CONCLUSION:** Physical training was able to reduce body fat, adipocyte volume and leptin levels, but did not promote change in adiponectin levels. **FINANCIAL SUPPORT:** FAPESP, CNPq

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**3146 Board #111 June 1 2:00 PM - 3:30 PM**

**Metabolic Inflexibility in the Acute Exercise Response of Type 2 Diabetics.**

Ciara O'Hagan<sup>1</sup>, Paul Medlow<sup>2</sup>, Josianne Rodrigues Krause<sup>3</sup>, Colin Murphy<sup>3</sup>, Gerard Colleran<sup>3</sup>, Gareth W. Davison, FACSM<sup>2</sup>, Colin AG Boreham, FACSM<sup>1</sup>, Giuseppe De Vito<sup>1</sup>. <sup>1</sup>University College Dublin, Dublin, Ireland. <sup>2</sup>University of Ulster, Belfast, United Kingdom. <sup>3</sup>Institute of Technology Tallaght, Dublin, Ireland. (Sponsor: Carl Foster, FACSM)

(No relationships reported)

**PURPOSE:** Metabolic flexibility (MF) has been defined as the ability to match fuel use to fuel availability. It is suggested that MF is diminished in type 2 diabetes and in obese, insulin-resistant adults, and that this is related to the accumulation of intramuscular lipids. Chronic exercise training has been shown to improve MF in response to hyperinsulinemic clamping and acute or chronic feeding of high-fat or high carbohydrate diets in type 2 diabetics, but MF responses to acute exercise bouts have not been investigated.

**METHODS:** 16 overweight males [8 control (CON), 8 type 2 diabetic (T2D)] participated in this study. Subjects completed an incremental treadmill test from which an estimated VO<sub>2max</sub> was obtained, and workloads corresponding to 25%, 35% and 45% of estimated VO<sub>2max</sub> were calculated. On a separate visit after an overnight fast, fasted respiratory exchange ratio (RER) was obtained by indirect calorimetry, as an average over 10 minutes of measurement after 15 minutes of supine rest. Subjects then completed a 6 minute steady-state exercise bout on the treadmill at each of the pre-determined individualised intensities. ΔRER was calculated as the difference between fasted and steady-state exercise RER.

Data are presented as means ±SD. Between group differences were analysed by unpaired Student's T-test, with significance set at p < 0.05.

**RESULTS:** CON were younger (51 ± 5.7 vs 59 ± 6.4 years) and fitter (37.2 ± 3.6 vs 30.2 ± 8.1 ml/kg/min estimated VO<sub>2max</sub>) than T2D, with no difference in BMI (32.2 ± 5.1 vs 30.7 ± 1.4 kg/m<sup>2</sup>). T2D had significantly higher glycosylated haemoglobin (7.7 ± 0.8 vs 5.7 ± 0.3 %) and fasting plasma glucose (8.6 ± 1.5 vs 5.2 ± 0.6 mmol/L) than CON. There was no difference in resting RER between the groups (T2D 0.79 vs CON 0.78). Exercise RER was consistently higher in CON than T2D, and this was reflected by significant differences in ΔRER at the 25% and 35% intensities (25%: -0.03 vs 0.09, 35%: -0.02 vs 0.05) and a non-significant difference at 45% (-0.06 vs -0.03).

**CONCLUSION:** These data suggest that individuals with type 2 diabetes have impaired MF in response to acute submaximal exercise challenges, relative to healthy controls.

Supported by grants from the Irish Research Council for Science, Engineering and Technology, and the Higher Education Authority Technological Sector Research: Strand 3.

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**3147 Board #112 June 1 2:00 PM - 3:30 PM**

**Strength Training Ameliorates Non-alcoholic Fatty Liver Disease And Adiposity In Rats Fed On Fructose-rich Diet**

José D. Botzezzelli, Lucieli T. Cambri, Pedro P. Scarioti, Ana C. Ghezzi, Leandro P. Moura, Rodrigo A. Dalia, Carla Ribeiro, Amanda C. Silva, Maria A. Mello. *Sao Paulo State University, Rio Claro-SP, Brazil.*

(No relationships reported)

**PURPOSE:** Over the last three decades, the fructose consumption in developed countries increased almost 500%. The timing of the increase in the prevalence of obesity coincides with the increased use of fructose in the diet in developed countries. Physical exercise is a powerful weapon used to reduce weight gain and triglyceride content in human beings and experimental mode. The aim of this study is to analyze the effect of strength exercise on triglycerides (TG) concentration in the liver (non-alcoholic fatty liver disease marker), heart and visceral adipose tissue (adiposity marker).

**METHODS:** Thirty two male Wistar (120 days old) rats were randomly separated into four groups with eight rats per group: C (AIN-93 diet), F (High-fructose diet), CS (AIN-93 diet+ Strength training) and FS (High-fructose diet+ Strength training). C was composed by animals fed on balanced diet (AIN-93) whereas the F group by animals fed on a fructose rich diet (60% fructose). The S groups were subjected to a strength training protocol consisting in four series of ten jumps in water separated by one minute of rest, five days/week. After eight weeks the animals were killed via sodium thiopental administration to evaluate the triglyceride concentration (µmol/mg) using commercial kit. The results were statistically analyzed by two-way ANOVA and the significance level was set at p ≤ 0.05, different letters indicate significant difference.

**RESULTS:** Liver [TG] was higher in the F groups compared to C groups: C= 6.4 ± 1.9<sup>a</sup>, CS= 9.2 ± 2.7<sup>a</sup>, F= 72.8 ± 25.2<sup>b</sup>, FS= 22.8 ± 6.2<sup>c</sup>. No difference was observed on heart [TG]: C= 0.6 ± 0.2<sup>a</sup>, CS= 0.6 ± 0.1<sup>a</sup>, F= 0.6 ± 0.1<sup>a</sup>, FS= 0.6 ± 0.2<sup>a</sup>. Mesenteric [TG] was lower in C group compared to other groups: C= 46.1 ± 5.2<sup>a</sup>, CS= 59.5 ± 6.0<sup>a</sup>, F= 57.5 ± 10.2<sup>b</sup>, FS= 51.2 ± 12.9<sup>b</sup>. Retroperitoneal [TG] was higher in F group compared to the others, also CS group showed the lowest [TG]: C= 70.1 ± 5.4<sup>a</sup>, CS= 56.1 ± 6.0<sup>b</sup>, F= 115.7 ± 28.5<sup>c</sup>, FS= 65.7 ± 9.2<sup>ab</sup>.

**CONCLUSIONS:** Fructose consumption led the animals to adiposity and non-alcoholic fatty liver disease. The heart [TG] of animals was not affected by diet or exercise training. Strength physical training was effective to protect the animals against the triglycerides infiltration in the liver and in the visceral adipose tissue. Supported by FAPESP Grant: 2009/ 15336-9



3148 Board #113 June 1 2:00 PM - 3:30 PM

**Exercise Training Combined With  $\alpha$ -Lipoic Acid Ingestion Attenuates LDL Oxidation In Obesity With Impaired Glucose Tolerance**

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(No relationships reported)

Obese subjects with impaired glucose tolerance (IGT) are more susceptible to oxidative stress and cardiovascular disease than healthy individuals.

**PURPOSE:** This randomised controlled investigation was designed to test the hypothesis that  $\alpha$ -lipoic acid supplementation and exercise training may elicit favourable clinical changes in obese subjects with IGT.

**METHODS:** All data were collected from 24 obese (BMI  $\geq$  30 kg/m<sup>2</sup>) IGT patients. Following participant randomisation into two groups, fasting venous blood samples were obtained at baseline, and before and following intervention. The first group consisted of 12 participants who completed a 12 week control phase followed by 12 weeks of chronic exercise at 65% HR<sub>max</sub> for 30 minutes a day, 5 days per week, while ingesting 1 gram per day of  $\alpha$ -lipoic acid for 12 weeks. The second group consisted of 12 participants who completed the same 12 week control phase, but this was followed by 12 weeks of 1 gram per day of  $\alpha$ -lipoic acid supplementation only (no exercise).

**RESULTS:** The main findings show a comparatively greater rate of low density lipoprotein (LDL) oxidation in the group consisting of  $\alpha$ -lipoic acid only ( $p < 0.05$  vs. pre intervention), although total oxidant status was lower post intervention ( $p < 0.05$  vs. baseline) in this group. However, exercise and  $\alpha$ -lipoic acid in combination attenuates LDL oxidation. Furthermore, in the  $\alpha$ -lipoic acid plus exercise training group, total antioxidant capacity was significantly increased ( $p < 0.05$  vs. baseline and pre intervention). Body fat percentage and waist and hip circumference decreased following exercise training ( $p < 0.05$  vs. post intervention). There were no selective treatment differences for a range of other clinical outcomes including glycaemic regulation ( $p > 0.05$ ).

**CONCLUSION:** These findings report that  $\alpha$ -lipoic acid ingestion may increase the atherogenicity of LDL when ingested in isolation of exercise, suggesting that in IGT the use of this antioxidant treatment does not ameliorate metabolic disturbances, but instead may detrimentally contribute to the pathogenesis of atherosclerosis and development of CVD. However, when  $\alpha$ -lipoic acid is combined with exercise, this atherogenic effect is abolished.

3149 Board #114 June 1 2:00 PM - 3:30 PM

**AMPK $\alpha$ 2 Down-Regulation Prevents Voluntary Wheel Running-Induced Changes in Glucose Uptake but not in Fatty Acid Uptake in Mouse Skeletal Muscle**

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(No relationships reported)

Exercise training has been deemed a beneficial treatment for obesity and insulin resistance induced by a high fat diet and may modulate its metabolic effects via AMPK activation, a key signaling molecule in metabolic regulation.

**PURPOSE:** To determine whether AMPK $\alpha$ 2 activity in skeletal muscle is required to obtain exercise training benefits while under high fat-fed conditions.

**METHODS:** Wild type (WT) and AMPK $\alpha$ 2 dominant negative (DN) male C57BL/6 mice were divided into control diet  $\pm$  voluntary wheel running (CD, n=10; VWR, n=10) or high fat diet (60% fat Bio-Serv)  $\pm$  VWR (HFD, n=12; VWR+HFD, n=12). After 6 wks, hindlimbs were perfused (550 $\mu$ M palmitate, 6mM glucose, [1-<sup>14</sup>C]palmitate, and 450 $\mu$ U/ml insulin).

**RESULTS:** In CD mice, VWR increased ( $P < 0.05$ ) FAU (46%) and FAO (267%) in WT mice but it had no effect on GU ( $P > 0.05$ ). The DN transgene decreased ( $P < 0.05$ ) FAU (43%) and raised ( $P < 0.05$ ) FAO (224%) but was not associated with further changes with VWR ( $P > 0.05$ ). In HFD mice, VWR increased ( $P < 0.05$ ) GU by 41% (10.1 $\pm$ 1.8 vs. 14.0 $\pm$ 1.0  $\mu$ mol/g/hr) in the WT mice, FAU by 93-108% in both WT (3.9 $\pm$ 0.7 vs. 7.4 $\pm$ 0.3 nmol/min/g) and DN (4.0 $\pm$ 0.3 vs. 8.2 $\pm$ 0.9 nmol/min/g) mice but did not alter ( $P > 0.05$ ) FAO in either group. In CD mice, VWR increased ( $P < 0.05$ ) pERK1/2 (120%) and pJNK1/2 (26-39%) in WT mice and similar VWR-induced increases in pERK1/2 (110%;  $P < 0.05$ ) and pJNK1/2 (39%;  $P < 0.05$ ) were observed in DN mice. In contrast to results obtained in CD mice, pERK1/2 in HFD mice was increased ( $P < 0.05$ ) by the DN transgene (36%) but was not affected ( $P > 0.05$ ) by VWR in either WT or DN mice. Conversely, pJNK1/2 in HFD mice was not affected ( $P > 0.05$ ) by the DN transgene but was reduced (41-45%;  $P < 0.05$ ) by VWR in both WT and DN mice.

**CONCLUSION:** Under HFD conditions, AMPK $\alpha$ 2 signaling appears to be required for VWR-induced changes in GU but not for changes in FA metabolism that may be maintained by a rise in ERK1/2 signaling.

3150 Board #115 June 1 2:00 PM - 3:30 PM

**Lipolytic And Glucoregulatory Responses To Feeding And Exercise In Obese And Lean Children**

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(No relationships reported)

**INTRODUCTION:** The effect of exercise on subsequent metabolic responses to eating has not been determined in lean or obese youth, despite the demonstrated positive effects of prior exercise on meal responses in adults.

**PURPOSE:** To determine whether or not an exercise bout can improve subsequent meal metabolic (lipolytic and glucoregulatory) responses in prepubescent children.

**METHODS:** Overnight fasted obese (n=56) and lean (n=34) children (>95th and <85th percentile of age-adjusted BMI, respectively) had microdialysis (MD) probes (CMA/20, CMA Microdialysis, Chelmsford, MA) placed in subcutaneous abdominal adipose tissue (SCAT). Following 60 min of equilibration, interstitial metabolites (glycerol and glucose) were collected in the MD dialysate prior to and following breakfast, exercise, and lunch. Interstitial glycerol and glucose were analyzed on an automated microdialysis analyzer (CMA 600; CMA Microdialysis, Chelmsford, MA). Dialysate comparisons were made between subjects categorized by BMI or exercise/control groups with repeated measures ANOVA. Data are mean  $\pm$  SD, and the  $\alpha$ -level was set at  $p \leq 0.05$ .

**RESULTS:** As expected, obese children had poor lipolytic suppression following a meal vs. lean counterparts (delta MD glycerol: -12.3  $\pm$  18.3 vs. -35.1  $\pm$  32.3  $\mu$ M, respectively;  $p < 0.01$ ). The lipolytic response in obese children to a second identical meal was no longer different from lean children (delta MD glycerol: -4.4  $\pm$  19.2 vs. -8.1  $\pm$  17.2  $\mu$ M, obese vs. lean, respectively;  $p = 0.36$ ), and was dependent on an acute exercise bout between the meals ( $p < 0.01$ ). MD glucose was increased following both meals ( $p < 0.01$ ) prior to and following exercise, and this response was higher in lean children in both cases ( $p < 0.01$ ). However, glucose responses were not dependent on exercise between the two meals ( $p = 0.37$ ).

**CONCLUSION:** These results suggest that poor suppression of lipolysis following feeding in obese children can be improved by implementation of a pre-meal exercise bout; however, glucose responses to a subsequent meal do not seem to be sensitive an exercise bout.

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3151 Board #116 June 1 2:00 PM - 3:30 PM

**Hypotriglyceridemic Effect Of High-intensity Interval Aerobic Exercise**

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(No relationships reported)

Continuous aerobic exercise, resulting in energy expenditure (EE) of >500-600kcal, lowers very-low-density-lipoprotein-triglyceride (VLDL-TG) concentrations 12-15 hours after exercise. This effect is manifested via an increase in VLDL-TG clearance whereas VLDL-TG production remains unchanged. In contrast, high-intensity interval aerobic training, (~450 kcal/exercise bout) reduces VLDL-TG concentration 48h after the last exercise bout via a decrease in VLDL-TG secretion from the liver.

**PURPOSE:** To examine the duration and the mechanism of the hypotriglyceridemic effect of a single bout of high-intensity interval aerobic exercise on VLDL-TG kinetics, 14 and 48 hours (h) after exercise cessation.

**METHODS:** Eight healthy sedentary men (VO<sub>2</sub>peak: 2.7±0.4 L/min, BMI: 23.1±2.2 kg/m<sup>2</sup>, age: 24±6 years) participated in three stable isotope-labeled tracer infusion studies, a) 14h after exercise (60 and 90% of peak oxygen consumption in 4 min intervals for a total of 32min (HIIE)), b) 48h after HIIE and c) control (REST), in a random order and after an overnight fast. Subjects replicated their diet for two days prior to the infusion studies and avoided any form of physical activity, other than walking. Kinetic data were analyzed using the monoexponential approach.

**RESULTS:** The mean gross energy expenditure of the exercise bouts was 331±47 kcal. VLDL-TG concentration was 22% lower at 14h (0.28±0.13mmol/L p<0.05) after HIIE compared to control (0.36±0.16mmol/L). VLDL-TG clearance rate increased by 21% after 14h (35.38±7.23 ml/min p<0.001) but not after 48h (32.46±8.23 ml/min p>0.05) of HIIE compared to control (29.19±5.42 ml/min). Hepatic VLDL-TG secretion rate was not different at 14h (2.86±1.12µmol/l/min p>0.05) or 48h (3.0±0.84 µmol/l/min p>0.05) after HIIE compared to control (3.00±1.26 µmol/l/min).

**CONCLUSION:** Acute, high-intensity interval exercise reduces fasting triacylglycerolemia in men 14h after the exercise bout via an increase in VLDL-TG clearance. This type of exercise seems to be sufficient to induce a hypotriacylglycerolemic effect despite the low energy cost of the exercise session. However, the effect is short-term and lasts less than 48 hours.

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**3152** Board #117 June 1 2:00 PM - 3:30 PM

**Aerobic Exercise Training Improves Adiponectin To Leptin Ratio And Insulin Resistance In Obese Adolescent Girls**

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(No relationships reported)

**INTRODUCTION:** Increased body fat, particularly in the abdomen, is associated with metabolic abnormalities including insulin resistance (IR) and resultant hyperinsulinemia in adolescents. In addition, abdominal obesity is associated with negative balance of adiponectin and leptin.

**PURPOSE:** The purpose of this study was to examine the effect of aerobic exercise training on IR and metabolic risk factors in obese girls.

**METHOD:** Twenty five obese girls (mean ± SEM, body mass index: 30 ± 3 kg/m and age: 16 ± 1 years) were randomly assigned to a control group (CON, n= 10) or exercise training group (EX, n= 15; 30 min of supervised treadmill exercise at 65-70% of heart rate maximum, 3 days/week) for 12 weeks. Fasting levels of glucose, homeostasis model assessment of IR, insulin, adiponectin, and leptin as well as body composition (bioelectrical impedance) were assessed pre and post. **Result:** An increase in adiponectin to leptin (A/L) ratio (P < .05) and decreases in homeostasis model assessment of IR (HOMA-IR) (P < .01), insulin (P < .01), body weight (P < .05), waist circumference (P < 0.01), and BMI (P < 0.01) were evident after EX compared with CON. The changes in adiponectin (+1.7 ± 0.7 µg/ml, P < 0.05) and leptin (-4.4 ± 1.9 ng/ml, P < 0.05) in EX were significantly changed as compared to CON. However, post EX values of leptin and adiponectin were not significantly improved compare to pre EX values (18.2 ± 2.4 vs 13.8 ± 1.9 ng/ml, and 6.2±0.8 vs 7.9±0.1 µg/ml, P<0.07, respectively). No significant changes in lean mass and body fat percentage were observed in both groups.

**CONCLUSION:** 12-weeks of aerobic exercise training improves IR and A/L ratio occurred independently of significant changes in adiponectin and leptin levels. Therefore, A/L ratio may be a better indicator of changes in obesity as a consequence of aerobic training than individual adipocytokines in obese girls.

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**3153** Board #118 June 1 2:00 PM - 3:30 PM

**Brisk Walking Alters Postprandial Lipemia After Fructose Ingestion Differently In Normal-weight And Obese Individuals**

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(No relationships reported)

Elevated postprandial triacylglycerol (TAG) concentrations are an independent risk factor for cardiovascular disease. Ingestion of fructose rich mixed meals amplifies the postprandial TAG response compared to fructose free mixed meals. Aerobic exercise performed prior to ingestion of a mixed meal lowers postprandial TAG concentrations. However, it has not been established if prior aerobic exercise lowers postprandial TAG to a fructose rich mixed meal.

**PURPOSE:** To determine the effect of 1 h of brisk walking performed 12 h prior to ingestion of a fructose rich mixed meal on postprandial lipemia in normal-weight and obese individuals.

**METHODS:** On two separate occasions 10 normal-weight (BMI < 25 kg/m<sup>2</sup>) and 10 obese (BMI > 30 kg/m<sup>2</sup>) individuals ingested a 600 calorie meal (45% carbohydrate [7.3% fructose], 40% fat, and 15% protein) in the morning after a 12 h overnight fast. Brisk walking (1 h, 55-60% maximal oxygen consumption) was performed 12 h prior to one of these two occasions (EX) while no exercise was performed prior to the other (NoEX). Blood samples were taken at baseline and 1, 2, 3, 4, and 6 h after the meal and analyzed for TAG, total cholesterol (TC), high density lipoprotein cholesterol (HDL-C), and low density lipoprotein cholesterol (LDL-C). The incremental area under the curve (iAUC) was used to quantify postprandial responses. A mixed model ANOVA with Bonferroni post hoc tests were used to compare iAUC values.

**RESULTS:** In normal-weight individuals, EX significantly reduced the postprandial TC response 150% (EX: -10 ± 26 mg/dL 6h, NoEX: 20 ± 31 mg/dL 6h, P = 0.02) and LDL-C response 143% (EX: -17 ± 12 mg/dL 6h, NoEX: 8 ± 20 mg/dL 6h, P = 0.02). In obese individuals, brisk walking significantly reduced the postprandial TAG response 18% (EX: 381 ± 168 mg/dL 6h, NoEX: 454 ± 217 mg/dL 6h, P = 0.02) and attenuated the reduction in HDL-C (EX: -2 ± 6 mg/dL 6h, NoEX: -6 ± 6 mg/dL 6h, P = 0.02).

**CONCLUSION:** Performing 1 h of brisk walking lowers the postprandial TAG response and attenuates the drop in HDL-C after a fructose rich mixed meal in obese individuals. Furthermore, brisk walking lowers the postprandial TC and LDL-C response in normal-weight individuals. Collectively, brisk walking prior to ingestion of a fructose rich mixed meal differentially, but beneficially, alters postprandial lipemia in normal-weight and obese individuals.

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**3154** Board #119 June 1 2:00 PM - 3:30 PM

**Long Chain Fatty Acid Transport Limitation After Endurance Training Is Improved By Ppar-δ Agonist**

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(No relationships reported)

Fatty acid oxidation is increased by aerobic exercise, but long chain fatty acids (LCFA) utilization is a well-known limiting factor of sub-maximal exercise duration. Although endurance performance is improved by PPAR-δ agonist, the effects of endurance training associated with a PPAR-δ agonist on fatty acids utilization remain unclear.

**PURPOSE:** To clarify the limiting steps of fatty acid utilization after endurance training, we studied PPAR-δ agonist effect on LCFA transport in skeletal muscle mitochondria.

**METHODS:** Four groups of female rats were constituted: sedentary (S) and trained (T), treated by vehicle (V) or GW0742 (GW). The training program consisted in 5 running sessions/week for 5 weeks on a treadmill. Treatment was administered during the last 3 weeks. Endurance performances were determined through both a maximal aerobic velocity test (MAV) and time to exhaustion at 65% of individual MAV (T65). Maximal mitochondrial oxidative capacity (V<sub>max</sub>) for palmitoyl-carnitine (PC) and palmitoylCoA (PCoA) were measured in plantaris skinned fibers. Mitochondrial sensitivity (1/Km) was calculated with a Michaelis-Menten model.

**RESULTS:** Endurance training increased aerobic performance in both V (MAV: +53%, p<0.001 / T65:+53%, ns) and GW groups (MAV: +47%, p<0.001 / T65: +65%, p<0.05). Despite an increase of 3-HAD activity (+59% ; p<0.001) after training, both V<sub>max</sub> for PC and PCoA were not altered. Normalized to maximal oxidative capacities, V<sub>max</sub> PC decreased to 13% in TV (p<0.05) compared to 19% in SV. Nevertheless, compared to TV rats, V<sub>max</sub> PC increased in TGW (+37%, p<0.05) and PC relative utilization level is corrected at 18%. A lesser modification was observed for V<sub>max</sub> PCoA in TGW (+17%, ns). In addition, sensitivity to PCoA was decreased after training (-100%, p<0.05), but treatment by GW compensated this effect.

**CONCLUSIONS:** Endurance performance is slightly improved by a PPAR-δ agonist treatment associated with aerobic training. Both CPT-1 and CPT-2 steps could explain the limitation of LCFA oxidation after endurance training. A PPAR-δ agonist could correct CPT-2 limitation and partially CPT-1 one. Moreover alteration of PCoA sensitivity with endurance training could be one of the molecular basis underlying the cross over concept since fatty acid oxidation would be shifted to higher LCFA concentration.

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3155 Board #120 June 1 2:00 PM - 3:30 PM

**Lipotoxicity In Cardiomyocytes: Reversal By Aerobic Training**

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(No relationships reported)

Sedentary lifestyle and unhealthy diets leads to obesity and associated cardiovascular diseases. Lipotoxicity effects in cardiac cells are poorly known.

**PURPOSE:** As training optimizes fatty acid oxidation in skeletal muscle cells even with excess of fats, we studied the effect of excess of saturated fatty acid palmitate on ventricular myocytes isolated from distinct models of metabolic disease (db/db and apolipoprotein E knockout, ApoE KO mice) and mice submitted (TR) or not (CT) to physical training.

**METHODS:** Cardiomyocytes were incubated with palmitate, we studied its effects on Ca<sup>2+</sup> signaling, action potential and reactive oxygen (ROS) levels. Exposure of cardiac cells from CT mice to palmitate led to Ca<sup>2+</sup> signaling dysfunction characterized by a reduced ( $\Delta F_0/F_0 = 4.8 \pm 0.2$  vs.  $3.6 \pm 0.2$   $\Delta F_0/F_0$ ,  $p < 0.01$ ) and slowed (decay time =  $230.3 \pm 5$  vs.  $255.5 \pm 5.3$  ms,  $p < 0.01$ ) Ca<sup>2+</sup> transient. Interestingly, palmitate had not worsened the behavior of cardiomyocytes from db/db and ApoE KO mice. To understand Ca<sup>2+</sup> signaling dysfunction induced by palmitate in cardiac cells from CT mice, we measured action potential and reactive oxygen species (ROS) levels.

**RESULTS:** There were no changes in action potential duration, but cells from CT mice exposed to palmitate increased ROS levels (DHE Fluorescence levels  $98.48 \pm 16.16$  vs.  $197.8 \pm 22.79$  a.u.,  $p < 0.01$ ). We investigated whether cells from TR mice were protected from palmitate induced Ca<sup>2+</sup> signaling dysfunction. Ca<sup>2+</sup> transient amplitude and kinetics in cardiomyocytes from TR mice were enhanced (vs. CT) and not altered by palmitate exposure ( $\Delta F_0/F_0 = 5.7 \pm 0.3$  vs.  $5.2 \pm 0.2$ , ns and decay time =  $224.5 \pm 3.1$  vs.  $223.7 \pm 3.5$  ms). Cardiomyocytes from TR mice presented significantly reduced basal ROS levels, still palmitate was able to induce ROS increase (DHE =  $16.13 \pm 3.30$  vs.  $72.17 \pm 12.85$  a.u.,  $p < 0.01$ ).

**CONCLUSION:** Excessively increased fatty acid levels do not aggravate Ca<sup>2+</sup> signaling dysfunction in cardiac cells from db/db and ApoE KO mice, but are related to Ca<sup>2+</sup> signaling dysfunction in ventricular myocytes from CT mice. Moreover, physical training confers the ability to cardiomyocytes to deal with fatty acid excess, as seen by the lack of effect of palmitate in the Ca<sup>2+</sup> transient, probably due to reduced basal production of superoxides by mitochondria in these cells. Supported by: NTNU and Capes

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3156 Board #121 June 1 2:00 PM - 3:30 PM

**Regular Endurance Exercise Improves The Diminished Hepatic Carnitine Status In Mice Fed A High Fat Diet**

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(No relationships reported)

**PURPOSE:** Carnitine is an essential metabolite that has a number of important functions in intermediary metabolism. Metabolic stress induced by chronic high-fat (HF) diet feeding or genetically induce diabetes impairs carnitine status.

Therefore, we tested the hypothesis that regular endurance exercise (EE) improves the HF diet-induced impairment of carnitine status through stimulating the expression of hepatic genes involved in carnitine synthesis and uptake.

**METHODS:** Eighteen male C57BL/6 mice were assigned to three groups: group S received a standard diet, group HF received a HF diet (20% of total energy as protein, 35% as carbohydrate, and 45% as fat), and group HFEE received an HF diet and was regularly exercised on a treadmill at an intensity corresponding to 80% VO<sub>2</sub>max. Before and after exercise exercise capacity was determined by mice spirometry and glucose tolerance was measured. Carnitin and its precursors and co-activators were determined by qPCR, western blotting and tandem mass spectrometry.

**RESULTS:** After 10 wk, mice of the HF and the HFEE groups were highly obese and insulin resistant compared with mice of the S group, but mice of the HFEE group were less insulin resistant than those of the HF group. The HF group had significant lower carnitine concentrations and mRNA and protein levels of genes involved in carnitine synthesis and uptake in the liver than the S group (-20%), whereas these parameters did not differ between the S group and the HFEE group. In addition, mice of the HF group had a reduced expression of PPAR- $\alpha$  and its co-activators, which was attenuated in mice of the HFEE group.

**CONCLUSIONS:** These findings indicate that regular EE reverses an HF diet-induced impairment of hepatic carnitine content by stimulating hepatic carnitine synthesis and uptake. Furthermore, we demonstrated an increase of PPAR- $\alpha$  and its co-activators suggesting a PPAR- $\alpha$  dependent mechanism.

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3157 Board #122 June 1 2:00 PM - 3:30 PM

**Physical Training and Detraining and Cardiac Lipid Metabolism**

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(No relationships reported)

**PURPOSE:** This study was designed to analyze body weight gain and triglyceride (TG) concentration, total lipids, protein/DNA ratio and lipogenic rates in the heart of rats submitted to physical training and subsequent detraining.

**METHODS:** Thirty weanling Wistar rats were utilized and divided into three groups: Control sedentary rats (C), Trained rats (T) submitted to physical exercise throughout the experiment, and Detrained rats (D) submitted to physical exercise for half of the experimental period and kept sedentary until the end of the study. The training protocol began when the rats were 28 days old and consisted of swimming 1hr per day, 5 days per week, at 80% of their individual anaerobic threshold (LAN), as previously determined by a lactate minimum test. The physical training lasted 16 weeks for the T group and 8 weeks for the D group.

**RESULTS:** Physical exercise throughout experiment (T group) decreased the body weight (g): (C:  $429.07 \pm 66.23$ ; T:  $353.43 \pm 51.01$ ; D:  $426.64 \pm 74.13$ ) and increased the heart lipogenic rates ( $\mu\text{mol 3H incorporated/hxg}$ ) when compared with the D group: (C:  $23.63 \pm 2.05$ ; T:  $24.52 \pm 2.78$ ; D:  $21.02 \pm 2.66$ ). The other heart metabolic markers did not show differences between groups, TG (mg/g): (C:  $3.58 \pm 0.38$ ; T:  $3.74 \pm 1.44$ ; D:  $3.48 \pm 0.51$ ), Total lipids (mg/100mg): (C:  $4.28 \pm 0.65$ ; T:  $4.95 \pm 0.92$ ; D:  $5.08 \pm 0.61$ ) and protein/DNA ratio (UI): (C:  $14.38 \pm 4.77$ ; T:  $16.28 \pm 4.70$ ; D:  $13.78 \pm 3.05$ ).

**CONCLUSIONS:** In summary, physical exercise at 80% of LAN, attenuates body weight gain but, increased fat synthesis in the heart. Moderate physical exercise and its cessation did not alter other cardiac aspect beyond fat accumulation.

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3158 Board #123 June 1 2:00 PM - 3:30 PM

**Effects of Normobaric Hypoxic Training on Changes in Whole Body Adiposity and Regional Lipid Accumulation**

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(No relationships reported)

Previous studies demonstrated that muscular lipid content was correlated with total body fat and abdominal adipose tissue in obese men. Some studies indicated that 6 weeks of moderate intensity physical activity for obese men reduced visceral adipose tissue (VAT) but did not elicit any change in intramyocellular lipid (IMCL) content (Gan et al. 2003). However, the other study showed that moderate intensity training of 16 weeks for obese old people increased IMCL despite decreased fat mass of the body (Dubé et al. 2008).

**PURPOSE:** To examine the effects of a short-term endurance training in normobaric hypoxic circumstances for sedentary young men on IMCL and extramyocellular lipid (EMCL) accompanied with whole body and regional adiposity including the VAT, subcutaneous abdominal adipose tissue (SAT), and intrahepatic lipid (IHL).

**METHODS:** Twenty-one sedentary healthy men participated in this study (Age 24.3 ± 5.5 yrs, BMI 25.5 ± 3.0 kg/m<sup>2</sup>). Subjects conducted 12 time training sessions during a 2 or 4 week period. Each training session was lasting 60 min with a cycle ergometer at 65% of maximal oxygen uptake (VO<sub>2max</sub>) under normobaric hypoxic condition (FiO<sub>2</sub> = 0.15). Before and after the training period, cross-sectional areas of VAT and SAT were determined by magnetic resonance imaging (MRI), and IMCL and EMCL of the right vastus lateralis muscle and IHL were evaluated by 1H-magnetic resonance spectroscopy. Body composition was measured by dual energy X-ray absorptiometry (DXA).

**RESULTS:** After the training period, body mass and body fat mass did not change significantly. IMCL was significantly increased from 11.1 ± 2.0 mmol/kg to 14.5 ± 5.6 mmol/kg (P < 0.05). EMCL was not significantly changed from 25.8 ± 19.5 mmol/kg to 18.9 ± 10.3 mmol/kg (P = 0.11). IHL was significantly decreased from 59.8 ± 14.9 % to 50.0 ± 21.1 % (P < 0.01). VAT and SAT were not significantly changed (VAT: 53.4 ± 39.6 cm<sup>2</sup> → 50.6 ± 39.7 cm<sup>2</sup>, P = 0.06, SAT: 185.4 ± 43.9 cm<sup>2</sup> → 183.1 ± 43.4 cm<sup>2</sup>, P = 0.49).

**CONCLUSIONS:** These results indicated that the short-term endurance training in hypoxic condition increased the IMCL contents with no changes in EMCL, abdominal adipose tissue and whole body fat, but with decreasing IHL. This study was partly supported by the Nakatomi Foundation.

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**3159** Board #124 June 1 2:00 PM - 3:30 PM

**The Effect of Conjugated Linoleic Acid on Fat Oxidation Following Short Term Aerobic Exercise.**

Sarah J. C. Brice, Justin D. Roberts. *University of Hertfordshire, Hatfield, United Kingdom.*

(No relationships reported)

There is evidential research supporting the use of conjugated linoleic acid (CLA) as an ergogenic nutraceutical to enhance fatty acid oxidation and improve total fat: lean muscle ratios. However, the potential benefit of CLA in normal weight females undertaking light aerobic exercise requires investigation.

**PURPOSE:** To determine the effect of CLA supplementation during a controlled 4 week aerobic exercise intervention on fat oxidation and body composition compared to a matched placebo (PL).

**METHODS:** Following familiarisation, 21 untrained female subjects (Age: 20.95 ± 1.77 years; Height: 163.25 ± 5.80 cm; Weight: 64.06 ± 4.53 kg) undertook baseline laboratory assessments for maximal oxygen uptake (VO<sub>2max</sub>: 1.231 ± 0.265 L·min<sup>-1</sup>), peak fat oxidation (FAT<sub>MAX</sub>: 0.128 ± 0.037 g·min<sup>-1</sup>) and body composition. Subjects were then randomly assigned to one of three conditions: 1) 3g·d<sup>-1</sup> gelatin capsule CLA; 2) 3g·d<sup>-1</sup> gelatin capsule PL (olive oil) or 3) control only, no supplementation/exercise (CON). Supplements were administered weekly in a double-blind manner. For the CLA/PL groups, participants undertook 3x30 minutes exercise weekly at individual FAT<sub>MAX</sub> over a 4 week intervention period. Fat oxidation was assessed via stoichiometric calculations utilising expired air sampling at week 2 and 4. Fat mass (FM) and fat free mass (FFM) were also measured at these time points.

**RESULTS:** Baseline FAT<sub>MAX</sub> was not significantly different between conditions at week 0 (P=0.207). However, by week 4, FAT<sub>MAX</sub> was significantly greater with CLA compared to CON only (0.204 ± 0.022 g·min<sup>-1</sup> and 0.115 ± 0.0433 g·min<sup>-1</sup>; P=0.02). Baseline FM and FFM was not significantly different between conditions at week 0 (P=0.87 and P=0.78 respectively). Additionally, no significant differences were found for either FM (CLA: 20.03 ± 1.39 kg; PL: 20.31 ± 0.88 kg; CON: 20.20 ± 2.83 kg; P=0.99) or FFM (CLA: 43.47 ± 1.19 kg; PL: 44.57 ± 1.06 kg; CON: 44.65 ± 1.71 kg; P=0.79) between conditions at week 4.

**CONCLUSION:** Acute CLA supplementation may enhance maximal fat oxidation rates. It is possible that the *trans*-10, *cis*-12 isomer found in CLA may augment the activity of carnitine palmitoyl transferase responsible for mitochondrial beta-oxidation. CLA supplementation did not improve body composition over a four week exercise intervention in untrained female subjects.

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**3160** Board #125 June 1 2:00 PM - 3:30 PM

**Niacin Supplementation Limits Fat Utilization During Short-Term Cycling Exercise**

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(No relationships reported)

The hydrolysis of fatty acids (FA) from triglyceride (TG) molecules in adipose tissue may be a limiting factor in aerobic exercise performance and impaired hydrolysis may be linked to the development of insulin resistance. Niacin, also known as nicotinic acid or vitamin B3, decreases TG breakdown and FA mobilization in adipose tissue while caffeine enhances FA mobilization from adipose tissue.

**PURPOSE:** To determine how time to exhaustion and substrate utilization are affected by caffeine versus niacin supplementation during a progressive-intensity aerobic exercise bout lasting less than 30 min.

**METHODS:** 17 young, healthy, active, untrained males completed three identical progressive-intensity aerobic exercise trials. Utilizing a balanced, randomized double blind crossover design, participants were administered one of three supplements, caffeine (C) (5mg/kg of body weight), niacin (N) (1000 mg), or placebo (P) 30 minutes prior to each trial. Substrate utilization was determined through gas analysis and time to exhaustion was recorded for each trial. Each trial was separated by a one week wash-out period.

**RESULTS:** N treatment had significantly higher (p<0.05) respiratory quotient (RQ) compared to P and C (N=0.98 ± 0.05 vs. P=0.88 ± 0.05 vs. C=0.88 ± 0.06) (mean ± std. dev.) and consequently, percentage of carbohydrate (CHO) utilization was higher for N compared to P and C (N=80% ± 13 vs. P=61% ± 17 vs. C=62% ± 20). Time to exhaustion was significantly different for all three trials (N=24.4 ± 3.8 vs. P=25.5 ± 3.1 vs. C=27 ± 3.4).

**CONCLUSIONS:** In untrained individuals, progressive-intensity aerobic exercise lasting less than 30 min is highly dependent on the body's ability to utilize CHO for fuel, however the ability to mobilize FA's from adipose is also critically important for this type of performance.

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**3161** Board #126 June 1 2:00 PM - 3:30 PM

**Effects Of Ovariectomy And Resistance Training On Lipid Metabolism And Oxidative Stress In Rats Liver**

Mateus M. Domingos, Maria Fernanda Cury Rodrigues, Uliana Sbeguen Stotzer, Danilo Rodrigues Bertucci, Markus Vinicius Campos Souza, Camila do Valle Gatto, Yone Sato, Heloisa Sobreiro Selistre de Araújo, Sérgio Eduardo de Andrade Perez. *Federal University of Sao Carlos, Sao Carlos, Brazil.*

(No relationships reported)

Estrogen deficiency is associated with hepatic steatosis (HS), through changes in gene expression of molecules related to fat oxidation and lipogenesis and increased oxidative stress (OS). Resistance training (RT) may reduce the HS in ovariectomized (Ovx) rats.

**PURPOSE:** To assess the effects of RT on the gene expression of molecules related to lipid metabolism and OS markers in the liver of ovariectomized rats (Ovx).

**METHODS:** Adult Sprague-Dawley rats were divided into four groups (n = 8 per group): sham sedentary (Sham-Sed), Ovx sedentary (Sed-Ovx), Sham-Rt and Ovx-Rt. A 10-week RT period during which the animals climb a 1.1 m vertical ladder with weights attached to their tails. The sessions were performed three times a week, with 4-9 climbs. Gene expression was analyzed by RT-PCR by the  $\Delta\Delta C_t$  method. The EO was measured by levels of reduced glutathione (GSH) and oxidized glutathione (GSSG), lipid peroxidation (LP), concentration of vitamin E. A two-way analysis of variance (ANOVA) test was used to compare the variables RT with Ovx.

**RESULTS:** The Ovx decreased the gene expression of molecules related to fat oxidation, carnitine palmitoyltransferase I (53%, p<0.05) and  $\beta$ -hydroxyacyl-CoA dehydrogenase (27%, p<0.05), increased of molecules related to lipogenesis, sterol regulatory element-binding protein-1c (106%, p<0.05), and stearoyl CoA desaturase-1 (109%, p<0.05), decreased in the (GSH / GSSG) ratio (28%, p<0.05), vitamin E concentration (45%, p<0.05), no significant change was detected of the LP. The ovariectomy-induced changes in expression of molecules related to lipid metabolism were restored by RT. However, the OS markers were not reversed by the RT.

**CONCLUSION:** The present results indicate that the RT has important effects on the prevention of HS in Ovx animals, through changes of molecules related to hepatic lipid metabolism. Nevertheless, the RT program adopted did not reverse the effects of Ovx in hepatic OS markers.

3162 Board #127 June 1 2:00 PM - 3:30 PM

**Effect Of Lifelong trans-Fatty Acid Intake On Exercise Capacity In Senescence-accelerated Mice**

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(No relationships reported)

During the aging process, there is a reduced capacity for physical exertion that impairs functionality. Both aerobic exercise capacity ( $VO_{2peak}$ ) and strength are reduced with age, and lifestyle choices may impact the severity of the decline. Specifically the types of dietary fats consumed may moderate the relative decline in physical function.

**PURPOSE:** Using the senescence-accelerated SAMP8 mouse model, a model for sarcopenia and other age-related disabilities, we studied the effect of dietary *trans*-fatty acids upon body composition, aerobic exercise capacity, and strength.

**METHODS:** From weaning, male SAMP8 mice were assigned either to control diet (Con) containing no partially hydrogenated oils or a diet from which 2 percent of energy was from *trans*-fatty acids (TFA diet). At 25 weeks of age (young, Y) and at 60 weeks of age (old, O), body composition was measured by magnetic resonance,  $VO_{2peak}$  with an enclosed treadmill and metabolic measurement system, and strength with a grip strength meter. Strength and  $VO_{2peak}$  were normalized for fat-free mass (FFM). Results were analyzed by analysis of variance and planned comparisons.

**RESULTS:** There was an age related increase in body fat mass ( $P < 0.05$ ), but this increase was blunted on the TFA diet such that O-TFA was significantly different ( $P < 0.05$ ) from O-Con (Y-Con,  $3.2 \pm 0.6$ ; Y-TFA,  $3.3 \pm 0.7$ ; O-Con,  $7.5 \pm 1.8$ ; O-TFA,  $3.9 \pm 0.4$  g body fat). There was an age-related decrease in  $VO_{2peak}$  and grip strength on the Con diet ( $P < 0.05$ ). The TFA diet caused an additional reduction in  $VO_{2peak}$  at young age ( $P < 0.05$ ) (Y-Con,  $11,148 \pm 345$ ; Y-TFA,  $10,185 \pm 181$ ; O-Con,  $10,139 \pm 199$ ; O-TFA,  $10,284 \pm 211$  mL/gFFM/hr). As well, in comparison to Con, the TFA diet led to a trend for further reduction of grip strength at old age (Y-Con,  $6.0 \pm 0.6$ ; Y-TFA,  $5.9 \pm 0.5$ ; O-Con,  $5.5 \pm 0.2$ ; O-TFA,  $4.7 \pm 0.4$  grams force / g FFM) (O-Con vs O-TFA,  $P = 0.056$ ).

**CONCLUSIONS:** The SAMP8 mouse model exhibits age-related declines in physical function. Furthermore, consumption of a diet containing even a modest amount of *trans*-fatty acids leads to further impairment in exercise capacity. This may be related to dysregulation of lipid metabolism and deposition. The results have implications for effects of dietary fatty acid composition upon incidence of sarcopenia and loss of functionality across the lifespan.

3163 Board #128 June 1 2:00 PM - 3:30 PM

**Effect Of Post-exercise Dietary Intervention On The Markers Of Energy Metabolism And Lipid Synthesis**

Wen-Hsin Chang<sup>1</sup>, Yi-Ting Pan<sup>2</sup>, Mei-chih Hsu<sup>2</sup>, Shene-Pin Hu<sup>3</sup>, Jen-Fang Liu<sup>3</sup>. <sup>1</sup>*Kaohsiung Medical University, Kaohsiung, Taiwan.* <sup>2</sup>*National Taiwan Sport University, Taoyuan, Taiwan.* <sup>3</sup>*Taipei Medical University, Taipei, Taiwan.*

(No relationships reported)

Intense or prolonged physical exercise causes the loss of body water, the depletion and exhaustion of fuel stores, imbalances in the status of nutrients and various homeostatic disturbances of hormones. In the process of recovery after exercise, nutrition intervention is a central consideration for rehydrating and refueling the body.

**PURPOSE:** The study was to investigate the effects of different dietary composition after exercise on energy metabolic markers and the protein expression of lipid synthesis-related genes in healthy men.

**METHODS:** Twelve healthy male subjects ( $21.3 \pm 0.4$  yr,  $52.8 \pm 1.2$   $VO_{2max}$ ) participated in a randomized, crossover-design diet intervention, where they consumed either water (300 mL, Control diet; CON), 75g glucose drink (300 mL, 300 Kcal, Glucose diet; GD), or an isocaloric balanced diet (300 Kcal, 60% carbohydrate, 26% fat, and 14% protein, Normal diet; ND) after a medium-intensity exercise test (65  $VO_{2max}$ , 30 min), with 2 weeks rest period in between. Blood samples were taken before exercise and at 0 (Eat-0), 1 (Eat-1), 2 (Eat-2), and 3 (Eat-3) hours after eating.

**RESULTS:** Compared with the CON, the GD and ND consumption significantly elevated glucose ( $116 \pm 5.8$  vs.  $104 \pm 4.3$  vs.  $84.4 \pm 1.7$  mg/dL for GD, ND, and CON, respectively,  $p < 0.05$ ) and insulin ( $28.0 \pm 2.9$  vs.  $21.6 \pm 2.5$  vs.  $4.24 \pm 0.4$  mU/L,  $p < 0.05$ ) concentrations and decreased free fatty acid ( $0.17 \pm 0.06$  vs.  $0.24 \pm 0.05$  vs.  $0.54 \pm 0.06$  mmol/L,  $p < 0.05$ ) level at 1 hour after eating. Serum TG concentration was greater for ND than GD and CON ( $69.7 \pm 3.9$  vs.  $57.7 \pm 3.2$  &  $54.8 \pm 3.3$  mg/dL,  $p < 0.05$ ). However, the protein expression of ChREBP (carbohydrate responsive element binding protein), ACC (acetyl-coenzyme A carboxylase), and FAS (fatty acid synthase), the markers of lipid synthesis, did not differ between diets.

**CONCLUSION:** Findings from this study show that a balanced diet consumption after exercise have a greater influence on energy utilization, but not on the protein expression of lipid synthesis-related genes.

3164 Board #129 June 1 2:00 PM - 3:30 PM

**Effects of Training Intensity on Non-Alcoholic Fatty Liver and Its Related Genes Expression in Mice**

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(No relationships reported)

**PURPOSE:** To investigate the effects of moderate- (MT) and interval training (IT) on fatty liver and its complications induced by a high-fat diet (HF).

**METHOD:** Mice (C57BL/6, 5 wks old) were divided into standard chow and sedentary (SC+SD, n=10) for 16 weeks and HF (n=30) groups. Mice submitted to HF remained sedentary for the first 8 wks, and were divided into sedentary (HF+SD, n=10) or MT (HF+MT, n=10) or IT (HF+IT, n=10) for the remaining 8 wks. The primary outcomes of the study included HOMA-IR, hepatic and serum lipids, serum adiponectin, liver enzymes including ALT and AST, and hepatic mRNAs for sterol-regulatory element binding protein (SREBP) 2 and its target genes.

**RESULTS:** A 16-wk high-fat (60%) diet resulted in significant increases in hepatic TG (SC+SD  $20.3 \pm 5.9$  vs. HF+SD  $50.4 \pm 4.8$  mg/mg,  $p=0.001$ ), HOMA-IR (SC+SD  $3.4 \pm 2.3$  vs. HF+SD  $19.7 \pm 7.2$ ,  $p=0.001$ ), and serum ALT (SC+SD  $31.5 \pm 7.2$  vs. HF+SD  $236 \pm 49.2$  U/L,  $p=0.001$ ) along with decreased adiponectin (SC+SD  $4.29 \pm 0.64$  vs. HF+SD  $3.45 \pm 0.48$   $\mu$ g/ml,  $p=0.007$ ). Exercise training induced significant reductions in hepatic TG (HF+SD  $50.4 \pm 4.8$  vs. HF+MT  $40.9 \pm 8.1$  mg/mg,  $p=0.032$  or HF+IT  $38.4 \pm 6.2$  mg/mg,  $p=0.015$ ), serum TC (HF+SD  $208.2 \pm 34.1$  vs. HF+MT  $180.2 \pm 12.5$  mg/dl,  $p=0.547$  or HF+IT  $169.0 \pm 22.2$  mg/dl,  $p=0.028$ ), HOMA-IR (HF+SD  $19.7 \pm 7.2$  vs. HF+MT  $10.1 \pm 7.4$ ,  $p=0.01$  or HF+IT  $9.5 \pm 5.4$ ,  $p=0.006$ ), serum ALT (HF+SD  $236.0 \pm 49.3$  vs. HF+MT  $187.8 \pm 36.8$  U/L,  $p=0.023$  or HF+IT  $149.1 \pm 48.3$  U/L,  $p=0.001$ ), and adiponectin (HF+SD  $3.4 \pm 0.5$  vs. HF+MT  $3.6 \pm 0.3$   $\mu$ g/ml,  $p=0.595$  or HF+IT  $4.3 \pm 0.7$   $\mu$ g/ml,  $p=0.004$ ). Exercise training reversed HF-induced decrease in LDLr mRNA (HF+SD  $3.03 \pm 0.33$  vs. HF+IT  $4.30 \pm 0.19$ ,  $p < 0.001$ ) and HF-induced increase in collagen mRNA (HF+SD  $24.80 \pm 4.14$  vs. HF+IT  $10.75 \pm 0.49$ ,  $p < 0.001$ ). SREBP2 mRNA of the HF+IT ( $6.60 \pm 1.8$ ) was higher than those of the HF+SD ( $2.2 \pm 0.54$ ,  $p=0.019$ ) or the HF+MT ( $3.4 \pm 0.20$ ,  $p=0.059$ ). Similarly, p-AMPK/AMPK ratio ( $0.99 \pm 0.07$ ) of the HF+IT was higher than those of the HF+SD ( $0.70 \pm 0.06$ ,  $p < 0.001$ ) or the HF+MT ( $0.88 \pm 0.04$ ,  $p=0.010$ ).

**CONCLUSION:** The findings of the study suggest that exercise training, especially an interval mode, might be an effective means against fatty liver and its metabolic complications associated with HFD.

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3165 Board #130 June 1 2:00 PM - 3:30 PM

**The Effects Of Short And Long Term Watercress Ingestion On Exercise-induced DNA Damage And Lipid Peroxidation**

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(No relationships reported)

Pharmacological antioxidant vitamins are routinely used for a prophylactic effect against exercise-induced oxidative stress. However, large doses are often required and may lead to a state of pro-oxidation and oxidative damage. Watercress contains compounds beyond their nutritional value which may increase protection against exercise-induced oxidative stress

**PURPOSE:** This randomised controlled investigation was designed to test the hypothesis that acute (consumption 2 hours prior to exercise) and chronic (eight weeks consumption) watercress supplementation can attenuate exercise-induced oxidative stress.

**METHODS:** Ten ( $n=10$ ) apparently healthy male subjects (age  $23 \pm 4$  yrs, stature  $179 \pm 10$  cm and body mass  $74 \pm 15$  kg), randomly assigned to either a control (no supplementation) or watercress supplementation group, volunteered to give blood at baseline (pre-supplementation), at rest (pre-exercise) and following exercise. Each subject completed an incremental exercise test to volitional exhaustion following acute and chronic watercress supplementation or control.

**RESULTS:** The main findings show an exercise-induced increase in DNA damage and lipid peroxidation over both acute and chronic control supplementation phases ( $P<0.05$  vs. supplementation), while acute and chronic watercress attenuated DNA damage and lipid peroxidation and decreased hydrogen peroxide accumulation following exhaustive exercise ( $P<0.05$  vs. control). A marked increase in the main lipid soluble antioxidants ( $\alpha$ -tocopherol,  $\gamma$ -tocopherol and xanthophyll) was observed following watercress supplementation ( $P<0.05$  vs. control) in both experimental phases.

**CONCLUSION:** These findings suggest that short and long term watercress ingestion has potential antioxidant effects against exercise-induced DNA damage and lipid peroxidation.

**3166** Board #131 June 1 2:00 PM - 3:30 PM

**The Effects of Fish Oil Supplementation on Markers of Inflammation in Chronic Kidney Disease Patients**

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(No relationships reported)

**PURPOSE:** A characteristic of chronic kidney disease (CKD) is excessive production of pro-inflammatory cytokines. The benefits of fish oil (FO) for an extensive range of populations and health concerns are apparent, yet the anti-inflammatory benefits for non-dialysis CKD patients are equivocal. Therefore, the purpose of this study was to investigate the effects of daily consumption of FO on IL-1 $\beta$ , IL-6, and TNF- $\alpha$  for 8 weeks in non-dialysis CKD patients.

**METHODS:** The study was conducted using a double blind, randomized, placebo-controlled experimental design. Thirty-one non-dialysis CKD patients were followed prospectively for 8 weeks while supplementing FO (2.4g/day (1400 mg EPA + 1000 mg DHA) or placebo (safflower oil) in their diet. **MAIN OUTCOME MEASURES:** IL-1 $\beta$ , IL-6, and TNF- $\alpha$  were all measured as markers of inflammation at pretest and at 8-weeks.

**RESULTS:** One-way ANOVA revealed no significant differences in IL-6 ( $p=.06$ ), IL-1 $\beta$  ( $p=.18$ ), and TNF- $\alpha$  ( $p=.20$ ) between groups at baseline. Additionally, no pretest differences existed between groups for age ( $p=.549$ ), weight ( $p=.324$ ), waist circumference ( $p=.086$ ), gender ( $p=.591$ ) and ethnicity ( $p=.875$ ). ANCOVA was calculated using compliance, age, gender, ethnicity, body weight, and waist circumference as covariates. No significant differences were discovered between groups after FO supplementation for IL-6 ( $p=.453$ ), and TNF- $\alpha$  ( $p=.242$ ). A significant difference was discovered for IL-1 $\beta$  ( $p=.050$ ) with lower levels in the FO group.

**CONCLUSIONS:** The results of this study is in agreement with some previous studies that suggest that FO supplementation has no effect on plasma pro-inflammatory cytokines TNF- $\alpha$  or IL-6, but does have an effect on IL-1 $\beta$  in non-dialysis CKD patients. The protective effects in this study and others are due primarily to eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) found in FO. Inflammation plays a significant role in cardiovascular disease in CKD patients with novel approaches needed to reduce the risk of cardiovascular disease.

**3167** Board #132 June 1 2:00 PM - 3:30 PM

**Maximizing Fat Utilization Postexercise with a Novel Low Glycemic Carbohydrate Meal**

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(No relationships reported)

Exercise can increase lipolysis and fat oxidation. Conversely, ingesting carbohydrate (CHO) increases insulin concentration and blunts lipolysis. As compared to higher glycemic index (GI) food, low GI food may be valuable in reducing blood glucose and insulin responses and, therefore, are valuable as postexercise meals to maintain elevated fat oxidation during recovery.

**PURPOSE:** To evaluate metabolic cost ( $\dot{V}O_2$ ) and substrate utilization (RER) after consumption of a low GI CHO, high GI CHO, and control (500mL H<sub>2</sub>O) during the recovery from a previous bout of exercise.

**METHODS:** A repeated-measures ANOVA model was used with LSD post hoc analyses where applicable. Means  $\pm$  standard deviations are presented. Ten healthy, non-smoking, college-aged men ( $21 \pm 2$  yrs) with average body composition ( $14.00 \pm 1.82$  % fat) and above average aerobic fitness ( $53.20 \pm 2.87$  mL/kg/min) were recruited. Participants completed three trials each in random order. Each trial began with a treadmill walk at 60% of their predetermined  $\dot{V}O_{2max}$  until 300kcal were expended, followed by consumption of 300kcal of a low GI CHO, high GI CHO, or a control. Then measurements of ventilatory gases were made during a two hour recovery period.

**RESULTS:** There were no significant differences in  $\dot{V}O_2$  among trials. However, RER was significantly different among trials and across time - presented in the table below.

**CONCLUSION:** In this sample, consuming a low GI CHO after a bout of exercise helped to maintain fat oxidation during the first hour of a two hour recovery.

|                 | Low GI CHO       | High GI CHO        | Control            |
|-----------------|------------------|--------------------|--------------------|
| Time*           | RER              | RER                | RER                |
| 1 (10-15)       | 0.79 $\pm$ 0.08  | 0.78 $\pm$ 0.10    | 0.81 $\pm$ 0.06    |
| 2 (25-30)       | 0.79 $\pm$ 0.05  | 0.82 $\pm$ 0.09    | 0.79 $\pm$ 0.03    |
| 3 (40-45)       | 0.82 $\pm$ 0.05  | 0.85 $\pm$ 0.06    | 0.81 $\pm$ 0.05H   |
| 4 (55-60)       | 0.83 $\pm$ 0.08  | 0.88 $\pm$ 0.05C   | 0.83 $\pm$ 0.05H,I |
| 5 (70-75) A     | 0.82 $\pm$ 0.06  | 0.93 $\pm$ 0.10C   | 0.81 $\pm$ 0.05    |
| 6 (85-90) A     | 0.84 $\pm$ 0.03G | 0.91 $\pm$ 0.05C   | 0.82 $\pm$ 0.03H   |
| 7 (100-105) A,B | 0.87 $\pm$ 0.07F | 0.92 $\pm$ 0.11C   | 0.80 $\pm$ 0.03    |
| 8 (115-120) A   | 0.87 $\pm$ 0.03E | 0.95 $\pm$ 0.11C,D | 0.81 $\pm$ 0.08    |

\*Last 5 minutes of a 10 minute measurement period; <sup>A</sup> High>Low,Control; <sup>B</sup> Low>Control; across High: <sup>C</sup> 4-8>1, <sup>D</sup> 8>6,7; across Low: <sup>E</sup> 8>1-6, <sup>F</sup> 7>1,2, <sup>G</sup> 6>2; across Control: <sup>H</sup> 3,4,6>2; <sup>I</sup> 4>5

Funded: Provost's Research Fund-Ohio University

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## F-28 Free Communication/Poster - Injury

JUNE 1, 2012 1:00 PM - 6:00 PM  
ROOM: Exhibit Hall

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**3168** Board #133 June 1 3:30 PM - 5:00 PM

### Treatment Of Acute Lateral Ankle Sprain With Tape Or Brace: A Randomized Controlled Trial

Ellen Kemler, Ingrid P. van de Port, Arno Hoes, Frank J.G. Backx. *University Medical Centre Utrecht, Utrecht, Netherlands.*  
(No relationships reported)

**PURPOSE:** Ankle sprains are the most common sports injuries often leading to pain and other impairments including physical limitations and recurrences of an ankle sprain. The risk of re-spraining within a period of 3 years after the initial ankle sprain ranged from 3 to 34%. Since the nineties functional treatment of ankle sprains is recommended. Nowadays, the regular treatment of an acute lateral ankle sprain includes ankle taping, the use of an ankle brace is conventional to prevent re-injuries. The purpose of this randomized controlled clinical trial is to investigate the effect of a 4-week treatment with an ankle brace (soft brace) compared to the treatment with ankle tape on recurrent sprain and residual symptoms within one year in patients with an acute lateral ankle sprain.

**METHODS:** Patients (aged > 18 yrs) with an acute lateral ankle sprain caused by an inversion trauma were included after visiting the emergency departments of two participating hospitals, their GP practitioner or physiotherapist. All participants were sequentially randomized to the treatment group (ankle brace) or control group (ankle tape). A sports physician conducted an anamnesis and a physical exam during which the ankle was examined for swelling, discoloration by hematoma, limited dorsoflexion and tenderness at baseline. Tests were performed to measure passive and active ankle stability. After baseline measurements, a 4-week treatment with brace or tape started. At week 5, 9, 13, 26 and 39 post-trauma, patients had to fill in online questionnaires asking about re-injuries and residual symptoms. After 52 weeks a final assessment with a physical exam by a sports physician took place.

**RESULTS:** In total 157 patients with an acute lateral ankle sprain participated in the study. Within 52 weeks after the initial injury 11 patients in the tape group and 13 in the brace group re-injured their ankle (HR 1.1, 95% CI 0.5 to 2.5). Of the residual symptoms, only the anterior drawer sign test showed a significant difference detrimental to the brace group (OR 3.3, 95% CI 1.3-8.1).

**CONCLUSIONS:** The ankle brace, is not more effective in the treatment of acute lateral ankle sprains. However, results suggest equal effectiveness which might lead to the conclusion that both ankle tape and ankle brace can be used to treat lateral ankle sprains.

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**3169** Board #134 June 1 3:30 PM - 5:00 PM

### Risk Factors Associated with Running Injuries in the United States Army

Tyson Grier, Michelle Canham-Chervak, Vancil McNulty, Bruce H. Jones, FACSM. *Army Institute of Public Health, Aberdeen Proving Ground, MD.*  
(No relationships reported)

Running injuries result from the interaction of a number of extrinsic and intrinsic risk factors.

**PURPOSE:** To identify risk factors associated with injuries attributed to running in U.S. Army Soldiers.

**METHODS:** Participants were male soldiers in a deploying U.S. Army unit (n=1320). Injury data, limited duty days, physical fitness, tobacco use, and previous Army physical fitness test (APFT) scores were obtained by survey. APFT variables (push-ups, sit-ups and 2 mile run) were converted into quartiles (Q), where Q1 = lowest performance and Q4 = highest performance. Odds ratios (OR) and 95% confidence intervals (95% CI) were obtained from multivariable logistic regression.

**RESULTS:** Overall injury incidence for the prior 12 months was 49% (n=652), with 28% of injured Soldiers (n = 180) attributing their injuries specifically to running. Limited duty profiles were given to 76% of the Soldiers (n=137) injured while running, with 62% (n=80) of the profiles limiting duty from 1-30 days. Higher risk of injury was independently associated with higher BMI (OR= BMI 26-29/BMI<24) = 1.98, 95%CI 1.07-3.65), (OR (BMI 30+/BMI<24) = 2.27, 95%CI 1.10-4.71), miles road marched per month (OR (5.1-10 miles/≤5 miles) = 1.86, 95%CI 1.03-3.34), (OR(20.1 miles/≤5miles) = 1.98, 95%CI 1.06-3.68), and poor aerobic endurance as measured by 2 mile run performance (OR (Q2/Q4) = 1.99, 95%CI 1.07-3.72), (OR (Q1/Q4) = 2.25, 95%CI 1.18-4.29). A lower risk of injury was independently associated with resistance training 1-2 times a week compared to no resistance training (OR (1-2 times per week/none) = 0.50, 95%CI 0.29-0.85).

**CONCLUSION:** Running-related injuries accounted for over a quarter of all reported injuries. Countermeasures to prevent such injuries might entail enhancing aerobic endurance, decreasing excess body fat, reducing the number of miles road marched per month, and resistance training 1-2 times per week.

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**3170** Board #135 June 1 3:30 PM - 5:00 PM

### Air Evacuated Non-Battle Injuries Diagnosed As Sport-Related Musculoskeletal Conditions, Us Army 2001-2010

Morgan Clennin, Bonnie J. Taylor, Keith G. Hauret, FACSM, Bruce H. Jones, FACSM. *Army Institute of Public Health, Aberdeen Proving Ground, MD.*  
(No relationships reported)

Sports and exercise are leading causes (23%) of non-battle injuries (NBIs) requiring medical air evacuation from ongoing military operations in Iraq and Afghanistan. Epidemiologic reports of sport-related injuries often capture traumatic injuries (ICD-9 codes 800-959) but not injury-related musculoskeletal (MSK) conditions (ICD-9 codes 716-739) which include overuse and recurrent injuries. Since injury-related MSK conditions are not routinely monitored it is difficult to ascertain their impact on lost duty days, operational readiness, and Soldier quality of life.

**PURPOSE:** To examine the incidence, rates, and causes of sports-related MSK injuries requiring air evacuation of deployed Army soldiers from Iraq or Afghanistan (2001-2010).

**METHODS:** Air evacuation records were used to identify Soldiers air evacuated from Iraq or Afghanistan between Oct 2001 and Dec 2010 for MSK NBIs (ICD-9 codes 716-739). Cause of injury was determined by experienced coders based on incident narratives. Analyses used descriptive statistics to report incidence, rates and cause.

**RESULTS:** Of the 7,304 MSK NBIs air evacuations, 998 were sports-related. Physical training was the leading cause (25%), followed by weightlifting (24%) and basketball (23%). The rate of sports-related MSK conditions was nearly double for Soldiers in the 30+ year age group (9.0 per 10,000 deployed Soldiers) compared to the <30 year age group (4.8 per 10,000 deployed Soldiers). Soldiers in the 30+ year age group had a significantly greater rate of basketball (p<0.01), physical training (p<0.01), football (p<0.05), and weightlifting (p<0.01) MSK injuries. Overall, knee (25%), back (14%), shoulder (14%), and ankle (13%) were the body parts associated with the majority of these injuries. On average, 81% of Soldiers air evacuated with sports-related MSK injuries are not returned to theater.

**CONCLUSIONS:** As a leading contributor to potentially preventable injuries, strategies to mitigate sports-related MSK NBIs should be implemented into existing injury safety programs. Injury prevention programs for sports-related MSK injuries must receive adequate resources to provide Soldiers with protective gear and additional tools.

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**3171** Board #136 June 1 3:30 PM - 5:00 PM

### Life-threatening Injuries Attributable To Sports Activity

William P. Meehan, III, Rebekah Mannix. *Children's Hospital Boston, Boston, MA.*  
(No relationships reported)

**PURPOSE:** Determine the proportion of life-threatening injuries (LTIs) attributable to sports activity.

**METHODS:** We examined the National Hospital Ambulatory Care Survey database for emergency department visits between the years 1999 and 2008. LTIs were defined as International

Classification of Diseases, 9th Revision codes for skull fracture [800.x-802.xx, 803.x-804.xx], cervical spine fractures [805.xx-806.10], intracranial hemorrhage [852.xx-853.xx], traumatic pneumothorax/hemothorax [860.00-860.05], liver lacerations [864.xx], and/or spleen lacerations [865.xx], traumatic aortic aneurysm or rupture [901.0; 902.0] and gastric/duodenal rupture [537.89]. We defined sport-related as having an external cause of injury code that was exclusively sport-related or when a text search of the visit confirmed the injury was sport-related.

**RESULTS:** Of the 300,394 observed ED visits, 0.5% (95% CI 0.5, 0.5) were for LTIs. Overall, 14% (95% CI 12, 17) of LTIs were sport-related, representing 890,000 ED visits in the 10 year sample. Of all visits for LTIs in children, 31% were sport-related (95% CI 25, 37); including 39% of all LTIs in children ages 6-18 years. In adults, 9% of LTIs (95% CI 7, 11) were sport-related. For adults aged 19-44 years, 12% (95% CI 9, 15) of LTIs of the head and neck were sport-related.

Of all pediatric cervical spine fractures, 23% (95% CI 6.5, 55) were sport-related. Seven percent (95% CI 4, 11) of cervical spine injuries in adults were due to sports injuries, representing 110,000 cervical spine injuries in the 10 year sample. Sports injuries accounted for 10% (95% CI 5, 20) of intracranial hemorrhages in adults, 4% (95% CI 1, 15) in children.

**CONCLUSION:** An estimated 89,000 LTIs secondary to sports activity occur annually. Nearly 40% of all life threatening injuries sustained by children between the ages of 6 and 18 years are sport-related. This represents a unique opportunity for prevention. Rule changes, protective equipment, and focused training have proven effective in decreasing sports injuries in the past. Given the proportion of all life-threatening injuries attributable to sports, and the ability to control the circumstances surrounding athletic injuries, further study of life threatening injuries in athletics is warranted.

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**3172** Board #137 June 1 3:30 PM - 5:00 PM

**Seasonal Differences in Injury Risks in Basic Combat Training**

Phillip Garrett, Elizabeth Clearfield, Ashly Westrick, Keith G. Hauret, Joseph J. Knapik, FACSM, Bruce H. Jones, FACSM. *United States Army Institute of Public Health, Aberdeen Proving Ground, MD.*

(No relationships reported)

Injuries during Army Basic Combat Training (BCT) have been previously found to be higher in the summer than in the fall season and correlated with daily high temperatures (Knapik, Ann Occup Hyg 46:15, 2002).

**PURPOSE:** To compare the injury risks (cumulative incidence %) across all four seasons during BCT.

**METHODS:** Army Training and Doctrine Command provided electronic rosters for all BCT recruits arriving at Fort Jackson, South Carolina, for one year (1 October 2009 through 30 September 2010). Rosters were linked to injury data from the Defense Medical Surveillance System. Injuries were identified based on specific International Classification of Diseases (ICD-9) codes. Seasons were defined as BCT classes (10 weeks long) beginning in particular months as follows: Summer (SU): July; Fall (F): October; Winter (W): January; Spring (SP): April. The injury incidence for each season was calculated as: recruits with  $\geq 1$  injury/total recruits X 100%. Risk ratios (RR) with 95% confidence intervals (95%CI) were determined using W as the reference time period.

**RESULTS:** Participants were 9,262 men and 4,363 women. Injury risks in W, SP, SU, and F were respectively 20.1%, 24.6%, 25.1%, and 21.6% for men, and 45.8%, 53.8%, 51.7%, and 47.3% for women. For men, injury risks in the SU and SP were higher than in the W (RR[SU/W]=1.25, 95% CI=1.13-1.38; RR[SP/W]=1.22, 95% CI=1.10-1.35, respectively) and tended to be the same in F (RR[F/W]=1.08, 95% CI=0.96-1.21). For women, injury risks in the SU and SP were higher than the W (RR[SU/W]=1.13, 95% CI=1.04-1.23; RR[SP/W]=1.18, 95% CI=1.08-1.28, respectively), but not in the F (RR[F/W]=1.03, 95% CI=0.95-1.13). The correlation between average high daily temperature and injury incidence was 0.94 for men and 0.79 for women. Average daily high temperatures ranged from 97.2°F (SU) to 55.9°F (W).

**CONCLUSIONS:** Compared to the winter, injury rates in BCT were higher in the SU and SP and about the same in the F. Daily high temperatures are predictive of injury risks.

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**3173** Board #138 June 1 3:30 PM - 5:00 PM

**Physical Fitness Tests' Ability To Predict Injuries In Officer Candidates And Their Association To FMS**

Peter J. Lisman<sup>1</sup>, Francis G. O'Connor, FACSM<sup>1</sup>, Patricia A. Deuster, FACSM<sup>1</sup>, Chris G. Pappas<sup>2</sup>, Joseph J. Knapik<sup>3</sup>. <sup>1</sup>Uniformed Services University of the Health Sciences, Bethesda, MD. <sup>2</sup>Womack Army Community Hospital, Fort Bragg, NC. <sup>3</sup>Public Health Command (Prov), Aberdeen Proving Grounds, MD.

(No relationships reported)

Low overall scores in physical fitness and Functional Movement Screening (FMS) appear to be related to an increased incidence of musculoskeletal injury in active military populations; however, the injury predictive ability of individual physical fitness tests (PFT) and their relationship to FMS is unclear.

**PURPOSE:** Determine whether the pull-up to exhaustion (PUE) test, 2-min abdominal crunch (AC), and 3-mi run for time (RT) were predictive of subsequent injury occurrence in Marine Corps Officer Candidate School (OCS) training. Also we assessed the association between specific PFT and FMS tests.

**METHODS:** Subjects included 874 male (22.4±2.7) candidates enrolled in either six (n = 447) or ten (n = 427) weeks of OCS. Prior to OCS, candidates completed a PUE, 2-min AC, 3-mi RT, and FMS. FMS consisted of deep squat, hurdle step, inline lunge (IL), shoulder mobility, active straight leg raise (SLR), push-up, and rotary stability tests. Injury incidence data were gathered throughout training and grouped as "any", "overuse", or "traumatic". Data were dichotomized for RT ( $\geq 20:53$  vs.  $< 20:53$ ), PUE ( $\geq 17$  vs.  $< 17$ ) and AC ( $\geq 100$  vs.  $< 100$ ). FMS test scores were grouped as "high" (score of 3) vs. "low" (score of 1 or 2).  $\chi^2$  statistics were used to evaluate group differences in injury risk and determine associations between PFT and FMS tests.

**RESULTS:** Candidates were 1.71 times more likely to suffer an injury if they had a RT  $\geq 20:53$  ( $p < 0.001$ ); 36.9% of persons with a RT  $\geq 20:53$  suffered an injury compared with 25.5% of those with a RT  $< 20:53$ . Likewise, candidates with a RT  $\geq 20:53$  were 1.7 and 1.65 times more likely to suffer a traumatic (28.7 vs. 19.2%,  $p = 0.001$ ) or overuse injury (12.1 vs. 7.7%,  $p = 0.03$ ), respectively, compared to a RT  $< 20:53$ . In contrast, both PUE and AC tests were independent of injury. RT was not associated with any specific FMS test, whereas PUE  $\geq 17$  were associated with high FMS scores in squat ( $\chi^2 = 5.91$ ,  $p = 0.015$ ), IL ( $\chi^2 = 8.32$ ,  $p = 0.004$ ), SLR ( $\chi^2 = 4.20$ ,  $p = 0.04$ ), and push-up ( $\chi^2 = 6.96$ ,  $p = 0.008$ ) tests. AC  $\geq 100$  were associated with high FMS scores in squat ( $\chi^2 = 6.29$ ,  $p = 0.012$ ) and IL ( $\chi^2 = 18.09$ ,  $p < 0.001$ ).

**CONCLUSION:** RT  $\geq 20:53$  was associated with increased injury risk while PUE had the greatest association with high FMS test scores. Further work is needed to determine what combination of PFT and FMS tests are more suitable for predicting injuries.

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**3174** Board #139 June 1 3:30 PM - 5:00 PM

**Impact of Injuries from Sports, Exercise, and Recreational Activity among Active Duty Military Personnel**

Keith G. Hauret<sup>1</sup>, Sheryl A. Bedno<sup>2</sup>, Tze-Cheg Kao<sup>3</sup>, Bruce H. Jones, FACSM<sup>1</sup>, Kelly Loring, FACSM<sup>4</sup>. <sup>1</sup>Army Institute of Public Health, Aberdeen Proving Ground, MD. <sup>2</sup>Eisenhower Army Medical Center, Fort Gordon, GA. <sup>3</sup>Uniformed Services University of the Health Sciences, Bethesda, MD. <sup>4</sup>20th Medical Group, Ellsworth Air Force Base, SD.

(No relationships reported)

Injuries are the biggest health problem for U.S. military forces in peacetime and combat, impacting the health and readiness of Service members (SMs). Sports and exercise are leading causes of injury hospitalizations among non-deployed SMs and non-battle injury air evacuations among deployed SMs. Because medical providers do not record causes of injury in medical records, the true magnitude of this injury problem is unknown.

**PURPOSE:** To determine the incidence of injuries from sports, exercise and recreational activity (SERA) among active duty SMs and describe the leading injury-causing activities and their associated injury types.

**METHODS:** Eleven questions about injuries within the past 12 months were added to the April 2008 Status of Forces Survey of Active Duty Service Members (SOFA0801). Survey design and weighting of self-reported responses produced population estimates (weighted percents with standard errors [SE]) for overall injury incidence, SERA injury incidence, injury types, injury causing activities, and days of limited duty. SUDAAN was used for all analyses.

**RESULTS:** Overall, 48.9% (SE=0.7) of SMs sustained an injury in the past 12 months and 25.4% (SE=0.6) reported at least one SERA injury. SERA injury incidence was nearly the same for men (25.3%; SE=0.6) and women (26.1%; SE=1.6). Running accounted for 45.1% (SE=1.4) of SERA injuries overall, 42.6% (SE=1.5) among men, and 58.1% (SE=3.5) among women. Among those injured while running, the leading injury types were sprained joint (21.7%; SE=1.7), strained muscle (19.3%; SE=1.6), tendonitis/bursitis (16.8%; SE=1.5) and fracture (7.5%; SE=1.3). Ankle and knee sprains accounted for 54.9% (SE=4.5) and 28.7% (SE=4.0) of joint sprains from running, respectively. Among all SMs with a joint sprain, 19.5% (SE=2.4) required 2 - 7 days of limited duty, 18.4% (SE=2.4) required 8 - 14 days, and 28.8% (SE=3.0) required more than 15 days.



**CONCLUSION:** This evaluation provides leaders with strong evidence for a significant contribution of sports, exercise, and recreational activity to the overall injury problem in the military services. It highlights the need to identify risk factors for SERA injury and to develop training programs that lower the associated injury risks, especially from running since it accounts for nearly half of the SERA injuries.

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**3175**     *Board #140*     **June 1**     **3:30 PM - 5:00 PM**

**Association Between Anatomic Alignment And Musculoskeletal Injuries In Recreational Runners: Cohort Prospective Study.**

Aline C.A. Carvalho, Ms, Luiz Carlos Mr Hespagnol Junior, Leonardo O.P. Costa, Mr, Alexandre D. Lopes, Mr.. *University São Paulo City, São Paulo - SP, Brazil.*  
(No relationships reported)

**BACKGROUND:** Much has been said about the influence of factors such as the alignment of the lower limbs and the development of musculoskeletal injuries in runners, but little evidence supports this hypothesis.

**OBJECTIVE:** To describe the anatomical alignment of the lower limbs, to measure the prevalence and incidence of musculoskeletal injuries related to running, to examine the associations between the characteristics of these injuries and anatomical alignment, and describe the major injuries among runners and the anatomical regions most affected.

**METHOD:** A prospective cohort study composed of 89 recreational runners who underwent measures of bilateral Q angle, subtalar angle, medial longitudinal arch and length discrepancy of lower limb and were followed for a period of 12 weeks. We performed descriptive analysis and verification of the association between the characteristics of anatomical alignment of the runners and injuries. The incidence of injuries was calculated using survival analysis and the association between potential risk factors and time of injury was determined by Cox regression models.

**RESULTS:** Participants of the study were on average 44 years-old (SD = 10), without major changes in the alignment of lower limbs and presented an association between changes in Q angle and the discrepancy of Q angle with musculoskeletal injuries. The prevalence of musculoskeletal injuries related to running was 61.8%, the incidence over 12 weeks was 27%, being tendinopathies and muscle injuries the most common injuries and the knee and the leg as the most affected regions.

**CONCLUSIONS:** It was possible to identify the association of the discrepancy between the Q angles and the angles Q changes with injuries in runners. We also identified tendinopathies and muscle injuries as major injuries and the knee as the most affected region.

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**3176**     *Board #141*     **June 1**     **3:30 PM - 5:00 PM**

**Epidemiology and Outcomes of Concussions in Major League Baseball**

Vincent Moretti, Leslie Schwindel, Jonathon Watson, Mark Hutchinson, FACSM. *University of Illinois at Chicago, Chicago, IL.*  
(No relationships reported)

**PURPOSE:** All contact sports carry the risk for concussions, but limited data exists on such injuries in baseball, particularly at the professional level. The purpose of this study is to document the epidemiology of concussions in Major League Baseball (MLB) and to quantify the impact of these injuries upon player performance.

**METHODS:** Data on MLB concussions occurring between 2001 and 2010 was gathered from MLB disabled list records. For each player identified, additional data was gathered from online game summaries and player profiles. Recorded variables included player position, date of injury, age at injury, injury situation, source of trauma, and date of return to play. Performance statistics were compiled for each player for the 15- and 30-day periods immediately after they returned to play. Identical statistics from the 30-days immediately pre-injury served as a control. Statistical analysis was performed using two-sided z-test for proportions with a significance level of 0.05.

**RESULTS:** 33 concussions were identified, 8 from 2001-2005 (per game incidence=0.03%) and 25 from 2006-2010 (per game incidence=0.10%). Average age at injury was 29 years. 9 players were concussed by batted balls (27.3%), 8 by pitched balls (24.2%), 7 by fielder-runner collisions (21.2%), 6 by fielder collisions (18.1%), and 3 by swung bats (9.1%). Nearly a third (30.3%) of injuries were to catchers. On average, players were unable to play for 67 days (range 1-349) or 38 games (range 1-152) after a concussion. 4 players (12.1%) never returned to MLB. Batting average through the first 15 days (0.237, p=0.423) and the first 30 days (0.252, p=0.970) after returning from injury were insignificantly decreased from the pre-concussion average (0.253). On-base percentage through 15 days (0.302, p=0.237) and 30 days (0.326, p=0.996) was insignificantly decreased from pre-injury (0.326). Slugging percentage through the first 15 days back (0.358, p=0.013) was significantly decreased from pre-injury (0.412), but not through the first 30 days back (0.393, p=0.290).

**CONCLUSIONS:** The recognition and reporting of concussions in MLB is increasing, with a near 3-fold increase in just the past 5 years. The impact of this injury can be significant, resulting in lengthy time on the injured list, temporary performance decreases, and even the end of careers.

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**3177**     *Board #142*     **June 1**     **3:30 PM - 5:00 PM**

**Risk Factors for Stress Fractures in United States Army Basic Combat Training: A Retrospective Analysis of 632,440 Recruits**

Joseph J. Knapik, FACSM<sup>1</sup>, Scott J. Mountain, FACSM<sup>2</sup>, Susan M. McGraw<sup>2</sup>, Tyson Grier<sup>1</sup>, Matthew R. Ely<sup>2</sup>, Bruce H. Jones, FACSM<sup>1</sup>. <sup>1</sup>*US Army Institute of Public Health, Aberdeen Proving Ground, MD.* <sup>2</sup>*US Army Research Institute of Environmental Medicine, Natick, MA.*  
(No relationships reported)

Stress fractures (SF) are a common and debilitating problem in United States (US) Army Basic Combat Training (BCT). Previous studies indicate that the medically diagnosed incidences of SF range from 0.8 to 5.1% of all male recruits.

**PURPOSE:** To examine demographic and physical risk factors for SF in a large cohort of male basic trainees.

**METHODS:** This retrospective cohort study utilized databases at the Armed Forces Health Surveillance Center. All male US recruits participating in US Army BCT from January 1997 to January 2007 were identified based on date of entry into the US Army. Birth year and race/ethnicity were obtained from the Defense Manpower Data Center Master Personnel File and physical characteristics (height and weight) were obtained from the Military Entrance Processing Station database. Body mass index (BMI) was calculated as weight/height<sup>2</sup>. Cases were recruits medically diagnosed with inpatient or outpatient SF in the Defense Medical Surveillance System. Data were analyzed using logistic regression; odds ratios (OR) and 95% confidence intervals (95%CI) were calculated. Age, height, weight and BMI were categorized into strata and baseline strata (RR=1.00) selected as the youngest age group (<19 years), average height (175-180 cm) and weight (71-78 kg), and normal BMI (18.5-24.9 kg/m<sup>2</sup>).

**RESULTS:** There were 475,745 male recruits in the survey period and they had an overall SF incidence of 19.3 cases/1,000 recruits. Factors that increased SF risk included older age (OR(>30 yrs/17-19 yrs)=3.4, 95%CI=3.1-3.7), greater stature (OR(≥185 cm/175-180 cm)=1.2, 95%CI=1.1-1.3), higher body weight (OR(≥87 kg/71-78 kg)=1.2, 95%CI=1.1-1.3), lower BMI (OR(<18.5 kg/m<sup>2</sup>/18.5-24.9 kg/m<sup>2</sup>)=1.7, 95%CI=1.5-1.9), higher BMI (OR (≥30 kg/m<sup>2</sup>/18.5-24.9 kg/m<sup>2</sup>)=1.1, 95%CI=1.1-1.2), and white race/ethnicity (OR (white/black)=1.7, 95%CI=1.6-1.9; OR (white/Asian)=1.2, 95%CI=1.1-1.5).

**CONCLUSIONS:** This was the largest sample of military recruits ever examined for SF since it included virtually the entire US Army male recruit population over a 10-year period. SF risk was elevated among male BCT recruits who were older, taller, weighed more, had lower or higher BMI, and/or were of white race/ethnicity.

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**3178**     *Board #143*     **June 1**     **3:30 PM - 5:00 PM**

**Sports Injuries Among US Army Soldiers Deployed To Operations Iraqi And Enduring Freedom, 2001-2010.**

Shuva Dawadi, Keith G. Haurert, Bonnie J. Taylor, Morgan N. Clennin, Bruce H. Jones, FACSM. *Army Institute of Public Health, Aberdeen Proving Ground, MD.*  
(No relationships reported)

Participation in sports and athletics is a major part of a Soldier's life and a major cause of serious, nonfatal injuries in the military. These injuries result in outpatient visits, inpatient hospitalizations, and medical air evacuations as well as substantial lost duty days and decreased military readiness.

**PURPOSE:** Determine the incidence and rate of sports and exercise-related (SER) injuries requiring medical air evacuation of US Soldiers deployed for Operations Iraqi Freedom (Iraq) and Enduring Freedom (Afghanistan) from 2001 to 2010 and describe the injury type and anatomical location of injury.

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**METHODS:** Air evacuation records were reviewed for Soldiers medically air evacuated from Iraq or Afghanistan for SER injuries (October 2001-December 2010). Narrative case history and diagnosis codes were used to determine incidence and rates of SER injuries and incidence of injury type, and anatomical location of injury.

**RESULTS:** Overall, 19,595 Soldiers were air evacuated for non-battle injuries (NBIs) from 2001 to 2010. For injuries with an identifiable cause (n=13,372), sports and exercise were the leading cause comprising 23% of NBIs (n=3,075; rate: 3/1,000 person-years). Sixty-one percent of SER injuries were caused by three activities: basketball (25%), physical training (19%), and American football (17%). The rest of the activities involved weightlifting (15%), wrestling/combat (7%), volleyball (4%), soccer (3%), softball (3%), and other specified sport activities (6%). This latter category included activities such as boxing, baseball, frisbee, swimming and diving, track and field, mountaineering, boating, hockey, and rugby. The leading injury types were sprain/strains/ruptures (27%), fractures (25%), and dislocations (18%). Knee (26%), ankle/foot (15%), wrist/hand (14%), and shoulder (14%) were the leading anatomical locations of injury.

**CONCLUSIONS:** Even in a dangerous combat environment, sports and exercise are an important cause of non-fatal injuries. These injuries, many of which are preventable, negatively impact soldier work performance and unit readiness during deployments. Identifying or developing and evaluating prevention strategies targeted to prevent these SER injuries is recommended to lessen this impact.

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**3179** Board #144 June 1 3:30 PM - 5:00 PM

**The Feasibility Of Examining Psychological States As Risk Factors For Injury: A Pilot Study**

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(No relationships reported)

**PURPOSE:** To test the feasibility of a prospective study designed to examine the role of psychological states on the risk of injury.

**METHODS:** We measured psychological traits at baseline (mood, ways of coping and anxiety), and psychological states every day (1-item questions on anxiety, sleep, fatigue, soreness, self-confidence) before performances in Cirque du Soleil artists of the show "O". Additional questions were added once per week to better assess anxiety (20-item) and mood. Questionnaires were provided in English, French, Russian and Japanese, representing the first or second language for all participating artists. Injury and exposure data were extracted from electronic records that are kept as part of routine business practices.

**RESULTS:** The 43.9% (36/82) recruitment rate was more than expected. Most artists completed the baseline questionnaires in 15min, a weekly questionnaire in <2min and a daily questionnaire in <1min. We improved the formatting of some questions during the study, and adapted the wording of other questions to improve clarity. There were no dropouts during the entire study, suggesting the questionnaires were appropriate in content and length.

**CONCLUSIONS:** A prospective study collecting psychological state data every day from subjects who train and work regularly together is feasible.

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**3180** Board #145 June 1 3:30 PM - 5:00 PM

**Overuse Injuries Associated With Mountain Biking: Is Single Speed Riding A Predisposing Factor?**

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(No relationships reported)

Pedaling a mountain bike with a single gear option is thought to require greater physical effort than riding a bike with multiple gears through which the rider may shift. For this reason, it has been proposed that riding a single geared mountain bike is associated with greater risk for overuse injury. This hypothesis, however, has not been investigated.

**PURPOSE:** The study's purpose was to compare the incidence of self-reported overuse injuries in individuals who ride mountain bikes with single and multiple gear systems.

**METHODS:** Data were collected from 402 Arizona mountain bikers responding to an online survey. Respondents were asked to report personal demographics, characteristics of their mountain bikes, riding volume and style, as well as mountain bike related overuse injuries sustained in the past year. Based on previous literature on cycling overuse syndromes, a logistic regression model was constructed to determine associations between explanatory variables and reported overuse injuries. Independent variables incorporated into the final model included gender, type of bike ridden (single gear, multiple-g geared, or both), and average number of hours ridden per week.

**RESULTS:** Statistical analyses suggest no differences in self-reported overuse injuries among riders of single or multiple geared mountain bikes. However, individuals who reported spending considerable time riding both single AND multiple geared bikes were significantly more likely to report an overuse injury than those only riding a single or multiple geared bike (p=0.036). A follow-up analysis of injury by anatomical region revealed a significant difference in the odds of a knee injury for those who did not ride both types of bikes as compared to those who did (p=0.042). Significance for other anatomical regions was not found.

**CONCLUSIONS:** Findings suggest individuals riding both single and multiple geared mountain bikes are significantly more likely to report an overuse injury than those only participating in one type of riding. It is hypothesized that single and multiple geared mountain biking are associated with different biomechanical demands. Bikers participating in both styles of riding may develop inefficient motor patterns and subject their tissues to greater stress levels.

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**3181** Board #146 June 1 3:30 PM - 5:00 PM

**Epidemiology Of Meniscal Injuries In US High School Boys' Football, Ice Hockey, and Lacrosse**

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(No relationships reported)

High school athletes sustain millions of injuries each year, many of which are knee injuries. Knee injuries, specifically meniscal injuries, are relatively common in high-impact sports such as boys' football, ice hockey, and lacrosse which involve frequent and rapid pivots and player-to-player contact. Meniscal injuries often require surgery or prolonged rehabilitation, and can result in long-term sequelae such as knee pain and osteoarthritis.

**PURPOSE:** Describe the epidemiology of meniscal injuries in US high school boys' football, ice hockey, and lacrosse.

**METHODS:** High school sports-related injury data was collected from 2008/09-2010/11 for boys' football, ice hockey, and lacrosse. We calculated overall injury rates, meniscal injury rates, and rate ratios.

**RESULTS:** From 2008/09-2010/11, certified athletic trainers reported a total of 7902 football, 528 ice hockey, and 758 lacrosse injuries during 2,065,536 football athlete exposures [AEs], 220,974 ice hockey AEs, and 339,971 lacrosse AEs. Overall injury rates were 3.83 per 1000 AEs in football, 2.39 in ice hockey, and 2.23 in lacrosse. Competition injury rates were significantly higher than practice for football (12.3 vs. 2.12 per 1000 AEs; RR 5.79, 95% CI 5.54-6.05), ice hockey (5.84 vs. 0.75 per 1000 AEs; RR 7.81, 95% CI 6.34-9.62), and lacrosse (4.40 vs. 1.27 per 1000 AEs; RR 3.47, 95% CI 3.00-4.01). Knee injuries accounted for 15.4% of all injuries in these sports, and 8.3% of all knee injuries involved the meniscus. Meniscal injury rates were 0.051 per 1000 AEs in football, 0.032 in ice hockey, and 0.015 in lacrosse. Overall meniscal injury rates were higher during competition than practice (RR 5.58, 95% CI 3.87-8.06). Over half (58.1%) were treated with surgery. Most were new (87.9%) as opposed to recurrences of previous meniscal injuries, and person-to-person contact (47.3%) was the most common mechanism.

**CONCLUSIONS:** Full-contact sports have high rates of injury, including knee injuries. Meniscal injuries are serious and frequently require surgery and expensive diagnostic evaluations. Targeted interventions should aim to reduce the incidence of meniscal injuries in US high school boys' football, ice hockey, and lacrosse to prevent long-term sequelae such as knee pain and osteoarthritis.

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**3182** Board #147 June 1 3:30 PM - 5:00 PM  
**Risk Factors for Closed Head Injuries in Military Parachuting**

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(No relationships reported)

Closed head injuries appear to have become an increasing problem in military parachuting. A recent study of an operational airborne unit found that injuries of this type accounted for 31% of all injuries (Knapik, Aviat Space Environ Med 82:797, 2011). However, few studies have specifically examined factors that might be related to head injuries in military parachuting.

**PURPOSE:** The purpose of this investigation was to examine risk factors associated with closed head injuries during military parachuting.

**METHODS:** Participants were soldiers in the 82<sup>nd</sup> Airborne Division at Fort Bragg, NC who performed parachute training jumps between June 2010 and September 2011. Injury data was collected directly on the parachute drop zone and verified by a physician using clinical records. Soldiers jumped with either the T-10 parachute or the newer T-11 parachute. Wind speed data was collected using an anemometer on the drop zone. Data on jump types (combat load or no combat load) and time of day (night or day) and were obtained from routine 82<sup>nd</sup> Airborne Division reports. Chi-square statistics, risk ratios (RR) and 95% confidence intervals (95%CI) were calculated.

**RESULTS:** There were 57,606 total parachute descents and 611 total injuries (10.6/1,000 jumps), with 210 of the 611 injuries (34%) classified as closed head injuries (3.6/1,000 jumps). A higher risk of closed head injury was associated with use of the T-10 parachute (RR [T10/T11]=3.2, 95%CI=1.3-7.6), high wind speeds (RR[high/low]=2.2, 95%CI=1.0-4.9), combat loads (RR[load/ no load]=3.0, 95%CI=2.2-4.0), and night jumps (RR [night/day]=1.8 95%CI=1.4-2.4).

**CONCLUSIONS:** The data indicate that the T-10 parachute, higher wind speeds, combat loads, and night jumps increase the risk of closed head injuries during military parachuting in an operational military unit.

**3183** Board #148 June 1 3:30 PM - 5:00 PM  
**Prevalence, Severity And Mechanism Of Acute Injuries In Male Elite African Youth Soccer Players**

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(No relationships reported)

A survey of injury rate for children in community sport reported the highest rate of injuries among soccer, when compared to other sport.

**PURPOSE:** The purpose of this study was to investigate the prevalence, severity and mechanisms of injury in male elite African youth soccer players.

**METHODS:** The study was conducted on hundred and sixty nine (N=169) male elite African youth soccer players aged 14 to 18 years from eleven countries in the African Continent. Data was collected retrospectively and included prevalence of injuries over a two-season period. A self-administered questionnaire was used to collect the data for this study. Descriptive statistics, Chi-Square Analysis and Independent t-tests were used for statistical analysis.

**RESULTS:** A total of 132 players sustained 544 injuries with a prevalence rate of 78%. More injuries were recorded during training (55%) than during competition (45%). Injuries during training showed statistical significant differences regarding playing position (p<0.05), with midfielders showing significantly higher injury rates. The injuries during training were most prevalent in the ankle (21%), groin (11%), finger (10%), shoulder (10%) and knee (9%). Body sites most commonly injured during competition showed similarities with the body parts injured during training. The distribution of injuries according to body part was unrelated to playing position. Most injuries were of minor severity accounting for 50% and 52% of injuries in training and competition respectively. The major mechanisms of injury in both training and competition were running, tackled, tackling and shooting.

**CONCLUSION:** The male elite youth soccer players in the present study had a higher injury rate compared to those studies in the literature. The injuries were most often of minor severity and the most frequent body part injured was the ankle joint. Since the ankle joint comprised a large proportion of the injuries, future studies aimed at preventive strategies for injuries in the ankle joint are recommended, especially at school level. Prevention programmes, fair play, and the continuing improvement of skills may reduce the incidence of injuries in the long term.

**3184** Board #149 June 1 3:30 PM - 5:00 PM  
**Risk Factors Associated With Lower Leg Injuries in the United States Army**

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(No relationships reported)

Lower leg injuries (region of the knee to foot) are a leading injury type among U.S. Army basic trainees, however this has yet to be investigated in Army operational units.

**PURPOSE:** To examine risk factors for lower leg injuries in a deploying Army unit.

**METHODS:** Male soldiers (n=1708) ages 18-30 were administered a survey querying unit physical training, personal fitness training, Army physical fitness test (APFT) scores, tobacco use, and injury. The APFT consists of a 2 mile run, push-ups and sit-ups. APFT scores were converted into quartiles (Q) where Q4 = lowest performance and Q1 = highest performance. Odds ratios (OR) and 95% confidence intervals (95% CI) from a multivariable analysis were calculated.

**RESULTS:** Of the 972 Soldiers that reported an injury within the last 12 months, 418 (43%) reported a lower leg injury. Of these lower leg injuries, 245 (59%) Soldiers were placed on limited duty profiles with 53% being placed on limited duty for  $\geq 30$  days. Individuals with the slowest run times had an increased risk of lower leg injury compared to individuals with faster run times (Q2/Q1) (OR = 1.61, 95% CI 1.11 to 2.33), (Q3/Q1) (OR = 1.71, 95% CI 1.18 to 2.48), (Q4/Q1) (OR = 2.57, 95% CI 1.76 to 3.75). Cross-training  $\geq 4$  times a week increased the risk of lower leg injury compared to those that did not participate in cross-training (OR  $\geq 4$  times per week/No cross-training) = 1.64, 95% CI 1.02 to 2.65. A marginal association found for tobacco use (OR (Smoker/Nonsmoker) = 1.27, 95% CI 0.98 to 1.65).

**CONCLUSION:** Lower leg injuries are a leading injury type in deploying Army units. There is a need for further evaluation and a plan to increase aerobic endurance, decrease tobacco use, and determine the appropriate amount of cross-training needed per week in an effort to reduce limited duty days attributed to injuries.

**3185** Board #150 June 1 3:30 PM - 5:00 PM  
**Running Related Injury, Mileage And Q-angle: A Prospective Follow-up Study.**

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(No relationships reported)

The Quadriceps angle (Q-angle) may be associated with the development of Running Related Injuries (RRI). Only a few studies have investigated the association between Q-angle, and the likelihood of RRI. These studies have not led to any firm conclusions, on the link between Q-angle and development of RRI. To our knowledge, none of these studies have taken mileage into account, which may be an important part of the causal pathways leading to injury development.

**PURPOSE:** To investigate if mileage to RRI differs between novice runners with different Q-angles.

**METHODS:** Participants were recruited via an online questionnaire. Inclusion criteria's were, age 18-65, running must not have exceeded 10km in total the past year, healthy individuals, consent to run at least two times per week over a 10 week period. Q-angle was measured at baseline, using a standard goniometer, the participant lying supine and the quadriceps relaxed. Participants were divided into three groups (Q-low  $\leq 10^\circ$ , Q-normal  $10^\circ$ - $14^\circ$ , Q-high  $\geq 15^\circ$ ). All training data was collected by a GPS watch, handed out at baseline. The data was uploaded to an online training journal, accessible to the researchers. No guidelines were given to running intensity, time or distance. The Kaplan-Meier method was used to estimate survival mileage until RRI in each group. If a participant reported an injury, their survival mileage was eliminated, they underwent examination and the RRI was diagnosed. To evaluate the outcome, cox-regression model was used to calculate the Hazard Ratio (HR) between groups, with Q-normal as the reference group.

**RESULTS:** N = 60 included, 3 participants excluded, due to missing training data. N = 114 legs was analyzed, divided between 57 participants (n = 30 male, n = 27 female). 14 injured legs was reported, divided between 9 participants (Q-low  $\leq 10^\circ$  RRI = 7, Q-normal  $10^\circ$ -  $14^\circ$  RRI = 5, Q-high  $\geq 15^\circ$  RRI = 2). HR for the Q-low  $\leq 10^\circ$  was (1.3, CI 95% 0.4 - 4.4,  $P_{\text{value}}$  0.609), HR for the Q-high  $\geq 15^\circ$  was (0.6, CI 95% 0.1 - 3.2,  $P_{\text{value}}$  0.558).

**CONCLUSION:** Novice runners with Q-angles lower or higher than  $10^\circ$ - $14^\circ$ , don't have a statistical significant higher hazard rate of sustaining RRI, while running at least, two times per week, over a 10 week period.

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**3186** Board #151 June 1 3:30 PM - 5:00 PM

**Gender Comparisons of Sports/Recreation- and Training-Related Injuries Among U.S. Service Members in Operation Iraqi Freedom**

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(No relationships reported)

**PURPOSE:** The aim of this cross-sectional study was to determine the distribution of sports/recreation- and training-related (SRT) injuries among service members deployed in OIF.

**METHODS:** We studied 1,372 U.S. military personnel (110 females, 1,262 males) who sustained at least one SRT-related injury while deployed in Iraq. Data included all nonbattle injuries that resulted from participation in an SRT-related activity. An injury was defined as any complaint that required the attention of a military health care provider, regardless of time lost from duty. Injury distributions were calculated for body location, injury type, and injury severity. Chi-square analyses were used to compare these injury distributions by sex.

**RESULTS:** Overall, 1,518 injuries were reported with similar injury rate ratios (IRRs) for females (120 injuries, IRR=1.09) and males (1,398 injuries, IRR=1.11) during SRT-related activities. Most injuries (80.0%) were mild in nature (Injury Severity Score=1). No significant differences were found between sexes for injury severity ( $p=0.46$ ). Overall, a slightly higher percentage of lower extremity injuries were sustained by females (45.8% vs. 39.4% [males]) and upper extremity injuries incurred by males (34.3% vs. 30.8% [females]). The most common lower extremity body region affected was the lower leg/ankle (40.1%), and the most common upper extremity body region affected was the shoulder/upper arm (47.6%). Sprains/strains (74.5%), contusions (8.8%), and fractures (8.6%) were the most common injury types, with similar distributions between females and males ( $p=0.26$ ). Sprain/strain injuries were most frequent at the lower leg/ankle and shoulder/upper arm regions, with significant differences between injuries incurred by males and females (foot/toes more frequent among females, shoulder/upper arm more common among males) ( $p=0.002$ ). Foot/toe fractures were more common among females ( $p<0.0001$ ). While fractures were most frequent at the hand/wrist/fingers, dislocations were most common at the shoulder/upper arm.

**CONCLUSIONS:** Results suggest that deployed service members sustaining injuries during SRT-related activities were likely to incur an extremity injury, especially sprains/strains. Most injuries were not likely to cause significant time lost from duty.

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**3187** Board #152 June 1 3:30 PM - 5:00 PM

**A Hospital-Based Study of Pediatric Sport and Recreational Injuries**

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(No relationships reported)

Nearly 30 million children and adolescents participate in organized sports annually in the United States. It is estimated that 3.7 million of these participants report to hospital emergency rooms (ER) each year with injury.

**PURPOSE:** To describe the frequency and distribution of pediatric sports and recreational injuries treated at a regional hospital over a 10-year period.

**METHODS:** The study used a retrospective case series design. Institutional Review Board approval was obtained from the University of North Dakota and Altru Health System. The hospital's ER database was searched for sports and recreational injuries affecting children ages 1-19 years using ICD-9 "E" codes.

**RESULTS:** During 2000-2009, 2,855 pediatric sports and recreational injuries were treated at the hospital ER. Although injuries were distributed throughout all months, September was marked by a relative high percentage of injuries (18%). The majority of injuries were sustained by males (74.2%). The peak frequency of injuries occurred at ages 11-13 for girls and 13-15 years for boys. The forearm was injured most often (18.3%), followed by head/neck (17.3%), and hand (16.8%) injuries. Bicycle-related injuries were most common (20.5%), especially among children  $\geq 14$  years of age, followed by football (19.7%) and hockey (16.2%), which were more common among older children and youth. Soft tissue injuries were the most common injury type (28.8%), followed by fractures (25.5%). Acute epiphyseal injuries accounted for 8.6% of all fractures. Two hundred and three concussions were treated, with most (79.8%) affecting youth 10-19 years. Concussions were commonly associated with football (24.6%), hockey (21.7%), and bicycling (21.7%). The vast majority of injuries were treated and released on the same day (99.7%). There were no fatalities.

**CONCLUSIONS:** Although denominator, and therefore injury rate data are lacking, this case series provides an estimate of the relative frequency of sport and recreational injury in a region, and gives an estimate of the morbidity load on a hospital ER. It is evident that some age groups, and some sports and recreational activities, should be targeted for further prevention and research efforts.

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**3188** Board #153 June 1 3:30 PM - 5:00 PM

**Epidemiology of Volleyball Injuries in Young Females**

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(No relationships reported)

Volleyball is currently among the most common club sports in the United States and Puerto Rico. Although, adolescent girls make up the largest number of athletes associated with this organization, epidemiologic studies in this population are limited.

**PURPOSE:** To describe volleyball related injuries in young females in Puerto Rico; identify injury patterns, and risk factors.

**METHODS:** A retrospective descriptive study was done. One hundred and five (105) young females (avg age 13.6 years) from local volleyball club leagues participated in the study. Each participant filled a written questionnaire. It included demographic, and current or previous injury information. For those with volleyball related injury, localization, mechanism, type, game versus practice situation, time elapsed since symptoms started, intervention/s, and severity of injury were included. The primary outcome measure is the frequency of volleyball related injury, evaluated by anatomic area, type, mechanism, and etiology. Secondary outcome measures include association of injury to position played, other sport participation, time of exposure, and game versus practice situation.

**RESULTS:** Ninety two percent (92%) of girls had more than 2 years of club volleyball experience, and sixty one percent (61%) reported history of at least one volleyball related injury and one hundred and two (102) injuries were reported. The lower extremities accounted for most acute injuries (51%); the ankle was the most commonly injured body part (35%). In the upper extremities acute injuries involved mostly the wrist and hand. Meanwhile, overuse injuries were evenly distributed in the shoulder, back/trunk, and knee. The most common mechanism of acute injuries was contact with floor and contact with another player, whereas overuse injuries occurred without contact, and occurred more frequently during practice (54%). Additionally, the front row positions were injured more often than the back row players.

**CONCLUSION:** Young female front row players are at high risk for acute volleyball injuries involving the ankle. Further research needs to be done in this population and other age groups, gender, and competition levels, in order to better understand if these elements alter injury mechanism, risk factors, and to plan preventive measures.

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3189 Board #154 June 1 3:30 PM - 5:00 PM

**Injury Risk Associated with Functional Movement Screening in the United States Army.**

Timothy T. Bushman, Tyson Grier, Michelle Canham-Chervak, Morgan K. Anderson, Malukah Waajid, Bruce H. Jones, FACSM. *Army Institute of Public Health, Aberdeen Proving Ground, MD.*

(No relationships reported)

Functional Movement Screening (FMS) is a measurement tool that aims to predict risk of injury in physically-active populations.

**PURPOSE:** To investigate injury risk associated with FMS in a deploying U.S. Army unit.

**METHODS:** Male Soldiers (n=807) ages 18-49 completed FMS which involved seven exercises: deep squat, hurdle step, in-line lunge, shoulder mobility, active straight leg raise, trunk stability pushup, and rotary stability. Each test had a range of 0-3 points with a maximum possible score of 21 if the individual demonstrated sound biomechanics throughout each movement and experienced no pain. If pain was present, the individual automatically scored a zero for that particular test. FMS scores were categorized into four categories, ≤14, 15-16, 17-18, 19-21. Injury occurrence within the last 12 months was collected by survey. Injury risk ratios (RR) and 95% confidence intervals (95% CI) comparing FMS categories are presented.

**RESULTS:** Overall injury incidence for the prior 12 months was 41% (n=340). We found that a higher risk of injury was associated with lower FMS scores (RR ≤14/19-21) = 1.95, 95% CI 1.57-2.41. However, intermediate FMS scores were not significantly different (RR 15-16/19-21) = 1.15, 95% CI 0.88-1.51 and (RR 17-18/19-21) = 1.16, 95% CI 0.91-1.47. During FMS, 57% (n=462) of the Soldiers experienced pain on at least one of the seven tests. Individuals who experienced pain and scored a zero or a one out of a possible three points (pts) had a higher risk of injury than their counterparts for the deep squat (RR 0pts/3pts)= 1.59, 95% CI 1.28-1.97, hurdle step (RR 0pts/3pts) = 1.81, 95% CI 1.47-2.23, in-line lunge (RR 0pts/3pts) = 1.82, 95% CI 1.51-2.20, shoulder mobility (RR 0pts/3pts) = 1.84, 95% CI 1.49-2.27, shoulder mobility (R/R 1pts/3pts) = 1.52, 95% CI 1.08-2.13, trunk stability push-up (RR 0pts/3pts) = 1.42, 95% CI 1.14-1.77, and rotary stability (RR 0pts/3pts) = 1.42, 95% CI 1.06-1.92.

**CONCLUSION:** Consistent with previous literature, a FMS score of ≤14 suggested higher risk of injury. Based on this study, experiencing pain on one of six specific tests indicated an elevated risk for injury. These findings suggest further attention may need to be paid to these particular tests in order to accurately quantify a Soldier's risk for injury with FMS.

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3190 Board #155 June 1 3:30 PM - 5:00 PM

**Incidence, Mechanisms, and Severity Of Game-related College Football Injuries On Artificial Versus Natural Grass**

Michael C. Meyers, FACSM. *Montana State University, Bozeman, MT.*

(M.C. Meyers: Contracted Research - Including Principle Investigator; FieldTurf, USA.)

In the past, serious injuries were attributed to playing on artificial turf. New generations of artificial turf were developed to duplicate the playing characteristics of natural grass. Only one study has been reported comparing game-related, college football trauma between the two surfaces.

**PURPOSE:** To quantify incidence, mechanisms, and severity of game-related collegiate football injuries on artificial turf versus natural grass.

**METHODS:** A total of 27 universities were evaluated over five competitive seasons for injury incidence, injury category, time of injury, injury time loss, player position, injury mechanism, primary type of injury, grade and anatomical location of injury, type of tissue injured, head, knee and shoulder trauma, and environmental factors.

**RESULTS:** A total of 786 college games were evaluated for football injuries sustained while playing on artificial or natural grass, with 387 (49.2%) games played on artificial versus 399 (50.8%) games played on natural grass. A total of 4,041 injuries were documented, with 1,664 (41.2%) occurring during play on artificial as compared to 2,377 (58.8%) on natural grass. Statistical analysis per 10 team games indicated significantly lower (p<0.05) total injury incidence rates of 43.0 on artificial (95% confidence interval, 42.2-43.5) versus 59.6 on natural grass (95% CI, 58.8-59.7). Significantly lower minor injury incidence rates of 35.0 (95% CI, 34.2-35.5) versus 48.6 (95% CI, 47.8-48.9; p<0.05), significantly lower substantial injury incidence rates of 5.1 (95% CI, 4.6-5.6) versus 6.7 (95% CI, 6.3-7.2; p<0.05), and significantly lower severe injury incidence rates of 2.9 (95% CI, 2.5-3.4) versus 4.2 (95% CI, 3.8-4.7; p<0.05) were documented on artificial versus natural grass, respectively. Findings also indicated significantly less trauma (p=0.040 to 0.0001) on artificial turf when comparing injury time loss, injury category and situation, grade of injury, injuries under various field conditions, and temperature. No significant differences in head, knee or shoulder trauma were observed between playing surfaces.

**CONCLUSION:** Artificial turf is, in many cases, safer than natural grass. The findings of this study, however, may only be generalizable to this level of competition and this specific surface.

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3191 Board #156 June 1 3:30 PM - 5:00 PM

**Widespread Education & Mandatory Product Warning Labels Are Keys To Preventing US Weight Training Injuries & Deaths**

V. Pateson Lombardi, Richard K. Troxel. *University of Oregon, Eugene, OR.*

(No relationships reported)

**PURPOSE & METHODS:** To document weight training-associated injuries and deaths and to compare more recent trends with data we have monitored over the past 20 yr, we examined US Consumer Product Safety Commission (CPSC) National Electronic Injury Surveillance System, Death Certificate and Reported Incidence files from 2008 to present.

**RESULTS:** For 2008, 2009, and 2010, respectively, there were an estimated 79027, 86307, and 94692 hospital-reported weight training injuries - a 9-10% increase per yr. Most injuries involved males (~80%) and the 15-24 yr (31%) and 25-44 yr (29%) age groups. Strains/sprains were common (42%) with lower trunk (20%), shoulder (13%), upper trunk (11%), and finger (9%) primary injury sites. From May 2008 until July 2011, we documented 18 deaths associated with weight training equipment. Fifteen (83%) involved males, 14 (78%) implicated the bench press, 12 (67%) occurred in the home, and 11 (61%) involved neck or chest compression with asphyxia. For the first time, there was an adult female fatality involving a blunt trauma mechanism and the bench press.

**CONCLUSIONS:** These fatalities continue to demonstrate that the bench press is the highest risk exercise especially when performed without a spotter in the home. Though the CPSC denied our Mar 2003 request for mandatory warning labels on bench presses, our recent data supports our contentions that widespread adult and adolescent education and mandatory product warnings are the keys to preventing weight training injuries and deaths.

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3192 Board #157 June 1 3:30 PM - 5:00 PM

**Injuries in Amateur and Professional Wheel Gymnastics**

Max D. Kauther, Silvia Rummel, Björn Hussmann, Sven Lendemann, Christian Wedemeyer. *University of Duisburg/Essen, Essen, Germany.*

(No relationships reported)

**PURPOSE:** Wheel gymnastics is an acrobatic sport with a tradition of nearly 100 years. It is known from gymnastic competitions as well as from shows. So far, there have been no studies or case reports about injuries in wheel gymnastics.

**METHODS:** This retrospective study of wheel gymnasts surveyed 51 professionals, 100 semi-professionals and 352 amateurs by questionnaire.

**RESULTS:** 7925 injuries and 422 overuse syndromes were found in 988718.9 hours of training leading to a loss of 17310.3 training days. Professionals reported significantly (p < 0.001) more injuries and overuse syndromes with significantly more injuries of the wrist (p < 0.001), knee (p < 0.001), hip/thigh (p = 0.003), ankle/foot (p = 0.013) and elbow (p = 0.033). Significant differences were found in the time per injury rate. Amateurs practised 155.8 hours, semi-professionals 221.8 hours and 331.7 hours until one injury occurred. The most frequent pain was found in the region of the wrist, spine, shoulder and ankle. A positive correlation significant at the 0.0001 level was found between the average pain frequency and the average frequency of wearing protective gear of the elbow, wrist, knee and ankle.

**CONCLUSIONS:** This study firstly describes specific injuries of wheel gymnastics. This sport bears the danger of falling from up to 3 meter height on bare floor. Physicians should be aware of the common risks in this highly acrobatic kind of gymnastics. The severity of injuries in wheel gymnastic should not be underestimated

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**3193**    *Board #158*    **June 1**    **3:30 PM - 5:00 PM**  
**Intrinsic And Extrinsic Risk Factors For Tennis Injuries**

Janine Stubbe<sup>1</sup>, Rebecca Kuiper<sup>1</sup>, Jasper Stege<sup>1</sup>, Ariëtte van Hespem<sup>1</sup>, Babette Pluim<sup>2</sup>. <sup>1</sup>TNO, Leiden, Netherlands. <sup>2</sup>Royal Netherlands Lawn Tennis Association, Amersfoort, Netherlands.  
(No relationships reported)

In addition to the well-documented beneficial effects, sport can have a negative side effect in the form of sports injuries. The total number of sports injuries in the Netherlands is about 3.6 million per year. Two-thirds of all medically treated sports injuries are associated with nine sports, including tennis.

**PURPOSE:** The objective of this study was to investigate the incidence, nature, and severity of tennis injuries, and to examine risk factors for tennis injuries. Method: In April 2010, baseline information on recreational tennis players aged 16 years and older was collected. Self-reported surveys containing items about personal characteristics, tennis-specific information and injury history were handed out by tennis trainers during practice sessions at three tennis academies in Amsterdam. After three (July 2010) and six months (October 2010) tennis players received a survey sent by e-mail containing items about sustaining an injury and match and training exposure. Injury incidences were calculated (e.g. the number of injuries per 1,000 hours tennis). Furthermore, logistic regression analyses were conducted to assess the risk factors for sustaining a tennis injury. The main outcome measure of the logistic regression analyses was whether the person sustained an injury during the data collection period or not. Injury was defined as physical complaints caused by playing tennis and resulting in a time loss from tennis of at least one day.

**RESULTS:** A total of 151 injuries were reported: 58% of the injuries were classified as acute and 36% as recurrent. The most common locations were: elbow, shoulder, lower back, calf, and ankle. Most injuries affected the players' tennis participation: 42% was classified as severe, 25% as moderate, and 13% as minor. The overall incidence rate was 3.55 injuries per 1,000 hours of tennis. Injury risk in tennis gradually increased with exposure (OR = 1.004).

**CONCLUSION:** Tennis has a high injury rate and injury risk gradually increases with exposure (OR = 1.004). More research is needed to examine the risk factors associated with tennis injuries.

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**3194**    *Board #159*    **June 1**    **3:30 PM - 5:00 PM**  
**Video Incident Analysis of Concussion Mechanisms in Boys' High School Lacrosse**

Shane V. Caswell<sup>1</sup>, Andrew E. Lincoln<sup>2</sup>, Reginald E. Dunn<sup>2</sup>, Jon L. Almquist<sup>3</sup>. <sup>1</sup>George Mason University, Manassas, VA. <sup>2</sup>Union Memorial Hospital, Baltimore, MD. <sup>3</sup>Fairfax County Public Schools, Falls Church, VA.  
(No relationships reported)

**PURPOSE:** To describe common game play scenarios and mechanisms of injury associated with concussion in boys' high school lacrosse using game video.

**METHODS:** Video of 518 boy's high school lacrosse games were captured by trained videographers during the 2008 and 2009 seasons. When an injury occurred, a log entry was recorded to include the time of injury, the body part injured, and the player number. Videotapes were analyzed using StudioCode (Sportstec USA, Camarillo, CA) software to identify event characteristics. Video data were linked to the injury report filed by the athletic trainer (AT) for further detail and verification.

**RESULTS:** 44 incidents (20 in 2008 and 24 in 2009) were determined to be a concussion, 34 (77%) of which had sufficient image quality for analysis. Most 22 (65%) head injuries involved varsity level athletes compared with 12 (35%) at junior varsity. 23 (67%) concussions occurred in the attacking zone compared with 10 (34%) in the midfield zone. All (100%) concussions resulted from intentional player-to-player bodily contact. Players were most often injured while playing the midfield (18, 53%) and defense (n=9, 27%) positions and attempting to pick up a loose ball (n=16, 47%) or when ball handling (n=14, 41%). Most frequently the striking player's head (27, 79%) was used in the collision and in 59% (n=20) the struck player's head was the initial point of impact. In 24 (71%) of cases a subsequent impact with the playing surface was suffered immediately following the initial impact. In 9 (26%) collisions a penalty was called.

**CONCLUSION:** This study identified intentional bodily collisions in which the striking player used his head to initiate contact as the most frequent cause of concussion. Concussions most often occurred during the acts of competing for a loose ball and ball handling. Since the time this study was conducted, rule changes have been enacted that prohibits deliberately initiating contact to an opponent's head or neck with a stick, or any part of the body. Further investigation of preventive measures such as the education of coaches and officials, enforcement of new rules designed to prevent head-to-head contact is warranted to reduce the incidence of concussion injuries in boys' lacrosse. Supported by the National Operating Committee on Standards for Athletic Equipment and US Lacrosse.

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**3195**    *Board #160*    **June 1**    **3:30 PM - 5:00 PM**  
**Injury Rates For Collegiate And High School Rugby Players**

Maggie McGinty<sup>1</sup>, Donald C. LeMay<sup>2</sup>. <sup>1</sup>The Ohio State University Medical Center, Columbus, OH. <sup>2</sup>Ohio Heath, Columbus, OH. (Sponsor: James R. Borchers, FACSM)  
(No relationships reported)

**PURPOSE:** There have been many studies done in reference to professional rugby world wide. However, there are few studies that evaluate the injury rates of tournaments that involve amateur High School and College athletes. Furthermore, there are minimal studies looking at female injury rates in rugby. We examined the distribution of injuries in this age group of rugby athletes with an epidemiological retrospective study of injuries that were reported to the medical tent during a two day rugby tournament from 2008 to 2010.

**METHODS:** There were 76 female and 111 male teams in attendance with a total of 131 female and 159 male matches played over the three year period. Data was collected during the injury screening and during the treatment course by ATC's, PT's, and physicians via an injury report and consent forms completed in the medical tent during the two days of competition each year.

**RESULTS:** A total of 1140 female and 1665 male athletes played in the tournament with a total of 168 female (TFI) and 162 male (TMI) injuries were reported to the medical tent for evaluation. Those injuries were classified as Concussions, Upper Extremity, Lower Extremity and Lacerations. Concussions represented 14.8%, UE represented 44.8%, LE represented 32.7% and Lac represented 5.7% of all injuries reported. The injury rate decreased from Saturday to Sunday in 2008 from 55% to 44%; in 2009 from 56% to 43% and in 2010 from 73% to 26%. Females sustained more concussions (17% of TFI) and lower extremity injuries (36% of TFI). Males reported a higher rate of lacerations needing sutures (11% of TMI). Both males and females had near equal injury rate to the upper extremity (44% females and 45% males).

**CONCLUSION:** Our study shows that even though there were less female teams/athletes participating in the tournament, they had a higher injury rate compared to males. The data also shows a decrease in reported injuries on the second day of the tournament that could be attributed to athletes waiting to see their Primary Care Providers at home and the desire not to be pulled from competition. Further studies could be done to evaluate the reason for the difference between the male and female rate of injury reported. Also, a more rugby-specific injury tracking system could help with reporting positional injury rates along with high school vs. collegiate injury rates.

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**3196**    *Board #161*    **June 1**    **3:30 PM - 5:00 PM**  
**12-Month Incidence of Exercise Injuries in Community-dwelling Older Adults Following an Exercise Intervention**

Rob Little, Liza Stathokostas, Dave Humphreys, Don H. Paterson, FACSM. University of Western Ontario, London, ON, Canada.  
(No relationships reported)

Fear of injury is reported as a barrier to exercise by older adults. However the literature is limited in describing exercise injuries in older adults.

**PURPOSE:** To evaluate the 12 month incidence of, and describe injuries to, previously sedentary community dwelling older adults (>60y) following an 8-week supervised exercise program.

**METHODS:** Data were collected from the "Get Fit for Active Living" 8-week exercise. A self-reported questionnaire was used to document the injuries incurred in the 12 months post-exercise intervention. Linear regression analysis was conducted to identify co-variants related to injury outcome.

**RESULTS:** 167 people completed the questionnaire. 63 respondents were male and 104 were female. 23 people (13%) reported injuries. 41% of injuries were to the lower extremities, 27% were upper extremity, 23% involved the trunk, and 9% affected multiple areas. The most common type of injury was repetitive/overuse muscle strains (32%, n=7), 5 were acute muscle strains, and 8 were ligament sprains. Over-exertion/strenuous movements were the most common cause of injury (n=9), followed by 6 overuse/repeated strains and 5 falls. Walking accounted for half

of the activities during which injury occurred. Following that were stretching and swimming (both 9%, i.e. 2 injuries in each of these activities). 70% of injuries reported required medical treatment, with 75% being visits to a physician, 12% to a physical therapist, one walk-in clinic and one emergency room visit. 44% were not able to continue exercising immediately. Return-to-activity time varied from 1 to 182 days. Univariable regression analysis was performed using sex, age, and exercise volume as correlates, but none were significantly associated with injury occurrence.

**CONCLUSIONS:** These results showed similar or lower exercise-related injury rates as compared with previous reports on younger and middle-aged adults, however the definition of, and criteria for "injury" reporting varies in the literature. This study indicates that older adults taking up exercise are not at an increased risk of injury, and participation in an intervention - where the instruction of safe participation is taught - might confer some "protective" effect. Supported by CIHR.

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3197 Board #162 June 1 3:30 PM - 5:00 PM

**Mechanism Of Injury Trends For Shoulder Injuries In Interscholastic Sports: 2007-2009**

Jennifer M. Medina McKeon, Erin M. Hagedorn, Timothy L. Uhl, Heather M. Bush. *University of Kentucky, Lexington, KY.*

(No relationships reported)

**PURPOSE:** For the shoulder, injuries and injury prevention are focused predominantly on baseball and softball. Systematic investigation of shoulder mechanism of injury (MOI) is an important step to risk factor analysis and injury prevention program development. The purpose was to describe trends shoulder MOIs in interscholastic athletes.

**METHODS:** Epidemiological data were collected by certified athletic trainers for injured high schools athletes at 7 high schools during the 2007-08 and 2008-09 academic years. Shoulder injury relative incidence rates (RIR) and 95% confidence intervals (CI) were calculated per 10,000 athlete-exposures (AE). The variable MOI, was separated into the following categories: contact with person (Person), contact with surface (Surface), contact with apparatus (Apparatus), Noncontact, Overuse, and Other. For MOI, shoulder injury frequency was converted into a percentage of the total number of shoulder injuries reported per sport.

**RESULTS:** A total of 135 shoulder injuries occurred during 188,925 AEs. Results are reported for the 4 sports with the highest incidence rates of shoulder injury (Wrestling, Football, Softball, Baseball). For wrestling RIR = 53.5 [30.0,76.9]; football, RIR = 14.6 [10.9, 18.2]; softball, RIR = 10.0 [4.8,15.2]; and baseball, RIR = 8.6 [4.6, 12.6]. For MOI, contact injuries accounted for a considerable percentage of shoulder injuries in football (Person = 36.8%; Surface = 63.8%) and wrestling (Person = 57.9%; Surface = 19.0%), with few reported in baseball (Person = 0%; Surface = 11.0%) and softball (Person = 0%; Surface = 7.1%). In contrast, noncontact injuries accounted for a distinct percentage of shoulder injuries in baseball (Noncontact = 16.7%; Overuse = 66.7%) and softball (Noncontact = 28.6%; Overuse = 64.3%), with relatively few injuries reported in wrestling (Noncontact = 0%; Overuse = 0%) and football (Noncontact = 5.2%; Overuse = 5.2%).

**CONCLUSIONS:** While shoulder injury prevention programs tend to focus on preventing overuse injuries, a considerable number of shoulder injuries occur during football and wrestling, and tended to be contact in nature. Further exploration of these contact injuries, including research associated with the development shoulder injury prevention programs for contact-related injuries may be warranted.

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3198 Board #163 June 1 3:30 PM - 5:00 PM

**Incidence And Risk Factors Of Running-Related Injuries: A Prospective Cohort Study**

Luiz C. Hespagnol Junior, Leonardo Oliveira Pena Costa, Alexandre Dias Lopes. *São Paulo Running Injury Group (SPRunIG) of Universidade Cidade de São Paulo (UNICID), São Paulo, Brazil.*

(No relationships reported)

Beside the positive effects of running, this activity may cause musculoskeletal injuries. An understanding of the incidence of injury and the risk factors associated with injuries in runners can assist in the implementation of prevention strategies in this population.

**PURPOSE:** To determine the incidence of running-related injuries in a cohort of amateur runners and to identify the aspects of training that are associated with running-related injury.

**METHODS:** In this prospective cohort study, 200 amateur runners answered a fortnightly online survey containing questions about their running training routine. These runners were followed-up for a period of 12 weeks. The incidence of injuries was calculated using survival analysis and the association between potential risk factors and time of injury was determined by Cox regression models.

**RESULTS:** A total of 191 runners completed all follow-up surveys (i.e. completeness of follow up=95.5%). A new RRI was observed in 34.6% (n = 66) of our sample, which is equivalent to 8 injuries per 1000 hours of exposure to running. The mean pain intensity was 1.4 (SD = 1.3) evaluated by a 10-point (1-10) pain numerical rating scale (NRS). The main types of RRI reported were muscle injuries (18.2%, n=12) and low back pain (13.6%, n=9), followed by plantar fasciitis (10.6%, n=7), and tendinopathies (9.1%, n=6). The anatomical areas most commonly affected were the thigh and the leg (18.2%, n=12 each one), followed by knee (16.7%, n=11), and foot (16.7%, n=11). The variables related to training characteristics that had a value of p<0.05 at least in the log rank test (univariate analysis) were included in the multivariate Cox regression model. The variables associated with RRI in the Cox regression analysis were duration of training greater than 60 minutes (hazard ratio (HR)=1.9; 95% confidence interval (CI)=1.0 to 3.4); training on mixed terrains (HR=3.4; 95% CI=1.8 to 6.2); and performing interval training (HR=1.9; 95% CI=1.1 to 3.3).

**CONCLUSION:** The incidence of RRI was 34.6% or 8 injuries per 1000 hours of exposure to running. The RRI risk factors observed in this population were performing endurance exercise (running) for over 60 minutes, training on mixed terrain (uphill and downhill), and perform interval training.

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3199 Board #164 June 1 3:30 PM - 5:00 PM

**Ability Of Previous Exercise Frequency To Predict Injuries In Officer Candidates And Its Association To FMS**

Selasi Attipoe<sup>1</sup>, Peter Lisman<sup>1</sup>, Francis G. O'Connor, FACSM<sup>1</sup>, Patricia A. Deuster, FACSM<sup>1</sup>, Chris G. Pappas, FACSM<sup>2</sup>, Joseph J. Knapik, FACSM<sup>3</sup>. <sup>1</sup>Uniformed Services University, Bethesda, MD. <sup>2</sup>Womack Army Community Hospital, Fort Bragg, NC. <sup>3</sup>Public Health Command, Aberdeen Proving Grounds, MD.

(No relationships reported)

Low levels of previous physical activity are predictive of future injury risk. Recently, an association between Functional Movement Screen (FMS) scores  $\leq 14$  and incidence of musculoskeletal injury was reported. However, the injury predictive value of specific exercise mode training frequencies (SETF) and their relationship to FMS is unclear.

**PURPOSE:** To determine whether self-reported frequency of running, weight-training (WT), and "general" exercise or sports (GES) would predict subsequent injury in Marine Corps Officer Candidate School (OCS) training. We also assessed the association between SETF and FMS tests.

**METHODS:** Participants included 874 male (22.4 $\pm$ 2.7 yrs) candidates enrolled in either six (n = 447) or ten (n = 427) weeks of OCS. Prior to beginning OCS, candidates completed a questionnaire and underwent FMS. Questions included self-reported frequencies for running, WT, and GES. FMS consisted of deep squat, hurdle step, inline lunge, shoulder mobility, active straight leg raise (SLR), push-up, and rotary stability tests. Injury incidence data were gathered throughout training and grouped as "any", "overuse", or "traumatic". WT frequency was grouped as  $\leq 1$ , 2-4, or  $\geq 5$ x/wk, whereas running and GES were grouped as  $< 5$  or  $\geq 5$ x/wk. FMS test scores were grouped as "high" (score of 3) vs. "low" (score of 1 or 2).  $\chi^2$  statistics were used to evaluate group differences in injury risk and determine associations between SETF and FMS tests.

**RESULTS:** Candidates were 1.6 times more likely to suffer an overuse injury if they reported a GES frequency  $< 5$ x/wk (p = 0.028); 14.1% of persons who reported a GES frequency  $< 5$ x/wk suffered an injury compared with 9.3% with frequencies  $\geq 5$ x/wk. In contrast, both running and WT frequencies were independent of injury. Increased WT frequency was associated with high FMS scores for SLR ( $\chi^2 = 9.87$ , p = 0.007), whereas running frequency  $\geq 5$ x/wk was associated with low FMS scores in shoulder mobility ( $\chi^2 = 4.71$ , p = 0.03). GES frequency  $\geq 5$ x/wk was associated with low FMS scores for squat ( $\chi^2 = 6.21$ , p = 0.013) and rotary stability ( $\chi^2 = 5.72$ , p = 0.017) tests.

**CONCLUSION:** GES frequency  $< 5$ x/wk was associated with increased overuse injury risk. Although weak associations were found between SETF and high FMS test scores, the implications of these findings remain to be determined.

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3200 Board #165 June 1 3:30 PM - 5:00 PM

**Incidence And Prevalence Of Main Running-Related Injuries: A Systematic Review**

Alexandre Dias Lopes<sup>1</sup>, Luiz Carlos Hespanhol Junior<sup>1</sup>, Leonardo Oliveira Pena Costa<sup>1</sup>, Simon Yeung<sup>2</sup>. <sup>1</sup>São Paulo Running Injury Group (SPRunIG) of Universidade Cidade de São Paulo (UNICID), São Paulo, Brazil. <sup>2</sup>Hong Kong Polytechnic University, Hong Kong, China.  
(No relationships reported)

There is no consensus in the literature about what are the incidence and prevalence of main musculoskeletal injuries in runners.

**PURPOSE:** The objective of this study was to systematically review the data available on incidence and prevalence of main running-related musculoskeletal injuries (RRMI).

**METHODS:** Searches were conducted on EMBASE, MEDLINE, SPORTDISCUS, LILACS and SCIELO databases, with no limits of date and language of publication, being the searches conducted in March 2011. We considered eligible articles related with RRMI that describe the incidence or prevalence rates of RRMI. We excluded studies that reported only the type of injury or anatomical region, studies conducted with injured runners only, and studies with incomplete data or some other reason that precluded interpretation of which would be the incidence and prevalence rates of the main RRMI in runners. The extracted data were: first author, publication year, study design, description of the population of runners, RRMI definition and the name of each RRMI with their rates of incidence or prevalence.

**RESULTS:** Among the 2781 titles, eight of them were considered eligible for the review. Most articles had moderate risk of bias and just one fulfilled less than a half of the risk of bias criteria. The main RRMI were: patellar tendinopathy (incidence ranged from 5.5% to 22.7%; prevalence ranged from 6.3% to 18.5%), medial tibial stress syndrome (incidence ranged from 13.6% to 20.0%; prevalence ranged from 7.8% to 11.1%), Achilles tendinopathy (incidence ranged from 9.1% to 10.9%; prevalence ranged from 6.2% to 18.5%), plantar fasciitis (incidence ranged from 4.5% to 10.0%; prevalence ranged from 5.2% to 17.5%), patellofemoral syndrome (incidence ranged from 5.5% to 6.9%; prevalence ranged from 5.5% to 15.6%) and iliotibial band syndrome (incidence ranged from 1.8% to 9.1%; prevalence ranged from 4.7% to 10.5%).

**CONCLUSION:** The main RRMI found in this systematic review were: (1) patellar tendinopathy, (2) medial tibia stress syndrome, (3) Achilles tendinopathy, (4) plantar fasciitis, (5) patellofemoral syndrome, and (6) iliotibial band syndrome.

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3201 Board #166 June 1 3:30 PM - 5:00 PM

**Comparison of Neutral Spine and Hamstring Stretch for Relief of Hyperlordotic Lumbar Pain**

Jolie Bookspan. *Neck and Back Pain Sports Medicine, Philadelphia, PA.* (Sponsor: Catherine Ratzin Jackson, FACSM)  
(No relationships reported)

**PURPOSE:** Widespread prescription for lower back pain (LBP) is hamstring stretching. Some patients report relief, others, worsening. A pilot study of 167 subjects found no relation between hamstring flexibility and LBP. Subsequent independent studies confirm no relation between hamstring flexibility and LBP. Sufferers of disc injury and spinal stenosis often worsen with flexion, contraindicating hamstring stretch during active pain. Previous work determined that hyperlordosis (swayback) results in one form of LBP by compression of facets and soft tissue, and shortening lumbar height. Neutral spine (NS) lengthens and unloads, directly stopping LBP. Momentary incidental lumbar lengthening during hamstring stretch briefly stops symptoms. It is proposed that temporarily reversing swayback with hamstring stretching became confused with the separate entity of flexibility. The purpose of this study is to compare a neutral spine method, Ab Revolution (AR) with conventional hamstring stretching (HS) for LBP from hyperlordosis.

**METHODS:** Plot study of 167 subjects measured degrees hamstring flexibility using straight leg raise test, compared to nominal measures of active LBP, previous LBP, or never LBP. Of initial 167 N, 113 had active LBP. Of these 113, 92 reported wanting to bend forward, lift one leg, sit, or bring knees to chest to relieve symptoms. 4 were lost to follow up. Remaining 88 were divided into two groups: AR N=43, Daily conventional hamstring stretching HS=43. Outcome measures of neutral spine NS, flexibility, and LBP were assessed at day 1, 6 weeks, and 6 mos, analyzed using Chi-Square.

**RESULTS:** AR showed sig reduction of LBP during daily activities (40 of 43) using NS. HS group showed no significant reduction in LBP: 41 of 44 increased hamstring flexibility, 43 had brief symptom relief during stretch but return to pain with upright stance and activities of daily living, 43 were measured no NS. 18 of 44 had increase in LBP.

**CONCLUSIONS:** Incidental lumbar flexion from hamstring stretch, not hamstring flexibility, briefly reduces LBP by reversing swayback. Hamstring stretch is stopgap, indirect, not curative, may aggravate symptoms, and over time create new ones. Lumbar lengthening to neutral through AR is functional, and gives sustainable pain relief by directly stopping causes of LBP from hyperlordosis.

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3202 Board #167 June 1 3:30 PM - 5:00 PM

**Costs of Physical Activity-Related Musculoskeletal Injury In Community-Dwelling Women**

Alison K. Herrmann<sup>1</sup>, James R. Morrow, Jr.<sup>2</sup>, James T. Morrison<sup>3</sup>, Madelena Ng<sup>1</sup>, Laura F. DeFina<sup>4</sup>, Robert M. Kaplan<sup>1</sup>. <sup>1</sup>UCLA School of Public Health, Los Angeles, CA. <sup>2</sup>University of North Texas, Denton, TX. <sup>3</sup>UCLA Health System Patient Safety Institute (PSI), Los Angeles, CA. <sup>4</sup>The Cooper Institute, Dallas, TX.  
(No relationships reported)

**PURPOSE:** Despite a substantial literature documenting benefits of physical activity (PA), regular exercise is also associated with some risks. For example, the risk of musculoskeletal injury (MSI) increases with greater exercise frequency. MSI is associated with financial costs including the costs of medical care and time lost from work. The purpose of this study was to evaluate the economic costs associated with PA-related MSI in community-dwelling women.

**METHODS:** Participants included 918 women in the WIN Study. Participants reported weekly on their PA behaviors and MSI incidence via the Internet for up to 3 years. Costs were estimated by review of medical records and through self-reports of medical care use. Participants reported MSI and provided consent to obtain health records. Components of costs included time missed from work, physician visits, medical facility contacts, and prescription medications. Frequencies of each item were tabulated and then weighted by estimated costs using prevailing charges in Dallas, TX. In addition to medical costs, we considered the costs of non-physician providers, durable medical equipment, radiology services, and over-the-counter medications.

**RESULTS:** Among the 918 participants, MSI data were available for 245 women reporting MSI associated with PA. Within this group of women, there were 2323 episodes of expenditure or contact with the health care system. Total costs of the episodes ranged from \$0.00-\$18,934. The modal cost was \$0.00 with a mean of \$433 (SD=\$1670). The distribution of injury costs was positively skewed with nearly all participants reporting no or very low costs.

**CONCLUSION:** About one in four community-dwelling women who are physically active experience a MSI. The great majority of these injuries are minor. Large expenses associated with these MSI are quite rare. Our analysis does not consider the potential costs associated with improved physical fitness. However, it is likely that the long-term costs savings resulting from PA outweigh the minor costs associated with a physically active lifestyle.

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3203 Board #168 June 1 3:30 PM - 5:00 PM

**Systematic Review of Methodology in Ski Injury Research**

Kristen A. Scopaz<sup>1</sup>, John Hatzenbuehler<sup>1</sup>, Tyler Bernaiche<sup>2</sup>, Christina Holt<sup>1</sup>, Kahsi Threlkeld<sup>1</sup>, William Dexter, FACSM<sup>1</sup>. <sup>1</sup>Maine Medical Center, Portland, ME. <sup>2</sup>Tufts University School of Medicine, Boston, MA.  
(No relationships reported)

Skiing and snowboarding cause numerous injuries. Research efforts using information from a ski clinic at a major northeastern resort proved difficult given missing and inconsistent data. Most ski injury research data collection methods are retrospective or survey-based. A standardized data collection tool will improve the quality of ski and snowboard injury research, which is needed to develop injury prevention strategies and manage ski injuries.

**PURPOSE:** To perform a systematic review of ski injury literature focusing on methodology for data collection.

**METHODS:** Medline and SPORTDiscus databases were searched using key words "ski\* injur\*" and "snowboard\* injur\*", limited to human studies in English in the past 20 years. Inclusion criteria were original studies that looked specifically at injuries to skiers or snowboarders and described data collection methods. Two reviewers screened the articles for inclusion. For any discrepancies, discussion with a third reviewer was conducted to reach consensus. For each included article, the methods section was reviewed and categorized according to method type.



**RESULTS:** 185 studies met inclusion and exclusion criteria. Almost all (179, 97%) were observational. Only 5 were experimental including 3 randomized controlled trials. There was one methodological study. Of the 179 observational studies, 8 (5%) were cohort, 29 (16%) case-control, 117 (65%) cross-sectional, 22 (12%) case series, and 3 (2%) were prospective case studies. Overall, 10 (5%) studies were fully prospective, 74 (40%) reported prospective collection of data with a retrospective analysis, and 101 (55%) were retrospective or not clearly defined. 72 studies included data collected at a ski mountain including from ski clinics, ski patrol and surveys. 91 studies used data collected at hospitals or medical clinics. Other sources of data included mailed or distributed surveys, injury surveillance databases, and death certificates. 61 studies utilized more than one data collection method.

**CONCLUSIONS:** Multiple methods of variable quality exist for collecting ski injury research data. A standardized data collection tool would improve the quality and implications of such research. Subsequently our aim is to create a ski injury data collection tool that provides consistent data.

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## F-29 Free Communication/Poster - Interventions to Increase Physical Activity in Adults

JUNE 1, 2012 1:00 PM - 6:00 PM

ROOM: Exhibit Hall

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3204 Board #169 June 1 2:00 PM - 3:30 PM

### Project VIA BRAZIL: Active Living, Finding Healthy Ways

Tania Bertoldo Benedetti<sup>1</sup>, Andiara C. Schwingel<sup>2</sup>, Wojtek Chodzko-Zajko, FACSM<sup>2</sup>, Giovana Zarpellon Mazo<sup>3</sup>, Eleonora d'Orsi<sup>1</sup>, Marcia Ory<sup>4</sup>. <sup>1</sup>Universidade Federal de Santa Catarina, Florianópolis, Brazil. <sup>2</sup>University of Illinois at Urbana-Champaign, Urbana-Champaign, IL. <sup>3</sup>Universidade do Estado de Santa Catarina, Florianópolis, Brazil. <sup>4</sup>School of Rural Public Health, TAMU, TX.

(No relationships reported)

In recent years several Federal initiatives in Brazil have focused on physical activity promotion. Most programs offer only traditional group-based exercise classes. Although exercise classes have shown to be very effective in improving health of participants, they tend to be relatively high cost and are able to reach only a small percentage of the eligible population.

**PURPOSE:** Project VIA Brazil is an ongoing research project that compares advantages and disadvantages of traditional group-based exercise programs with an evidence-based behavioral change program designed to promote physically active lifestyles among older Brazilians.

**METHODS:** Project VIA Brazil enrolled 100 community dwelling older adults aged 60 years and older living in Florianópolis, Southern Brazil. They were divided among two intervention groups: traditional exercise class (GE) and a behavioral change program (GB); and a control group (GC). GE group consisted of a 3-month aerobics class, 3 times per week, 60 min each; whereas GB group a 12-session 'Active Living Every Day' program. The programs were offered in public health centers through the city.

**RESULTS:** In this presentation we describe the outcome of the qualitative component of the analyses that using the RE-AIM public health evaluation model, explored the reach, adoption, implementation, and sustainability of the two interventions. Key staff members at participating health centers were interviewed as well as selected older adult participants. Our data suggest that both traditional exercise programs and behavioral change programs have merit and that public health centers should consider offering a combination of classes to maximize the reach of physical activity promotion efforts.

**CONCLUSIONS:** Traditional exercise programs and more modern behavioral change programs each have merit and both should be considered as important elements of physical activity promotion.

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3205 Board #170 June 1 2:00 PM - 3:30 PM

### Effects of Seated Pedaling on Calorie Expenditure and Perceived Productivity

Peggy A. Plato, Heather A. McDowell. San Jose State University, San Jose, CA. (Sponsor: Craig Cisar, FACSM)

(No relationships reported)

Obesity is a major problem in the US population, and a sedentary lifestyle contributes to this problem. Despite public health efforts promoting the importance of physical activity, the majority of U.S. adults do not meet the minimal activity recommendations. Because adults are increasingly spending time seated, often in front of a computer monitor, interventions that fit into this lifestyle and increase energy expenditure have potential to positively impact health and well-being.

**PURPOSE:** To evaluate the efficacy of a seated leg pedaling device for increasing calorie expenditure and perceived productivity.

**METHODS:** Participants (3 men, 7 women, 22.8 ± 0.5 yrs, 167.9 ± 3.2 cm, 69.1 ± 4.5 kg) were recruited from a university lecture class that met 2 days per week. One day each week participants used the device, pedaling at their own pace, and recorded the number of revolutions completed during the 50 min class. On both pedaling (P) and non-pedaling (NP) days, participants completed a survey at the end of class rating their perceived productivity (1= low, 5 = high). Following the 4 week intervention, calorie expenditure was measured during seated rest and while pedaling.

**RESULTS:** Pedaling significantly increased calorie expenditure compared to seated rest (1.7 ± 0.1 vs. 1.1 ± 0.1 Kcal/min respectively, p<0.001). Although Kcal expenditure increased by only 0.6 Kcal/min, using the pedaling device 4 hr/day, 5 days/week would increase energy expenditure by 37,440 Kcal/year, equivalent to a 4.8 kg weight loss if calorie intake remained constant. Participants reported that the pedaling device was comfortable and easy to use. Perceived energy level (3.5 ± 0.3 P vs. 3.0 ± 0.3 NP, p<.01), motivation (3.4 ± 0.2 P vs. 3.0 ± 0.3 NP, p<0.05), and alertness (3.5 ± 0.2 P vs. 3.1 ± 0.3, p<0.05) were higher when pedaling during class. There were no significant differences in perceived ability to focus and participation in class between pedaling and non-pedaling days.

**CONCLUSION:** A leg pedaling device can be used at work or school to increase energy expenditure during seated activities. Although the additional energy expenditure is small, over time it can impact energy balance and help individuals reach or maintain healthier body weights. Additionally, this low level physical activity may increase energy, motivation, and alertness while working.

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3206 Board #171 June 1 2:00 PM - 3:30 PM

### Do User Intentions and Health Feedback Influence Exergame Duration of Use and Measured Exertion?

Eric B. Hekler<sup>1</sup>, Frank X. Chen<sup>2</sup>, Abby C. King, FACSM<sup>2</sup>. <sup>1</sup>Arizona State University, Phoenix, AZ. <sup>2</sup>Stanford University, Stanford, CA.

(No relationships reported)

Although previous research suggests some exergames (e.g., Wii Fit, Kinect) promote moderate intensity or more vigorous physical activity (e.g., >3 METs), little is known about the impact of intentions (e.g., game vs. exercise) or health feedback (e.g., calorie trackers) on exertion and duration of use.

**PURPOSE:** Determine if a person's intentions when using an exergame (i.e., as a game or as "exercise") and presence of health feedback (i.e., calorie counter displayed or not) result in greater perceived and actual exertion and time spent using Kinect Dance Central.

**METHODS:** : A randomized 2x2 (exercise vs. game intention; calorie counter vs. not) experiment was conducted among university students and staff. Participants (N=42, Mage=26.5±7.2, 59.5% men; 61.9% reported regular exercise) were recruited via local advertisements and listservs and invited to participate in a 90-minute "stress relief" study. Participants were excluded if they owned and/or regularly used the Xbox Kinect. All participants received a 5-minute Kinect and supervised dance tutorial and then were left alone to use the program for as long as they desired. The "intention" manipulation was accomplished via [a] an oral instruction with references to the action as either "exercise" or "game" and [b] setting-based contextual cues (e.g., "Exercise time. Have a great workout!" was written below the monitor for the Exercise condition). Participants either had the program's "workout mode" (i.e., a calorie counter and duration of use of the system) turned on or off. Manipulations were tested and refined prior to the experiment. Perceived exertion was measured via the Borg Scale. Actual exertion (i.e., average METs across the time using the program) was measured via the Zephyr Bioharness. Time spent using the program was measured via stop watch.

**RESULTS:** ANOVA analysis revealed a significant main effect of intention on duration of use (F=5.2, p<0.05, Me=49.2±9.6, Mg=39.7±14.4) but not feedback or feedbackXintention (ps>0.25). There were no significant predictors of perceived or actual exertion (ps>0.54, sample M<sub>per</sub>=12.8±1.7, M<sub>met</sub>=4.5±1.1).

**CONCLUSIONS:** Results suggest that this sample of young adults, when using an exergame framed as “exercise”, used it for a longer time than those for whom the program was framed as a “game.”

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**3207**    *Board #172*    **June 1**    **2:00 PM - 3:30 PM**  
**Changes in Preservice Classroom Teachers’ Activity Levels through Participation in a Physical Education Infusion Program**  
Tan Leng Goh, James C. Hannon. *University of Utah, Salt Lake City, UT.* (Sponsor: Janet M. Shaw, FACSM)  
(No relationships reported)

Preservice classroom teachers (PCTs) have an influence on the health and wellbeing of school children.

**PURPOSE:** To examine changes in the physical activity (PA) levels of PCTs at the end of a 12-week intervention program, Physical Education Programming Infusion (PEPI).

**METHODS:** Participants were 19 female PCTs (Age = 28.4±7.2yrs). The 30-minute weekly PEPI was infused into a required semester-long science methods course. The objective of PEPI was to provide PCTs the skills to integrate movement and healthy lifestyle knowledge into classroom subjects. Activities were also structured to help PCTs to become aware of their personal PA behaviors. To assess the participants’ PA levels, they wore pedometers (New Lifestyle NL-1000) over 6 consecutive days at the start and end of the PEPI. Difference in baseline and post PA levels was assessed by paired-sample t-test. Participants also completed open-ended questionnaires to examine their experiences using the pedometers. Thematic analysis was used to analyze the questionnaires.

**RESULTS:** There was a significant difference in average daily step counts ( $p < 0.05$ ) between baseline (7553±3365) and post-intervention (8421±4476). There was also a significant difference in weekend step counts ( $p < 0.05$ ) between baseline (5841±4201) and post-intervention (7942±4786). Results from the open-ended questionnaires revealed that: 1) participants became more aware of their PA levels through the pedometer activity, 2) wearing the pedometer motivated them to exercise more, 3) they set goals to increase their PA levels, and 4) they find that a similar pedometer activity is feasible to be implemented with their school children.

**CONCLUSIONS:** Pedometers were used as an assessment of the PCTs’ PA levels and a tool to motivate them to be active. Post-intervention step counts of PCTs increased as they became more aware of their PA levels. In designing and implementing courses to train PCTs to become future physical educators, it is important to help them become aware of their personal PA behaviors, identify benefits of an active lifestyle and encourage them to pursue activities that they enjoy. Consequently, this will strengthen their beliefs in their positions as PA role models. Future research should address barriers and facilitators among PCTs to meet the recommended 10,000 steps per day.

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**3208**    *Board #173*    **June 1**    **2:00 PM - 3:30 PM**  
**Cost-effectiveness Of A Pedometer-based Versus Time-based Physical Activity Prescription Program: The Healthy Steps Study**  
Gregory S. Kolt<sup>1</sup>, William Leung<sup>2</sup>, Toni Ashton<sup>2</sup>, Grant M. Schofield, III<sup>3</sup>, Nicholas Garrett<sup>3</sup>, Ngaire Kerse<sup>2</sup>, Asmita Patel<sup>3</sup>. <sup>1</sup>*University of Western Sydney, Sydney, Australia.* <sup>2</sup>*University of Auckland, Auckland, New Zealand.* <sup>3</sup>*Auckland University of Technology, Auckland, New Zealand.* (Sponsor: Karen Croteau, FACSM)  
(No relationships reported)

Physical activity (PA) promotion interventions based in primary care settings have demonstrated effectiveness. As older adults are at particular risk of several non-communicable diseases, and particularly those related to physical inactivity, examining methods of engaging them in cost-effective programs is important.

**PURPOSE:** To investigate the cost-effectiveness of a pedometer-based versus time-based PA prescription program (the New Zealand Green Prescription) in improving PA and health-related quality of life in low-active older adults.

**METHODS:** Participants in the Healthy Steps study were 330 low-active adults aged 65 years and older (mean age 74.1± 6.1 years) recruited through primary care physicians. Participants were randomized into either a pedometer-based or a standard time-based Green Prescription where they received 3 telephone counselling sessions over 12 weeks based on increasing PA. Outcomes were measured at baseline, 3 months (end of intervention) and at 12 months (follow-up). PA was assessed with the Auckland Heart Study Physical Activity Questionnaire, health-related quality of life was measured with the EQ-5D, with utility scores based on the New Zealand tariff 2 for cost-effectiveness analysis. Quality-adjusted life years (QALY) were calculated using these utility scores. Costs included public and private healthcare costs and exercise/PA-related personal expenditure. The 259 participants who completed the 12-month follow-up and who submitted full cost and healthcare utilization data were included in the analysis.

**RESULTS:** There were no significant between-group differences in costs. Cost-effectiveness acceptability curves showed that, compared to the standard time-based Green Prescription, the pedometer-based Green Prescription was statistically cost-effective for the 3 cost categories (community care costs, exercise and community care costs, and all costs), as well as for all QALY thresholds. At a New Zealand cited threshold of \$20,000 per QALY the pedometer Green Prescription had a probability of being between 93% and 96% cost-effective for the 3 cost categories.

**CONCLUSIONS:** Outcomes indicate that pedometer-based Green Prescriptions may be cost-effective in increasing PA and health-related quality of life over 12 months in previously low-active older adults.

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**3209**    *Board #174*    **June 1**    **2:00 PM - 3:30 PM**  
**Use and Tailoring of an Evidence-Based Physical Activity Behavior Change Program in a Worksite Population**  
Bhibha M. Das<sup>1</sup>, Steven J. Petruzzello, FACSM<sup>2</sup>. <sup>1</sup>*University of Georgia, Athens, GA.* <sup>2</sup>*University of Illinois at Urbana-Champaign, Urbana, IL.*  
(No relationships reported)

As the overweight and obesity rates rise, so do health care costs in the US. Employers often bear the brunt of these rising costs along with the side effects of overweight and obesity, such as increased presenteeism and absenteeism. An excellent intervention for the growing overweight and obesity epidemic is worksite wellness programs, a recent trend in the field of health education.

**PURPOSE:** To assess the effects of an evidence-based physical activity (PA) behavior change program on mass transit employees.

**METHODS:** Active Living Every Day (ALED), originally designed as a 20-wk program, was condensed into a 6-wk format for this study and delivered in 2 phases. Phase 1 (P1) presented the 6-wk version in its original format, without any tailoring. Phase 2 (P2) received a 6-wk version, tailored for the mass transit population. Tailoring was done with focus groups at the end of P1, using the Nominal Group Technique.

**RESULTS:** In P1 (age = 47.6 ± 9 yrs, BMI = 32.5 ± 8.9 kg/m<sup>2</sup>), significant changes were seen in “caring about consequences to others” (P = 0.05), “increasing healthy opportunities” (P = 0.007), “committing oneself” (P = 0.005), and “reminding oneself” (P = 0.04). These factors were all part of the processes of change. For P2 (age = 46.6 ± 11.7 yrs, BMI = 32.1±1.9 kg/m<sup>2</sup>), significant changes were seen in decisional balance (P = 0.029), “increasing healthy opportunities” (P = 0.006), “substituting alternatives” (P = 0.017), “rewarding oneself” (P = 0.041), “reminding oneself” (P = 0.034), sleep quality (P = 0.004), PA affect (P = 0.001), PA enjoyment (P = 0.001), perceived stress (P = 0.004), reduced motivation (P = 0.024), and overall physical and mental health (P = 0.02). Comparing the non-tailored to the tailored version of ALED, statistically significant changes were exhibited in two measures: “increasing healthy opportunities” (P = 0.013) and physical fatigue (P = 0.002).

**CONCLUSIONS:** It is inconclusive to determine whether tailoring the ALED intervention had any significant impacts on the outcome measures. The ALED intervention is a relatively inexpensive and easy to implement worksite wellness program and did demonstrate significant changes in participants’ processes of change, sleep quality, perceived stress, fatigue, physical activity enjoyment, and overall physical and mental health status.

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**3210**    *Board #175*    **June 1**    **2:00 PM - 3:30 PM**  
**Effectiveness of an Exercise Program in Improving Balance in Adults Diagnosed With HIV**  
Francheska Mojica<sup>1</sup>, Glorimar Garcia<sup>2</sup>, Martin Rosario<sup>1</sup>, Alexis Ortiz<sup>1</sup>. <sup>1</sup>*University of Puerto Rico-Medical Sciences Campus, San Juan, Puerto Rico.* <sup>2</sup>*La Perla de Gran Precio, San Juan, Puerto Rico.*  
(No relationships reported)

Balance impairments are common in adults diagnosed with HIV as a consequence of infection and from secondary effects of medications. Such impairments could predispose this population to falls and decreased mobility.

**PURPOSE:** To assess balance with eyes open and eyes closed after a three-month physical fitness exercise program.

**METHODS:** Participants (n = 23) were assessed previous to participating in a community-based physical fitness exercise program and three months after program initiation. Balance was measured with a MatScan™ (Tekscan, Boston, MA) as the displacement of the center of pressure in cube centimeters in two conditions; eyes open and eyes closed. Eyes open represented visual, vestibular, and proprioceptive systems integration whilst eyes closed represented only vestibular and proprioceptive systems. Paired t-tests were used to compare pre and post balance values for both conditions.

**RESULTS:** Balance values with the eyes open improved significantly (p = 0.04) from baseline (3.78 ± 1.4 cm2) to three months (0.84 ± 0.14 cm2) post exercise participation. Although, balance with eyes closed improved over time (2.26 ± 0.56 cm2 - 1.42 ± 0.37 cm2), such improvement was not statistically significant (p = 0.15).

**CONCLUSIONS:** Participation in a fitness program appears to improve balance with opened eyes suggesting improvement throughout the visual, vestibular, and proprioceptive systems. Balance with closed eyes appears to improve with a smaller magnitude suggesting most improvements occur first through the visual system. **ACKNOWLEDGEMENTS:** Thanks to the support of La Perla de Gran Precio.

**3211** Board #176 June 1 2:00 PM - 3:30 PM

### Effect Of A 45-minute Exercise Session On Total Activity In Normal-weight And Obese Women

Tyler Clark, Bliss Hanlon, Bruce W. Bailey, Michael Larson, James D. LeCheminant, FACSM. Brigham Young University, Provo, UT.

(No relationships reported)

**PURPOSE:** The purpose of this study was to compare total physical activity level in normal-weight and obese women under two separate conditions (an acute bout of exercise; non-exercise). This study used a matched subject design (except for BMI) with treatment conditions randomized and counter-balanced.

**METHODS:** Seventeen normal-weight (31.4±9.2 y, 22.8±1.3 kg/m2) and 17 obese (32.9±9.0 y, 34.0±4.9 kg/m2) women completed testing for both conditions. During the exercise condition, participants completed an early morning (8-9am) exercise session on a motor-driven treadmill at 3.8 mph and 0% grade for 45 continuous minutes. Each participant was fitted with an accelerometer immediately prior to the exercise session and wore it continuously for the following 24-hours. There were no instructions or limitations on subsequent activities. During the non-exercise session participants wore an accelerometer on the same day of the week (1 week later), for the same 24-hour period, but did not complete a supervised exercise session and received no instructions or limitations on physical activities.

**RESULTS:** For both the normal-weight and obese women, the exercise condition resulted in significantly more total physical activity (accelerometer counts), moderate-intensity activity (min), vigorous-intensity activity (min), moderate-to-vigorous intensity activity (MVPA) min, and less sedentary time (min) than the non-exercise condition (P<0.05). Physical activity counts were 73% and 57% higher during the exercise condition than the non-exercise condition for the non-obese and obese group, respectively. There was a significant group\*condition interaction for MVPA (F=4.48; P=0.043) with the obese women showing less MVPA on the exercise day (20 min less) than the normal-weight group.

**CONCLUSIONS:** A supervised and planned exercise bout dramatically increases total physical activity in normal-weight and obese women compared to a day without planned exercise. The normal-weight women spontaneously obtained more MVPA on the exercise day than the obese women.

**3212** Board #177 June 1 2:00 PM - 3:30 PM

### Are Changes In Sedentary Behavior And Steps Maintainable After A 3-month Intervention?

Amanda Libertine, Sarah Kozye-Keadle, Patty S. Freedson, FACSM. University of Massachusetts, Amherst, MA.

(No relationships reported)

Exercise training studies have been conducted to increase physical activity (PA) in overweight, sedentary individuals. More recently, sedentary time reduction (STR) interventions have targeted decreases in sedentary behavior (SB). Short-term changes in these behaviors may occur; however, follow-up evaluations are not commonly done.

**PURPOSE:** To determine if maintenance in PA and SB 3-months following a training study is better in a STR, exercise only (EX), or exercise and STR (EX-STR) group.

**METHODS:** Overweight/obese (n=47) individuals completed a 3-month training study. Participants were randomized into 1 of 3 groups: 1) STR: met weekly with a researcher who gave recommendations to reduce SB and increase PA, 2) EX: exercised 5 days/week, and 3) EX-STR: combination of EX and STR. The interventions were effective in eliciting behavioral change from baseline to 3-months. Thirty-one participants (BMI= 33.6± 4.58 kg·m<sup>-2</sup>; age= 45.2±10.19 years) agreed to the follow-up. Participants wore an activPAL(AP) monitor at end of study (M3) and 3-months post-study (M6). The AP recorded time spent sitting/lying, standing, and stepping. Percent sedentary (%SED) was calculated as sitting time/monitor wear time. Steps/day (surrogate for PA) were also determined. Linear mixed effects models were used to test for differences in %SED and steps within and between groups.

**RESULTS:** EX and STR maintained %SED and EX-STR did not. %SED was significantly higher in EX than STR at M6. The % change from M3 to M6 in steps/day for STR, EX, and EX-STR was 22.8, 26, and 43.3%, respectively.

|    | %Sed (mean) |      |        | Steps (mean) |        |          |
|----|-------------|------|--------|--------------|--------|----------|
|    | STR         | EX   | EX-STR | STR          | EX     | EX-STR   |
| M3 | 64.2        | 67.5 | 60.9a  | 9067.9b      | 9722.5 | 12191.9b |
| M6 | 62.0c       | 68.6 | 65.7*  | 7000.2*      | 7194*  | 6917.9*  |

adifferent than EX at M3, bdifferent than EX-STR at M3, cdifferent than EX at M6, \*different from M3 to M6 (p<0.05 for all)

**CONCLUSION:** These data suggest it may be more feasible to sustain reductions in %SED following an STR than maintaining an increase in PA following exercise training.

Funded by RC HL099557

**3213** Board #178 June 1 2:00 PM - 3:30 PM

### Community Walking Program Promotes Physical Activity in Adults and Youth for 10 years

Nobuko Hongu, Shuang Huang, Linda M. Block, Cathy L. Martinez, Barron J. Orr, Sharon Hoelscher Day, Nicholas B. Knutson, Yuta T. Torrey, Robin B. Harris. The University of Arizona, Tucson, AZ. (Sponsor: Linda Houtkooper, FACSM)

(No relationships reported)

**PURPOSE:** Cooperative Extension professionals strive to educate community members about healthy lifestyles, including physical activity and nutrition. The University of Arizona Cooperative Extension developed the Walk Across Arizona (WAAZ), state-wide, community team-based walking promotion program and has implemented it for 10 years (2001-2011). The program goals are to encourage individuals and families to increase their physical activity by joining a walking team and to increase satisfaction with being in a community and to decrease social isolation of people within communities.

**METHODS:** WAAZ participants were recruited by word of mouth, program fliers, and community newspapers. Participants enrolled in the program by completing an on-line registration form and brief survey including demographic characteristics of the participants, their usual physical activity behaviors, fruits and vegetable intakes, and community involvement. During the program the participants reported the steps or miles they walked weekly. The total miles walked by the teams were posted on the WAAZ Web site (<http://cals.arizona.edu/walkacrossaz/>). Following completion of each 8-week program, participants were provided incentives and asked to complete program assessments.

**RESULTS:** The WAAZ program started with 329 participants (34 teams). Over the past 10 years 1,328 teams with 11,589 participants walked over 2.4 million miles during the program. The community planning Task Force and collaborations with community organization partners helped extend outreach of WAAZ statewide with inclusion of youth and people with limited resources.

The changes in fruits and vegetable intakes during the program were associated with reported average walking miles per week. The program also promoted a sense of belonging among participants in a community. In 2011, 791 participants, 6 to 99 years old recorded walking an average of 21 miles per week, and 170 miles per person during 8-week program. Currently, 2 schools (n=58) are participating in the WAAZ program as a part of their PE classes.

**CONCLUSION:** A community team-based walking program effectively promotes physical activity. The WAAZ program is a model that can provide research based physical activity, and nutrition education resources to promote healthy lifestyles within a community.

**3214 Board #179 June 1 2:00 PM - 3:30 PM**

**Effect Of Physical Activity On Primary Care Total Number Of Visits In Inactive Patients**

Carne Martin-Borràs<sup>1</sup>, Maria Giné-Garriga<sup>1</sup>, Anna Puig-Ribera<sup>2</sup>, Carlos Martin-Cantera<sup>3</sup>, Antonio Cuesta<sup>4</sup>, Mercè Solà<sup>5</sup>, PPAF Group<sup>6</sup>. <sup>1</sup>FPCEE Blanquerna, Universitat Ramon Llull, Barcelona, Spain. <sup>2</sup>Universitat de Vic, Vic, Spain. <sup>3</sup>IDIAP Jordi Gol, Barcelona, Spain. <sup>4</sup>Universidad de Málaga, Málaga, Spain. <sup>5</sup>Institut Català de la Salut, Sant Joan Despí, Spain. <sup>6</sup>Institut Català de la Salut, Catalonia, Spain. (Sponsor: Viswanath Unnithan, FACSM)

(No relationships reported)

Inactive people with multiple morbidities are associated with increased health costs. Previous reviews of physical activity programs have assessed their effects on health and functional outcomes. None, to our knowledge, have examined their effects on primary care utilization in terms of number of visits.

**PURPOSE:** To assess the effectiveness of a primary care based physical activity program on altering the total number of visits to the healthcare centre among inactive population seen in primary care, over 27-month period.

**METHODS:** 362 primary healthcare patients (283 women, 79 men) (66.52 ± 12.33 years old) not undertaking 30 minutes of moderate intensity physical activity on at least five days of the week were randomly allocated into two groups (Control Group, CG=172; Intervention Group, IG=190). IG went through a 3-month standardized physical activity program linked to community resources. CG met once a month for educational and social meetings. Total numbers of consultations to the healthcare centre, registering the total number of visits during the twelve months prior and after the program, were assessed. Consultations included face-to-face and home visits by GPs or nurses, and also out-of-hours visits to the healthcare centre. Secondary outcomes for IG and CG were self-reported health status documented via the SF-12 survey, and assessed at baseline (month 12), at the end of the intervention (month 15), and at 6 and 12 months follow-up after the end of the intervention (month 21 and 27, respectively). An analysis of covariance (ANCOVA) was performed for all outcome measures.

**RESULTS:** Consultations of the IG participants showed a significant decline relative to those in the CG (p < 0.05) (mean score ± SD in number of visits of participants in the IG and CG groups were 9.32 (3.25) and 15.79 (4.82), respectively in month 27).

**CONCLUSIONS:** In summary, our findings indicate that our intervention reduces the number of consultations, which is a direct measure of health economic costs.

**F-30 Free Communication/Poster - Medical Issues**

JUNE 1, 2012 1:00 PM - 6:00 PM

ROOM: Exhibit Hall

**3215 Board #180 June 1 3:30 PM - 5:00 PM**

**Intensive Lifestyle Modifications Reduce Lp-PLA2 Mass In Patients With HIV Lipodystrophy**

Kevin S. Chapman<sup>1</sup>, Joshua S. Wooten<sup>1</sup>, Preethi Nambi<sup>2</sup>, Baiba K. Gillard<sup>2</sup>, Vijay Nambi<sup>2</sup>, Henry J. Pownall<sup>2</sup>, Lynne W. Scott<sup>2</sup>, Christie M. Ballantyne<sup>2</sup>, Ivonne Coraza<sup>2</sup>, Ashok Balasubramanyam<sup>2</sup>. <sup>1</sup>Southern Illinois University Edwardsville, Edwardsville, IL. <sup>2</sup>Baylor College of Medicine, Houston, TX.

(No relationships reported)

Patients with HIV-associated dyslipidemia have exhibited Lp-PLA<sub>2</sub> levels above what is observed in patients with coronary heart disease (CHD), which may indicate accelerated development of CHD.

**PURPOSE:** To assess if an intensive diet and exercise (D/E) program independently and combined with fenofibrate and niacin provided added benefits to usual medical care at reducing circulating Lp-PLA<sub>2</sub> mass and CCL5/RANTES in patients with HIV dyslipidemia.

**METHODS:** Participants (n=107) were randomized to five study groups: 1) Usual care; 2) D/E; 3) D/E with fenofibrate (160 mg/d); 4) D/E with niacin (2 g/d); and 5) D/E with fenofibrate and niacin for 24 weeks. General linear models (SPSS 18.0) was used to compare the five randomized groups with respect to Lp-PLA<sub>2</sub> mass and CCL5/RANTES while controlling for age, baseline BMI, baseline CD4<sup>+</sup> T-cell count, baseline viral load, duration of HIV, and duration of antiretroviral drug therapy, as well as the baseline outcome value. Statistical significance was set at P<0.05.

**RESULTS:** Following the 24-week intervention, Lp-PLA<sub>2</sub> concentration (Table 1) was significantly lower in patients who participated in D/E only, D/E plus fenofibrate, and D/E plus niacin than patients receiving usual medical care. Interestingly, there was no significant difference in Lp-PLA<sub>2</sub> mass between patients who received D/E only, D/E plus fenofibrate and D/E plus niacin. No significant differences were observed between groups for CCL5/RANTES concentrations following the 24-week intervention.

**CONCLUSIONS:** This study is first to demonstrate that when compared to standard medical care, plasma Lp-PLA<sub>2</sub> mass can be reduced by an intensive D/E program in patients with HIV dyslipidemia.

Supported by NIH Grant R01 HL73696 (A.B.).

Table 1. Lp-PLA<sub>2</sub> and RANTES levels following the 24-week intervention.

| Group | Lp-PLA <sub>2</sub><br>(ng/mL)<br>Baseline | Lp-PLA <sub>2</sub><br>(ng/mL)<br>Post-treatment | RANTES<br>(pg/mL)<br>Baseline | RANTES<br>(pg/mL)<br>Post-treatment |
|-------|--|--|-------------------------------|-------------------------------------|
| 1     | 415.1 ± 138.2                              | 436.0 ± 88.8                                     | 42.4 ± 25.8                   | 47.4 ± 30.5                         |
| 2     | 387.2 ± 83.8                               | 370.2 ± 102.6*                                   | 40.0 ± 14.9                   | 52.4 ± 28.8                         |
| 3     | 403.3 ± 158.6                              | 368.8 ± 70.0*                                    | 44.3 ± 23.7                   | 58.5 ± 36.8                         |
| 4     | 373.0 ± 97.1                               | 352.0 ± 84.1†                                    | 52.6 ± 39.1                   | 49.2 ± 37.9                         |
| 5     | 363.7 ± 139.8                              | 380.2 ± 100.3                                    | 41.3 ± 22.2                   | 41.4 ± 23.0                         |

Data are presented as Mean ± SD. Group 1 is usual care + 2 placebos; Group 2 is intensive diet/exercise program + 2 placebos; Group 3 is intensive diet/exercise program + fenofibrate; Group 4 is intensive diet/exercise program + niacin; Group 5 is intensive diet/exercise program + fenofibrate + niacin. \*P<0.05, †P<0.01, significantly different than Group 1 Post-treatment.

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3216 Board #181 June 1 3:30 PM - 5:00 PM

**Intense Training Improves Prognosis On An Ex-elite Athlete With Smoldering Multiple Myeloma**

Daniel A. Boulosa<sup>1</sup>, Laurinda Abreu<sup>2</sup>, Anthony S. Leicht<sup>3</sup>. <sup>1</sup>Universidade Católica de Brasília, Brasília, Brazil. <sup>2</sup>Lavadores, Vigo, Spain. <sup>3</sup>James Cook University, Townsville, Australia.

(No relationships reported)

**PURPOSE:** To evaluate the influence of a supervised training program on: changes in serum monoclonal protein level (i.e. IgG), percentage of bone marrow plasma cells (BMPCs), performance, and cardiac autonomic control (i.e. heart rate [HR] variability [HRV]) on a female diagnosed with smoldering multiple myeloma.

**METHODS:** A 38-year-old female patient with smoldering multiple myeloma and former elite youth athlete, was followed for four years while participating in a high intensity training regime designed for the development of various physical capacities. HRV was evaluated via time (root mean square of successive differences [RMSSD]) and frequency (low [LF] and high [HF]) domain parameters with analysis of two 24 hrs R-R recordings per week during a six week period at the middle and the end of the follow-up. Changes in muscular strength, muscular endurance, and aerobic capacity; IgG levels, and BMPCs were evaluated throughout the entire follow-up.

**RESULTS:** HRV parameters exhibited significant ( $p < 0.01$ ) increments (18-29%) in RMSSD, LF, HF with the LF/HF ratio being ( $2.28 \pm 0.41$  vs.  $2.22 \pm 0.43$ ,  $p = 0.595$ ) unchanged. Exercise performance was significantly improved (e.g. 233 % increase in maximum number of pull-ups, and 22% increase in 1 repetition maximum bench press). Similarly, IgG levels exhibited a significant ( $p < 0.001$ ) reduction (44%, from 3,290 mg-dL<sup>-1</sup> vs. 1,840 mg-dL<sup>-1</sup>) while BMPCs also decreased from 20% to 10%.

**CONCLUSIONS:** The current case report results indicated that an intense training program designed for the development of various physical capacities, and adapted to the patient's former elite training background, significantly improved exercise performance, cardiac autonomic control, and hematologic function that may improve long-term prognosis for smoldering multiple myeloma. Examination of similar exercise training for other cancer populations may assist in the development of treatment regimes for improved prognosis.

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3217 Board #182 June 1 3:30 PM - 5:00 PM

**Three-Dimensional Global Area Tracking is a Valuable Quantitative Parameter for Left Ventricular Function in Athletes**

Victor C. Wang<sup>1</sup>, Frank Mayer<sup>1</sup>, Marc Dorenkamp<sup>2</sup>, Klaus Bonaventura<sup>3</sup>. <sup>1</sup>University Outpatient Clinic Potsdam, Potsdam, Germany. <sup>2</sup>Charité - Universitätsmedizin Berlin, Berlin, Germany. <sup>3</sup>Klinikum Ernst von Bergmann, Potsdam, Germany.

(No relationships reported)

The one- and two- dimensional echocardiography offers established methods for quantitative evaluation of left ventricle systolic function such as the measurements of the ejection fraction by Teichholz or Simpson. In recently developed three-dimensional (3D) speckle tracking, the result of area tracking is used as a new method with global strain measurement to quantify global and regional left ventricular function. Global area tracking can be calculated by the time-to-peak area tracking related to the heart cycle and may offer an alternative to current echocardiographic standards for quantitative assessment of global left ventricular function in athletes.

**PURPOSE:** The aim of this study is to determine the correlation between ejection fraction and global area tracking in cardiovascular patients and athletes.

**METHODS:** Standard 3D speckle tracking echocardiography was performed in 21 healthy athletes (age  $23 \pm 4.8$  yr, height  $186 \pm 9.4$  cm, weight  $84 \pm 10.2$  kg) and 9 cardiovascular patients. Ejection fraction and area tracking values were calculated by 3D wall motion tracking software. Echocardiography measurements of 3 consecutive beats were taken from each subject during the tests. Mean values of 3 measurements from both ejection fraction and area tracking were calculated for Spearman's rho correlation tests for nonparametric statistical comparisons.

**RESULTS:** Mean values for ejection fraction were  $55 \pm 5\%$  in athletes and  $55 \pm 8\%$  in patients. Mean values for global area tracking were  $-39 \pm 4\%$  in athletes and  $-38 \pm 6\%$  in patients. All three groups of the subjects (21 athletes, 9 patients and combined group of 30 subjects) showed significant negative correlation between ejection fraction and area tracking. Correlations were found for athletes  $\rho = -.776$ , for cardiovascular patients  $\rho = -.929$  and for combined group  $\rho = -.855$ . All correlations were significant ( $p < 0.01$ ) (2-tailed).

**CONCLUSION:** Significant negative correlations between ejection fraction and area tracking were found regardless of different physical fitness and cardiovascular conditions in athletes and cardiovascular patients.

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3218 Board #183 June 1 3:30 PM - 5:00 PM

**Regular Exercise As A Protective Factor Against Obesity Risk Among Extreme Sleep Phenotypes In Athletes**

Christopher P. Herrera, Abdulaziz Farooq. ASPETAR-Qatar Orthopaedic & Sports Medicine Hospital, Doha, Qatar.

(No relationships reported)

Recent studies suggest a strong relationship between extreme sleep phenotypes (e.g. short and long sleepers) and higher obesity rates in the general population. Increased adiposity and a lack of physical activity are reported to mediate this relationship. Notably, sleep phenotype has not been explored in an athlete population but is of interest given the apparent differences in lifestyle patterns of physical activity compared to the general population which may attenuate the risk of obesity.

**PURPOSE:** To determine the influence of regular physical activity in athletes on factors underlying the relationship between sleep and obesity risk.

**METHODS:** Football players ( $n = 111$ ,  $23.6 \pm 5$  years, range 17-35) from the Qatar Stars League who were attending pre-competition screening assessments during August 2011 were queried using a standardized sleep questionnaire. The Arabic version of the Pittsburgh Sleep Quality Index (PSQI) was used to determine the quantity and quality of sleep. The reported total sleep time was used to establish sleep phenotype: short 9h. Height and weight were assessed from chart review and used to calculate body mass index (BMI, kg/m<sup>2</sup>). The percent body fat (BF) was determined by DEXA scan. All athletes underwent hematological investigations for lipid profile (cholesterol - HDL, LDL - and triglyceride). Between-group comparisons were made using ANOVA and the association between sleep quantity (TST) and BMI or BF was determined by pearson correlation.

**RESULTS:** Sleep phenotype was normally distributed: short (18%), regular (66.7%), and long (15.3%). Sleep quality was worse in short sleepers (PSQI  $7.2 \pm 2$ ) compared to regular (PSQI  $5.2 \pm 2$ ) and long (PSQI  $5.5 \pm 2$ ) sleepers ( $p < 0.05$ ). Total cholesterol, HDL, LDL and triglycerides were similar between groups ( $p$  values range 0.39-0.91). TST was poorly associated with BMI ( $r = -0.11$ ,  $p = 0.27$ ) and BF ( $r = -0.02$ ,  $p = 0.85$ ).

**CONCLUSIONS:** The relationship between sleep phenotype and higher obesity risk was not present in this group of football players. Although the mechanisms remain unclear, regular sports participation likely plays a protective role against increased obesity risk in athletes with extreme sleep phenotype.

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3219 Board #184 June 1 3:30 PM - 5:00 PM

**Sleep Quality and Daytime Sleepiness in High-Performance Athletes**

Andreas Mierau, Kim Reuland, Julia Mierau, Heiko K. Strueder. German Sport University, Cologne, Germany.

(No relationships reported)

There is strong scientific evidence that metabolic, neuroendocrine, immunologic, restorative physiologic, memory and psycho-motor functions are negatively affected by sleep restriction. Elite athletes are particularly exposed to factors that may impair sleep quality such as mental and physical stress and forced shifts of the individual circadian sleep/wake phase due to training and competition schedules. The quality of sleep among elite athletes, however, is not well documented.

**PURPOSE:** To determine sleep quality, daytime sleepiness and chronotype distribution in Luxembourgian elite athletes as well as to analyze the role of gender and time of season in this context.

**METHODS:** 23 (11 females: 21.4 ± 2.3 years; 171.2 ± 8.7 cm; 61.3 ± 6.1 kg and 12 males: 19.9 ± 1.9 years; 179.2 ± 8.3 cm; 72.8 ± 8.6 kg) Luxembourgian elite athletes from different sports completed three online questionnaires with regard to their sleep quality (Pittsburgh Sleep Quality Index: PSQI), the daytime sleepiness (Epworth Sleepiness Scale: ESS) and the individual chronotype (Athlete Morningness/Eveningness Scale: AMES). Respondents were also asked to specify their individual time of the season (preparation, competition, transition or rest period).

**RESULTS:** 39% of the athletes who participated in this survey were chronotyped as "normal" or "moderate morning type" and 22% as "moderate evening type" with no effect of gender. 40% of the athletes scored greater than or equal to 5 on the PSQI, indicating poor sleep quality. There was no effect of gender but a trend towards better sleep quality in the competition if compared to the transition period and in the transition if compared to the rest period. Furthermore, 17% of the athletes had ESS scores higher than 10 and 13% higher than 14 indicating abnormal and clinically relevant daytime sleepiness, respectively.

**CONCLUSION:** The current study suggests that there is a relatively high prevalence of poor sleep quality in elite athletes. Moreover, our results suggest that time of the season could be a crucial factor for sleep disturbances. In combination with our results on daytime sleepiness we conclude that individual sleep schedules including daytime naps could be helpful to improve sleep quality and to reduce daytime sleepiness in elite athletes.

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**3220** Board #185 June 1 3:30 PM - 5:00 PM

**Exhaled Nitric Oxide Predicts Airway Inflammation Of The Rugby Players During Training Camp**

Tomoko Imai<sup>1</sup>, Shoji Takayanagi<sup>1</sup>, Masahiro Takemura<sup>1</sup>, Takuo Furukawa<sup>1</sup>, Kazuhiro Shimizu<sup>1</sup>, Takeo Akama<sup>2</sup>, Shunpei Miyakawa<sup>1</sup>, Koichi Watanabe<sup>1</sup>. <sup>1</sup>University of Tsukuba, Tsukuba, Japan. <sup>2</sup>Waseda University, Tokorozawa, Japan.

(No relationships reported)

A high prevalence of exercise induced respiratory symptoms, bronchial hyper responsiveness (BHR) and airway inflammation have been reported in athletes. The exhaled nitric oxide fraction (FeNO) has been proposed as a useful marker of airway inflammation. Previous studies reported changes in FeNO during and after exercise. Practice load and bout during training camp seemed to be higher than those of daily training. So airway inflammation may be higher during training camp than during daily training. However, there had been not investigated with FeNO during training camp.

**PURPOSE:** The purpose of the study is to investigate the airway inflammation of rugby players during training camp

**METHODS:** 69 rugby players participated in this study. We measured their FeNO before training camp (Pre), during middle of training camp (mid-camp) and at the end of training camp (end-camp). They were also asked about the history of respiratory symptoms. FeNO were measured by using a portable MINO (NINOX MINO).

**RESULT:** The rugby players average age, height and weight were 19.5±5.1yr, 176.4±6.2cm, 83.6±13.4kg. Twenty of 69 who reported respiratory symptoms had asthma or past history of asthma. And thirty-two of them had allergy such as allergic dermatitis, nasal inflammation, allergic rhinitis, and food allergy. FeNO of the Pre was 28.2±28.6ppb. 27 rugby players exceeded the normal limit of airway inflammation level (FeNO<25). FeNO of the mid-camp and end-camp were 25.3±15.8ppb, 25.6±16.2ppb. 15 players whose Pre NO levels were under the limit exceed airway inflammation level during camp. Players of less than FeNO<13ppb didn't exceed the FeNO≥25.

**DISCUSSION:** We found 42% of all players had airway inflammation without past history of asthma. 15 rugby players with Pre FeNO ≥13ppb exceeded normal airway inflammation level during camp. Strenuous training of camp may influence response to developing of their airway inflammation. Those whose Pre exceeded 50ppb showed the decline FeNO during the camp. It was suggested that training of the previous day might be influence on the FeNO level of next day.

**CONCLUSION:** Many rugby players who trained hard had airway inflammation. If the athletes FeNO levels are over 13 ppb before the training camp, airway condition of the athletes might change according to training load or training condition.

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**F-31 Free Communication/Poster - Mental Health**

JUNE 1, 2012 1:00 PM - 6:00 PM

ROOM: Exhibit Hall

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**3221** Board #186 June 1 2:00 PM - 3:30 PM

**Stress Habituation and Alterations in Perceived Stress Predict BMI Percentile Changes Across a School Year.**

April M. Seelbinder, Denise M. Fedra, Joan Dorn, James N. Roemmich, FACSM. University at Buffalo, Buffalo, NY.

(No relationships reported)

Adolescents experience stressful situations at a high rate during school. Indeed, school is the most common source of stress for teens. This high rate of stress may promote increases in adiposity during a developmental period important for establishing the adult physique. Adiposity gains may be the result of teens engaging in common stress coping behaviors; snacking on energy dense foods, television, and reduced physical activity; all of which may increase adiposity. Adolescents who experience repeated bouts of the same stressors during the school year and continue to react to them would be most at risk for gains in adiposity. However, teens who habituate faster, or reduce their responding to repeated presentations of the same stressor may seek out fewer obesogenic coping mechanisms, which may be protective against gains in adiposity.

**PURPOSE:** To determine the relationship between alterations in perceived stress levels and BMI percentile across a school year, and to determine whether the rate of habituation to stress is associated with alterations in BMI percentile.

**METHODS:** 41 adolescents ages 13-16 y completed the Perceived Stress Survey-14 prior to the beginning and at the end of the academic year. Adolescents' height and weight was also measured at both time points. The stress habituation protocol was completed once and consisted of 6 mental serial subtraction trials and measured the rate of reduction in perceived stress across trials. 34 of the 41 adolescents completed the habituation protocol.

**RESULTS:** When controlling for gender, race, family position on the social ladder and change in physical activity, increases in perceived stress across the school year predicted ( $\beta = 0.44$ ,  $p < 0.02$ ) increases in BMI percentile. When using the same covariates, a rapid reduction in (quicker habituation) perceived stress to repeated presentations of the same stressor was associated ( $\beta = 28.1$ ,  $p < 0.05$ ) with smaller changes in BMI percentile.

**CONCLUSIONS:** Increases in adolescents' perceived stress during a school year may promote increases in BMI percentile. A greater habituation to repeated presentations of the same stressor may be protective against increases in BMI percentile. Supported by a UB 2020 Interdisciplinary Research Development Fund.

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**3222** Board #187 June 1 2:00 PM - 3:30 PM

**Body Fat Percentage Predicts HRQoL over Measures of Fitness and Activity in Postmenopausal Sedentary Women**

Elizabeth S. Edwards, Layne E. Eidemiller, Christopher J. Womack, FACSM, Judith A. Flohr. James Madison University, Harrisonburg, VA.

(No relationships reported)

**PURPOSE:** The purpose of this study was to determine the association of Health-Related Quality of Life (HRQoL) with certain anthropological measures, cardiovascular fitness, muscular strength, and physical activity (PA) in sedentary postmenopausal women.

**METHODS:** Data was collected at baseline on thirty-four postmenopausal sedentary women (age 57.9 ± 4.7 yrs.) as part of a larger pilot study. Measurements included: waist circumference (WC), body fat % via DXA (BF%), maximum relative oxygen consumption (VO2max), chest press, leg press, and physical activity via the IPAQ. Chest press and leg press 1RM were estimated from 5RM measurements, and then were converted to ratios by dividing the weight lifted by body weight. HRQoL was evaluated using the CDC 4-question Healthy Days module. Bivariate Pearson's correlations were used to identify variables that were associated with HRQoL. Stepwise regression was then used to identify variables that significantly predicted HRQoL.

**RESULTS:** The average number of healthy days in the previous month was  $23.5 \pm 8.8$ . Both BF% ( $r = -0.47, p = .006$ ) and VO<sub>2</sub>max ( $r = 0.40, p = .021$ ) were significantly associated with HRQoL, but neither measure of muscular strength nor IPAQ were significantly correlated with HRQoL. In the regression model, only BF% significantly predicted HRQoL,  $b = -0.69, t(32) = -2.97, p = .006$ . BF% explained a significant proportion of the variance in HRQoL,  $R^2 = 0.22, F(1,32) = 8.83, p = .006$ .

**CONCLUSIONS:** BF% explained a significant proportion of HRQoL, whereas measures of cardiovascular and muscular fitness, as well as physical activity, did not. This is contrary to what has been reported previously in the literature, which have consistently indicated a correlation between HRQoL and self-reported PA. However, previous studies have primarily used other forms of measuring HRQoL, such as portions of the Short Form-36, as well as various self-report methods for PA. Additionally, it should also be noted that HRQoL correlated highly with VO<sub>2</sub>max and IPAQ, which may indicate that BF% mediates the effect of cardiovascular fitness and PA on HRQoL.

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**3223** Board #188 June 1 2:00 PM - 3:30 PM

**Assessment of VO<sub>2</sub>max and Body Composition Following a 3-Month Wellness Intervention for Severe Mental Illness**

Jeremy A. Patterson, FACSM<sup>1</sup>, Rachel M. Drake<sup>1</sup>, Alisha Shoenecker<sup>2</sup>, Judy A. Johnston<sup>3</sup>. <sup>1</sup>Wichita State University, Wichita, KS. <sup>2</sup>Breakthrough, Wichita, KS. <sup>3</sup>University of Kansas School of Medicine, Wichita, KS.

(No relationships reported)

Maximal aerobic capacity (VO<sub>2</sub>max) is a good indicator of overall health and is commonly measured in the general population, but often goes overlooked in individuals with severe and persistent mental illness (SMI).

**PURPOSE:** To assess the VO<sub>2</sub>max, weight, and BF% in individuals with SMI, before and after a wellness intervention.

**METHODS:** Weight, BF%, and VO<sub>2</sub>max were measured pre and post a 3-month wellness intervention that included exercise promotion, dietary education, and group activities. VO<sub>2</sub>max was assessed by the YMCA bike test and BF% by skinfolds. Baseline measures compared to endpoint were analyzed with all participants, separated by gender and disorder.

**RESULTS:** 49 individuals ( $43 \pm 13.20$  yrs/ $27/22$  m/f) were assessed. SMI classifications were: schizophrenia ( $n=11$ ), bipolar disorder ( $n=17$ ), schizoaffective disorder ( $n=14$ ), major depressive disorder (MDD) ( $n=7$ ). No significant difference was observed between pre / post measurements of BF% in all diagnoses except MDD. Males with MDD benefited from a wellness intervention reporting a significantly lower BF% ( $p(.036); p<0.05$ ). No significant change in VO<sub>2</sub>max was observed following the intervention ( $p(.0358); p<0.05$ ). Individuals with SMI continually rated in the very poor to poor classifications for VO<sub>2</sub>max.

**CONCLUSION:** Individuals with SMI tend to have low VO<sub>2</sub>max and high BF%. Individuals in the current study did not statistically benefit from a wellness intervention in terms of BF% and VO<sub>2</sub>max except males with MDD. Males with MDD significantly lowered their BF% following a wellness intervention. Although this study statistically found no significant increase in VO<sub>2</sub>max in this cohort following a wellness intervention, it is worth noting the variations in test results in this study. 14 of the participants showed significant improvements from pre to post ( $26.63 \pm 6.93$  to  $35.00 \pm 9.05$  ml/kg/min respectively) and 9 of the participants that started with a higher VO<sub>2</sub>max showed equally, significant decreases ( $35.56 \pm 11.62$  to  $26.20 \pm 10.16$  ml/kg/min), suggesting how complicated this type of study is with this population. Many participants will experience set backs that rapidly affect their health and others that can remain stable and adapt to a routine will benefit greatly, as was observed in our study.

Supported by RWJ Foundation Grant.

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**3224** Board #189 June 1 2:00 PM - 3:30 PM

**Objectively Measured Physical Activity Characteristics and Depressive Symptoms in Older Latino Adults**

Eduardo E. Bustamante<sup>1</sup>, Alexis F. Manning<sup>2</sup>, Beth A. Staffileo<sup>2</sup>, Louis Fogg<sup>2</sup>, JoEllen Wilbur<sup>2</sup>, David X. Marquez, FACSM<sup>1</sup>. <sup>1</sup>University of Illinois at Chicago, Chicago, IL. <sup>2</sup>Rush University Medical Center, Chicago, IL.

(No relationships reported)

**PURPOSE:** Older Latinos have the highest rates of major depression among racial/ethnic groups in the US, a problem that is compounded by barriers to care, resulting in high unmet need. Latinos report the least leisure-time physical activity (LTPA) but participate in the most objectively-measured PA of any racial/ethnic group due to high levels of non-LTPA (i.e. household, occupational, and transportation PA). The influence of non-LTPA, best captured by accelerometry, on depressive symptoms in minority populations has been understudied. Thus, the purpose of this study is to examine the relationship between characteristics of objectively-measured PA (i.e., dose, intensity, and bout duration) and depressive symptoms in older Latinos.

**METHODS:** A total of 174 older Latinos ( $\geq 50$ ) completed interview style questionnaires and wore a triaxial accelerometer for 7 days. Output was used to estimate time spent in light, moderate, and vigorous intensity PA categorized by Miller (2010) cutpoints. Multiple linear regression analyses were used to predict Center for Epidemiologic Studies Depression Scale (CES-D) score. Established correlates of depression in older Latinos (i.e., age, gender, income, disability, education, acculturation, marital status, chronic disease, perceived health, and perceived hardship) were entered first. Then PA variables (i.e., minutes of total PA/day [dose], light, moderate, and vigorous PA/day [intensity], and minutes of light and moderate PA in 10-min bouts/day [bout duration]) were entered separately as additional terms to test for increments in variance explained by the model.

**RESULTS:** Most participants were female (74%), Mexican (55%), and Latino-oriented (85%). Twenty-two percent met CES-D criteria for possible depression ( $\geq 16$ ). Daily minutes of moderate PA ( $M = 30.3, SD = 28.4, \beta = -.18, \Delta R^2 = .02, p < .05$ ) and minutes of moderate PA in 10-min bouts ( $M = 12.1, SD = 17, \beta = -.22, \Delta R^2 = .04, p < .01$ ), but not daily minutes of total, light, or vigorous PA, emerged as significant independent predictors of depressive symptoms.

**CONCLUSIONS:** Results provide preliminary evidence that the relationship between depressive symptoms and PA in older Latinos is driven by moderate PA and PA in 10-min bouts, while light PA and PA in shorter bouts may have a smaller impact on depressive symptoms in this population.

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**3225** Board #190 June 1 2:00 PM - 3:30 PM

**Association of Park Access with Usual Stress of Adolescents**

Denise Feda, April Seelbinder, Samina Raja, Li Yin, James Roemmich, FACSM. University at Buffalo, Buffalo, NY.

(No relationships reported)

Chronic usual stress is associated with obesity, weight gain, disorders of growth, development, and metabolism, and is also a risk factor for chronic diseases, such as cardiovascular disease. Previous studies have found that the presence of subjective measures of green space in adolescents' built environment may protect against daily psychological stress, but did not control for the potential stress reducing benefits of physical activity.

**PURPOSE:** To determine the association between objective measures of neighborhood park area and usual stress of adolescents, while controlling for physical activity.

**METHODS:** 32 boys and 36 girls, ages 12-15, completed one-week of accelerometer and activity recording. Adolescents completed the PSS-14 measure of perceived stress, and parents completed a demographic questionnaire. Neighborhood built environment and park access variables were calculated using a geographic information system (GIS) and ArcGIS 9 and Network Analyst software. A network 0.5 mile was used for distance calculations. Accelerometer data were screened for completeness by trained researchers and converted to METs. Multiple regression was used to test the association of park area and the interaction of park and gender with usual stress while controlling for socioeconomic status and physical activity.

**RESULTS:** Separate models of neighborhood total park area (ft<sup>2</sup>) ( $\beta = -0.000007, p \leq 0.05$ ) and percentage of park area ( $\beta = -67.53, p \leq 0.03$ ) both predicted usual stress.

**CONCLUSIONS:** Access to neighborhood parks and green space may buffer usual stress of adolescents, even when controlling for socioeconomic status and the protective effects of exercise on stress. Supported by NIH Grant HD055270.

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## F-32 Free Communication/Poster - Nutrition Knowledge and Dietary Supplement Behaviors

JUNE 1, 2012 1:00 PM - 6:00 PM  
ROOM: Exhibit Hall

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**3226** Board #191 June 1 3:30 PM - 5:00 PM

### The Relationship of Socio-Demographic Characteristics and Nutrition Knowledge in Triathletes

Daniel Christopher Washmuth, Celines Martinez, Valerie George. *Florida International University, Miami, FL.*  
(No relationships reported)

Previous studies have shown that as a person's nutrition knowledge increases, nutritional content of consumed food improves. A number of socio-demographic factors can influence nutrition knowledge. The relationship of socio-demographic characteristics and nutrition knowledge in Triathlete is unknown even though nutrition plays a key role in performance and in overall health.

**PURPOSE:** To determine the relationship of socio-demographic characteristics (i.e., gender, age, education, income, and marital status) on the nutrition knowledge of triathletes.

**METHODS:** An online survey was conducted in the fall of 2011. Emails were sent to potential participants through triathlon clubs and organizations in the U.S. asking them to complete the four sections of the *Nutrition Knowledge Questionnaire; Dietary Recommendations, Sources of Food/Nutrients, Choosing Everyday foods, and Diet-Disease Relationship* (Wardle and Paramater, 2001).

**RESULTS:** A total of 104 triathletes (54 female, 50 male) completed the questionnaire. The mean percent correct score was; *Dietary Recommendations* ( $68 \pm 19$ , mean  $\pm$  S.D.), *Sources of Food/Nutrients* ( $70 \pm 21$ ), *Choosing Everyday Foods* ( $60 \pm 2$ ). Marital status influenced nutrition knowledge, with triathletes who reported being married having a significantly ( $p < 0.05$ ) higher Total Nutrition Knowledge (TNK) score (69%) compared to single (50%). The majority (45%) were college graduates, 40% had post graduate degrees. Eighty eight percent reported income  $>$  \$50,000. There was a significant correlation ( $p < 0.05$ ) between TNK score and education and household income. The scores in the *Choosing Everyday Foods* were the lowest out of all the categories. The triathletes reported that they believed the recommendations for fruits and vegetables was 4 servings/day.

**CONCLUSIONS:** The high level of education and income of these Triathlete perhaps provided them with the opportunity to learn more about nutrition either through formal education or guidance of a nutritional professional. However, athletes with less education and lower income may be in need of assistance to increase nutrition knowledge. Since the score for the category, *Choosing Everyday Foods* was the lowest, Triathletes need more education to help them understand how they can apply nutrition knowledge in making healthy food choices.

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**3227** Board #192 June 1 3:30 PM - 5:00 PM

### Education to Empower Collegiate Athletes to Fuel for Better Health and Performance

Kelly M. Ping, Nanna L. Meyer. *University of Colorado, Colorado Springs, CO.*  
(No relationships reported)

**PURPOSE:** The demands of combining academics and athletics put college athletes under pressure to succeed, and in order to be successful, athletes must have an understanding of how to effectively fuel their bodies. Research shows that athletes with a higher level of sport nutrition knowledge make better choices related to the intake of food and fluids, which positively affects performance, health, and social interactions. The purpose of this study was to enhance athletes' sport nutrition knowledge and dietary behavior through interactive educational approaches.

**METHODS:** Twenty-nine athletes were assigned to the experimental group (EXP; females=20; males=9; freshmen=10, sophomores=10, juniors=7, seniors=2) and 13 athletes to the control group (CON; females=6; males=7; freshmen=3, sophomores=6, juniors=3, seniors=1). EXP included cross-country (7), track (6), soccer (8), and softball (3) players with an average of  $19 \pm 1.2$  y, height of  $172 \pm 9.8$  cm, and weight of  $66.4 \pm 10.2$  kg. CON consisted of cross-country (9), softball (2), and volleyball (2) players, who opted out of the intervention. Each participant completed a previously validated and reliable sport nutrition knowledge questionnaire at the beginning and the end of the 6-month intervention, which was comprised of 4 interactive workshops using experiential learning (i.e. fueling for performance, grocery shopping, cooking/eating together, and body image and acceptance). It was hypothesized that EXP would have improved sport nutrition knowledge and dietary behaviors compared to CON.

**RESULTS:** Paired t-tests showed that EXP increased nutrition knowledge, while CON did not (EXP:pre SNK:  $43.7 \pm 9.1$ ; post SNK:  $50.6 \pm 4.8$  [ $p < 0.001$ ]; CON pre SNK:  $48.2 \pm 6.6$  and post SNK:  $49.0 \pm 10.1$  [ $p = 0.914$ ]). Behaviorally, EXP showed a significant increase in daily vegetable consumption (pre:  $2.0 \pm 1.6$ ; post:  $2.2 \pm 1.5$ ;  $p = 0.006$ ) and a trend in weekly food preparation (pre:  $2.1 \pm 2.2$ ; post:  $3.0 \pm 2.3$ ;  $p = 0.053$ ) with no difference in CON from pre to post.

**CONCLUSION:** This study shows that providing interactive learning opportunities to college athletes improves sport nutrition knowledge and dietary behaviors, such as eating more vegetables and preparing meals more frequently at home or in the dorms.

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**3228** Board #193 June 1 3:30 PM - 5:00 PM

### Anaerobic Performance In Women Is Unaffected By An Eight-week Lacto-ovo Vegetarian Diet

Emily J. Sauer, Jessica Knurick, Gavin Moir, Shala E. Davis, FACSM. *East Stroudsburg University, East Stroudsburg, PA.*  
(No relationships reported)

Vegetarian diets are associated with health benefits such as lower incidence of diabetes, obesity, and ischemic heart disease. Despite these benefits, the consequences of a vegetarian diet on athletic performance have been questioned. Specifically, the effects of vegetarianism on anaerobic performance are largely unexplored.

**PURPOSE:** The purpose of this study was to evaluate the effects of a vegetarian diet on anaerobic performance.

**METHODS:** Twenty-two recreationally active women ( $21.7 \pm 1.6$  years) were matched and assigned to either a lacto-ovo vegetarian (LO;  $n = 11$ ) or omnivorous (OM;  $n = 11$ ) diet for 8 weeks. Subjects were tested prior to (PRE), midway (MID), and following the 8 week diet (POST). Wingate anaerobic cycle tests were performed to determine peak power (PP) and fatigue index (FI). Lean body mass (LBM) was assessed using air displacement plethysmography. Repeated measures ANOVA were used to analyze LBM, FI, and PP.

**RESULTS:** There was no difference in PP between LO (PRE:  $628.8 \pm 42.0$ W; MID:  $719.4 \pm 52.3$ W; POST:  $679.7 \pm 47.9$ W) and OM (PRE:  $645.9 \pm 67.4$ W; MID:  $663.5 \pm 58.5$ W; POST:  $640.2 \pm 53.8$ W) at any time point ( $p = 0.6$ ) or as a result of diet ( $p = 0.6$ ). There was no difference in FI between LO (PRE:  $68.7 \pm 5.1$ %; MID:  $62.3 \pm 3.5$ %; POST:  $66.5 \pm 4.7$ %) and OM (PRE:  $62.3 \pm 3.3$ %; MID:  $71.5 \pm 3.4$ %; POST:  $69.7 \pm 3.5$ %) at any time point ( $p = 0.5$ ) or as a result of diet ( $p = 0.8$ ). There were no differences in LBM in either group (LO:  $48.4 \pm 1.7$ kg (PRE);  $47.7 \pm 1.7$ kg (MID);  $43.0 \pm 4.6$ kg (POST). OM:  $44.8 \pm 3.4$ kg (PRE),  $46.6 \pm 2.3$ kg (MID),  $46.9 \pm 2.4$ kg (POST)) at any time point ( $p = 0.8$ ) or as a result of diet ( $p = 0.2$ ).

**CONCLUSION:** The present study found that anaerobic performance and lean body mass is unaffected by an 8 week lacto-ovo vegetarian diet. Future studies should evaluate the effects of a vegetarian diet on athletes to assess anaerobic athletic performance.

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**3229** Board #194 June 1 3:30 PM - 5:00 PM

### The Effects of a Vegetarian Diet on Anaerobic Capacity and Body Composition

Jessica R. Knurick, Shala E. Davis, FACSM, Emily J. Sauer, Gavin L. Moir. *East Stroudsburg University, East Stroudsburg, PA.*  
(No relationships reported)

The adoption of a vegetarian diet is a growing trend amongst both the general and athletic populations today. However, despite the evidence of health advantages, there is considerable speculation regarding the efficacy of a vegetarian diet on anaerobic, strength-based performance.

**PURPOSE:** To evaluate the effects of an 8-week forced lacto-ovo vegetarian (LO) diet on anaerobic capacity and body composition in active females aged 19-24.



**METHODS:** In an 8-week interventional design, 22 women (21.73 ± 1.61 years) were matched and assigned to either an LO (n=11) or omnivorous (OM; n=11) group. The LO group abstained from eating meat, fish, and poultry, while maintaining activity level during the 8 weeks. Mean power, 1RM squat strength, and body fat percentage were all assessed in both groups at pre, mid, and post testing periods.

**RESULTS:** There were no significant changes in mean power output from pre to post testing within or between dietary groups (Pre-OM: 375.20 ± 83.67, Post-OM: 375.32 ± 78.94, Pre-LO: 412.76 ± 86.00, Post-LO: 403.94; p > 0.05). 1RM squat performance significantly increased in both groups at each testing session (Pre-OM: 139.44 ± 27.66, Mid-OM: 160 ± 28.5, Post-OM: 171.11 ± 20.73, Pre-LO: 172.5 ± 41.98, Mid-LO: 181 ± 42.48, Post-LO: 198 ± 35.1; p 0.05). No changes in body fat percentage were experienced from pre to post testing within or between dietary groups (Pre-OM: 26.02 ± 7.53, Post-OM: 26.75 ± 7.75, Pre-LO: 24.99 ± 4.67, Post-LO: 26.24 ± 3.24; p > 0.05).

**CONCLUSION:** Adherence to either an LO or OM diet over an eight-week period was shown to have no effects on anaerobic capacity or body composition measures.

**3230 Board #195 June 1 3:30 PM - 5:00 PM**

**Nutritional Evaluation of Physical Active Individuals Assisted in Nutrition Clinic from a Brazilian Federal University**

Aline G. Amorim, Fabiana B. Ferreira, Jessica Mm Moraes, Maria En Santos, Patricia P. Correa. *Federal University of Maranhao, Sao Luis, Brazil.*  
(No relationships reported)

**BACKGROUND:** Nutritional requirements of physically active individuals differ from sedentary individuals, and the dietitians's approach is important in this context.

**PURPOSE:** To evaluate, from a nutritional point of view, physical active subjects attending a sports nutrition clinic in a federal university from Brazil.

**METHODS:** Data regarding physical activity, anthropometry (Body Mass Index-BMI, waist circumference) and food (use of dietary supplements, food frequency according to Food Pyramid groups, 24-hour recall) were obtained from patients, assisted by a nutritionist, who practice regular physical activity (active for at least 3 months, 3 times / week). Data were analyzed using unpaired t-test between gender, where p<0,05 was considered significant.

**RESULTS:** The group consisted of 22 patients, with mean age 36.8 ± 18.6 years. From these, 14 were male (63.6%), and 8 were female (36.4%). 50% of the male individuals and 35.7% of the female preferred weightlifting, while others 35.7% of the female tended to walking. According to BMI, both male (25.0 ± 4.8 kg/m<sup>2</sup>) and female (26.8 ± 4.6 kg/m<sup>2</sup>) were overweight. However, four women (28.6%) were obese, while only one man (12.5%) exhibited such diagnosis. Only 3 patients reported the use of nutritional supplements. A higher frequency was observed for bread, grains and other starches (81.8%), sugar (77.3%), dairy products (72.7%), fats (72.7%) and fruits (68.2%) intake. The energy intake was 3126.0 ± 571.1 Kcal / d for male and 1613.0 ± 191.5 Kcal/ d for female (p <0.05). The protein intake reached 2.1 ± 1.3 and 1.1 ± 0.5 g protein/ Kg body weight for male and female (p<0.05), respectively. Carbohydrate intake did not differ between genders (5.9 ± 3.4 and 3.4 ± 2.9 g carbohydrate/ Kg body weight for men and women, respectively).

**CONCLUSION:** The subjects were mostly female and overweight, in spite of the regular exercise practice. Male subjects had twice the energy intake and protein intake relative to body weight compared to women, who still presented more obese individuals. The patient's nutritional intake should meet their nutritional requirements in order to reverse or even prevent health outcomes that are incompatible to good life style, such as adequate energy consumption, low sugar and fat intake. **ACKNOWLEDGEMENTS:** FAPEMA for financial support

**3231 Board #196 June 1 3:30 PM - 5:00 PM**

**Dietary Supplement Habits of Soldiers of 101st Airborne Division Air Assault**

Kim Crawford<sup>1</sup>, Matthew E. Darnell<sup>1</sup>, Heidi Stapel<sup>1</sup>, Mita T. Lovalekar<sup>1</sup>, John P. Abt<sup>1</sup>, Timothy C. Sell<sup>1</sup>, Larry J. McCord<sup>2</sup>, Michael D. Wirt<sup>2</sup>, Takashi Nagai<sup>1</sup>, Jennifer B. Deluzio<sup>1</sup>, Scott M. Lephart<sup>1</sup>. <sup>1</sup>University of Pittsburgh, Pittsburgh, PA. <sup>2</sup>101st Airborne Division (Air Assault), Fort Campbell, KY.  
(No relationships reported)

To achieve optimal military readiness, Soldiers are turning to dietary supplements (DS) to increase strength, endurance, alertness and overall health.

**PURPOSE:** Evaluate DS habits of 101<sup>st</sup> Airborne Division (Air Assault) Soldiers.

**METHODS:** A total of 390 Soldiers (Age 28.2 ± 6.6 years; BMI 26.5 ± 3.5 kg/m<sup>2</sup>) completed a diet history including a detailed DS questionnaire.

**RESULTS:** Sixty-one percent of Soldiers consumed at least one DS, of these 58% consume multivitamin supplements (MV), 32% whey protein, 16% energy drinks, 10% creatine and 10% nitric oxide (Table 1). Fifty-one percent consume more than one DS.

Table 1: Dietary Supplement Use, Perceived Benefits and Adverse Reactions

| Supplement   | Purpose of Use  | Usage   | Perceived Benefit   | Adverse Reaction  |
|--------------|---|---|---|---|
| MV           | Supplement diet & improve health<br>Improve performance<br>Improve joint health                                 | Military Training (MT) 52%<br>Deployed (DP) 24%<br>Both 24% | More energy/less fatigue<br>Fewer colds<br>Increase well being                    | Nausea  |
| Whey         | Increase muscle mass, strength, recovery<br>Improve performance<br>Supplement diet and improve health           | MT 53%<br>DP 25%<br>Both 16%                                | Increase muscle mass<br>Recovery<br>Weight/body fat loss                          | Decrease appetite<br>Weight gain  |
| Energy Drink | Improve physical performance<br>Improve cognitive function<br>Improve joint health                              | MT 37%<br>DP 34%<br>Both 29%                                | Feel more energized<br>Alertness<br>Stay awake                                    | Jittery feeling<br>Dehydration<br>Indigestion<br>Crashing feeling<br>Dependency |
| Creatine     | Increase muscle mass, strength, recovery.<br>Improve performance<br>Supplement diet and improve health          | MT 50%<br>DP 29%<br>Both 17%<br>N/A 4%                      | Increase work out duration/intensity<br>Increase muscle strength, size, endurance | Upset stomach<br>Dehydration  |
| Nitric Oxide | Increase muscle mass, strength, recovery.<br>Improve physical performance<br>Supplement diet and improve health | MT 53%<br>DP 18%<br>Both 18%<br>N/A 11%                     | Increase energy to workout<br>Less muscle soreness<br>Improve quality of workout  | None reported   |

**CONCLUSION:** Soldiers are using DS to correct nutrient inadequacies and improve the quality of the daily diet, to optimize adaptations from training and expedite recovery and to improve health and physical readiness. Future efforts should focus on educating Soldiers to use foods, fluids and nutrient timing as a safer and more effective alternative to DS.

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3232 Board #197 June 1 3:30 PM - 5:00 PM

**Use of Dietary Supplements by Puerto Rican Athletes at the 2010 Central American-Caribbean Games**

Lucía R. Martínez<sup>1</sup>, Alexis Ortiz<sup>2</sup>, Carolyn Cardona<sup>1</sup>, Iván Cancel<sup>1</sup>, Iván Soto<sup>1</sup>, Carmen Nevárez<sup>2</sup>. <sup>1</sup>University of Puerto Rico-Río Piedras Campus, San Juan, Puerto Rico. <sup>2</sup>University of Puerto Rico-Medical Sciences Campus, San Juan, Puerto Rico. (Sponsor: Farah Ramírez-Marrero, FACSM)  
(No relationships reported)

It has been reported that athletes at different competition levels and of diverse countries look to enhance athletic performance through the use of dietary supplements (DS). However, research on the use of DS by Puerto Rican national athletes is very limited.

**PURPOSE:** To determine dietary supplementation practices of athletes representing Puerto Rico at the 2010 Central American and Caribbean Games.

**METHODS:** Three hundred and fifty athletes (194 men, 156 women) of 23 sports participated in the study. Mean age ( $\pm$  SD) was 23.8  $\pm$  7.8 years, mean competitive years was 8.9  $\pm$  5.4, and training time ranged between 11 to over 25 hours per week. Dietary supplement use was determined through a questionnaire that included: demographic profile, use of DS, reasons for use, sources of information, and places where DS are purchased. Analyses consisted of frequencies and percentages of the variables of interest.

**RESULTS:** Seventy percent (70%) of the athletes reported having used DS in the past 12 months (64.7% men, 78.4% women). Of these, sports drinks (89.3%), multivitamins (65.8%), B12 (32.9%), and protein powder (28.8%) were the DS most used. The main reasons for using DS were to enhance athletic performance (49.4%), health maintenance (47.3) and to increase energy levels (46.1%). The most frequently reported sources of information were the nutritionist/dietitians (35.8%), strength and conditioning coaches (34.6%), and physicians (32.5%). Supplements were mostly obtained in health food stores (44.9%).

**CONCLUSION:** Athletes representing Puerto Rico at the 2010 Central American and Caribbean Games demonstrated dietary supplementation practices similar to those reported by national athletes in other countries.

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3233 Board #198 June 1 3:30 PM - 5:00 PM

**Dietary Supplementation of High Performance Korean and Japanese Judoists**

Jongkyu Kim<sup>1</sup>, Namju Lee<sup>1</sup>, In-ho Cho<sup>1</sup>, Misook Lee<sup>1</sup>, Junghoon Nam<sup>1</sup>, Sung-sook Jung<sup>2</sup>, Hyun-chul Cho<sup>2</sup>. <sup>1</sup>Sports Science Institute, Korea National Sport University, Seoul, Korea, Republic of. <sup>2</sup>Yong-in University, GyeonGi-Do, Korea, Republic of.  
(No relationships reported)

**PURPOSE:** This research investigated the use of dietary supplements patterns and doping awareness among high-ranked Judoists in two countries.

**METHODS:** Korean (70 males and 31 females) and Japanese (37 males and 34 females) national Judo team members divided into two groups (high and low competitive performance levels) according to their international and national rankings.

**RESULTS:** Among Koreans, 59% consumed dietary supplements, whereas 61% of the Japanese consumed dietary supplements. Among Koreans, 88% at the high and 51% at the low competitive performance level consumed dietary supplements, while 68% of high and 57% of low competitive performance level Japanese consumed dietary supplements. The most commonly consumed dietary supplements among Koreans were oriental supplements (34%), vitamins (23%), and protein powder (12%). However, vitamins (45%), protein powder (33%), and minerals (15%) were most commonly consumed among Japanese. Surprisingly, 38% Judoists of both countries had not received any proper education about anti-doping, while 44% had not received about anti-doping list knowledge. In addition, there was a significant difference in education about anti-doping ( $p < 0.001$ ) between high and low competitive performance levels of Korean Judoists. However, Korean Judoists received significantly less anti-doping education than Japanese Judoists ( $p < 0.001$ ). The associations for anti-doping education and anti-doping list knowledge with the use of dietary supplements were 3.46 (95% CI = 1.31-9.12) and 1.63 (95% CI = 0.71-3.76), respectively.

**CONCLUSIONS:** Our findings showed similar trends as previous studies. However, interestingly, we found that Judoists' use of dietary supplement was increased as they experienced anti-doping education.

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3234 Board #199 June 1 3:30 PM - 5:00 PM

**Nutritional Supplement of Triathletes and Source of Supplement Information**

Celines Martinez, Daniel Washmuth, Valerie George. Florida International University, Miami, FL  
(No relationships reported)

Triathlon competitions are made up of three disciplines (swim, bike, run). They can take anywhere from a couple of hours (i.e., sprint triathlon) to over 14 hours (i.e., ironman). Such rigorous activities require adequate nutrition and perhaps in some instances supplements. Little is known about what supplements are being used by Triathlete and where these athletes get their information.

**PURPOSE:** To evaluate the use of nutritional supplements by triathletes, their source of information and purpose for using supplements.

**METHODS:** An online survey was conducted in the fall of 2011. Emails were sent to potential participants through triathlon training clubs and organizations in the U.S. The email invited triathletes to complete the *Supplement Use Survey* created by Froiland et al (2000).

**RESULTS:** One hundred and twenty six triathletes (63 male, 63 female) were surveyed, ranging in age from 18-75 years. The majority (87%) were between 25-54 years of age. Approximately, 60% of the participants reported using supplements  $\geq$  5 times/wk and 28%, 2-4 times/wk. The most frequently used supplements were multivitamins (80%), whey protein (65%), meal/calorie replacement drinks (67%), and fish oils (66%). The most common sources of information for supplements were; fellow athletes (68%), magazines (57%), books (54), and the internet (48%). Only 32% of participants reported receiving nutritional supplement information from a Sports Nutritionist/Registered Dietitian. A large portion of the participants (56%) reported that the reason they used supplements was to prevent injury and illness.

**CONCLUSIONS:** The majority of triathletes in this study reported using a wide variety of supplements but only about a third of those athletes reported seeking information from nutrition professionals before engaging in a supplement regimen. Triathletes have special nutritional needs and would benefit from working with nutrition professionals to ensure they are using the appropriate supplements to achieve optimum nutrition.

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**F-33 Free Communication/Poster - Policy/Recommendations**

JUNE 1, 2012 1:00 PM - 6:00 PM

ROOM: Exhibit Hall

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3235 Board #200 June 1 2:00 PM - 3:30 PM

**Impact Of National Policy For The Reduction Of Obesity In School In Mexico**

Ma. Teresa Melchor Moreno<sup>1</sup>, Fredy Hernan Polo<sup>2</sup>, Jose G. Montaña Corona<sup>1</sup>, Fernando Cervantes Aguayo<sup>1</sup>. <sup>1</sup>Universidad de Guanajuato, Leon, Mexico. <sup>2</sup>Universidad Nacional de Trujillo, Trujillo, Peru, Peru. (Sponsor: Universidad de Guanajuato, FACSM)  
(No relationships reported)

**PURPOSE:** Demonstrate the impact of national physical activation to reduce obesity in schoolchildren 10 to 12 years in the municipality of León, Mexico.

**METHODS:** Evaluated a total of 180 children (100 girls and 80 boys (10 - 12 years). Physical activity level (PAL) was obtained through physical activity questionnaires (PAQ) behavior in relation to physical activity was assessed following the transtheoretical model of Prochaska, environmental factors with socio-environmental survey intra-and extra-curricular.

**RESULTS:** 30 percent of the children showed risk of overweight and obesity, two thirds of these children are female, 47 percent reported adverse environment and 14 percent were found in the contemplation stage. In general, children with an attitude of action were of normal weight, with an average BMI of 20.6 &#177; 2.8, with respect to adverse environment there was no difference between children in the contemplation stage and the action stage (p &#8804 0.05)

**CONCLUSIONS:**The greatest influence on the transition from the contemplation stage to action was given by family and social environment of the school.

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**3236** Board #201 June 1 2:00 PM - 3:30 PM

**Physicians' Views and Experiences of Counseling for Physical Activity: The New Zealand Green Prescription Program**

Asmita Patel<sup>1</sup>, Grant M. Schofield<sup>1</sup>, Gregory S. Kolt<sup>2</sup>, Justin W.L. Keogh<sup>3</sup>. <sup>1</sup>AUT University, Auckland, New Zealand. <sup>2</sup>University of Western Sydney, Sydney, Australia. <sup>3</sup>Bond University, Gold Coast, Australia. (Sponsor: Karen Croteau, FACSM)

(No relationships reported)

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Regular physical activity is beneficial in both the prevention and management of chronic health conditions. A large proportion of adult New Zealanders, however, are insufficiently active. To assist in increasing population levels of physical activity (PA) in New Zealand, the Green Prescription (GRx), a primary care, PA scripting program with ongoing telephone-based support was developed.

**PURPOSE:** To identify why physicians counsel for PA and administer GRxs. A secondary aim was to examine physicians' views and experiences of GRx counseling for the management of depression.

**METHODS:** Individual face-to-face interviews were conducted with 15 primary care physicians. Interviews were audio-taped and transcribed. Data were analyzed using an inductive thematic approach.

**RESULTS:** Physicians counseled for PA and administered GRxs for both primary preventive (e.g., weight control) and secondary management (e.g., diabetes management) purposes. Physicians reported that the benefits of the GRx program centred around two main themes: (i) a non-medication approach to a healthier lifestyle and (ii) the ongoing specialized support provided by the exercise counselor through the telephone counseling. The only main theme that emerged regarding physicians perceived barriers to GRx use related to time constraints around the consultation. PA in general and PA prescribed through the GRx program were viewed by physicians as beneficial for the management of depression.

**CONCLUSION:** GRxs are being administered to individuals who can benefit from physical activity (i.e., those with pre-existing conditions and/or weight problems). GRxs may also be used to promote PA in currently healthy, but low-active and sedentary individuals. Such individuals are at risk for future health-related problems because of their inactive lifestyle. More research is required into the role that the GRx can have in helping manage depression. Supported by Health Research Council of New Zealand Grant 05/279.

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**3237** Board #202 June 1 2:00 PM - 3:30 PM

**Variation Of Knowledge Of ACSM Physical Activity Recommendations With The Use Of Different Information Sources**

Luis Leite<sup>1</sup>, Paulo Gonçalves Pinheiro<sup>2</sup>, Dulce Leal Esteves<sup>3</sup>, Kelly O'Hara<sup>3</sup>, Ricardo Gouveia Rodrigues<sup>2</sup>, Rui Brás<sup>3</sup>. <sup>1</sup>Beira Interior University, Covilha, Portugal. <sup>2</sup>Beira Interior University - Research Unit in Business Sciences, Covilha, Portugal. <sup>3</sup>Beira Interior University & CIDESD, Covilha, Portugal.

(No relationships reported)

Increasing efforts to disseminate ACSM Physical Activity (PA) Recommendations have been made, and the use of both traditional forms and new technologies tools has increased. Nevertheless, little investigation focus on the effect of the use of different information sources and the extent to which knowledge has diffused through a population (knowledge retention).

**PURPOSE:** This study aims to examine whether knowledge the American College of Sports Medicine (ACSM) PA recommendations for Health Promotion varies by the use of different information sources.

**METHODS:** The study included a randomly recruited sample of 848 subjects (54.5% M; 45.5% F), 42.0±19.6 y. The awareness of ACSM PA Recommendations was assessed as indicated by Bennett et al., 2009. A survey was designed to (1) identify main information sources and (2) relate knowledge retention on adequate PA for health benefits and PA information sources.

**RESULTS:** All information sources investigated revealed low adherence. The main information sources identified were friends/family (2.90±1.175); sport professionals (2.81±1.408); Medical doctors (2.65±1.381) and school teachers (2.63±1.406). Recommendations knowledge was significantly higher (p<.05) when information source are sport professionals. Recommendation knowledge was significantly lower (p<0.05) for Internet users (information source Internet or social networks).

**CONCLUSIONS:** Despite efforts to promote PA and widespread knowledge on ACSM recommendations, few (about a quarter) Portuguese adults can accurately identify adequate PA characteristics for health improvement. Sport professionals are the information source that better widespread knowledge on ACSM PA recommendations. The use of new information technologies as PA information source seems to lead to lower level of knowledge, what could be related with quality of PA information on web.

These findings highlight the limited ability to enhance knowledge from existing PA information sources and the need for more effective strategies to widespread accurate information. REFERENCE: Bennett, G., Wolin, K. et al. (2009) Awareness of National Physical Activity Recommendations for Health Promotion among US Adults. Med Sci Sports Exerc. 41(10), pp. 1849-1855

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**3238** Board #203 June 1 2:00 PM - 3:30 PM

**Awareness Of ACSM Physical Activity Recommendations for Health Promotion Among Portuguese Population**

Sergio Vieira<sup>1</sup>, Dulce Leal Esteves<sup>2</sup>, Paulo Gonçalves Pinheiro<sup>3</sup>, Kelly O'Hara<sup>2</sup>, Rui Brás<sup>2</sup>. <sup>1</sup>Beira Interior University, Covilha, Portugal. <sup>2</sup>Beira Interior University & CIDESD, Covilha, Portugal. <sup>3</sup>Beira Interior University - Research Unit in Business Sciences, Covilha, Portugal.

(No relationships reported)

Regular moderate physical activity (PA) has an important influence on health and well-being, but is not clear if people know the adequate PA characteristics for health improvement.

**PURPOSE:** This study aims to examine the extent to which knowledge of the ACSM PA recommendations has diffused through the Portuguese population and whether the knowledge of those recommendations varies by age, gender and education level.

**METHODS:** The study included a stratified randomly recruited sample of 848 subjects (54.5% M; 45.5% F), 42.0±19.6 y. divided in 4 age groups: young (Y): 210 subjects, 15-24 years; young adults (YA): 224, 25-39 years; adults (A) 206, 40-60 years; older (O), 208, > 60 years. The awareness of ACSM Physical Activity Recommendations for Health Promotion was assessed as indicated by Bennett et al., 2009.

**RESULTS:** Almost a quarter of respondents (26.3%) were accurately knowledgeable of the ACSM physical activity recommendations. Recommendations knowledge was slightly higher among women (27.5%) than men (25.5%) and increase with age: Y: 20.1%; YA: 23.2%; A: 27.7% and O: 29.0%. No significant differences were found on recommendations knowledge among the different educational levels investigated.

**CONCLUSIONS:** Despite efforts to promote PA and widespread knowledge on ACSM recommendations, the majority of Portuguese population (73.7%) can not accurately identify adequate PA characteristics for health improvement. These findings highlight the need for more effective campaigns to widespread ACSM recommendations for health promotion.

REFERENCES: Bennett, G., Wolin, K. et al. (2009) Awareness

of National Physical Activity Recommendations for Health Promotion among US Adults. Med Sci Sports Exerc. 41(10), pp. 1849-1855

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3239 Board #204 June 1 2:00 PM - 3:30 PM

**Measuring Progress In The Implementation Of The U.S. National Physical Activity Plan**

Daniel B. Bornstein<sup>1</sup>, Kelly E. Evenson<sup>2</sup>, Sara B. Satinsky<sup>2</sup>, Amy A. Eyster<sup>3</sup>, Ross C. Brownson<sup>3</sup>, Russell R. Pate, FACSM<sup>1</sup>. <sup>1</sup>University of South Carolina, Columbia, SC. <sup>2</sup>University of North Carolina - Chapel Hill, Chapel Hill, NC. <sup>3</sup>Washington University - St. Louis, St. Louis, MO.  
(No relationships reported)

Evaluation of a national physical activity (PA) plan is critical to its overall success; yet, most national PA plans from around the world lack a formal evaluation process. Authors of the U.S. National Physical Activity Plan (NPAP), released in 2010, are committed to evaluation, seeking evidence of achievements and opportunities for improvement. To provide this evidence, change in population levels of PA is a logical outcome to measure; however, it likely will not be evident for years or decades and is influenced by a multitude of factors. Therefore, it is necessary to have more proximal indicators, such as implementation of the NPAP's strategies, which target policy and environmental change.

**PURPOSE:** To identify progress and barriers encountered by six, sector-specific teams leading implementation of the NPAP.

**METHODS:** Quarterly reports were developed and disseminated to six sector-specific teams (Business and Industry; Education; Health Care; Parks, Recreation, Fitness, and Sports; Public Health; Transportation, Land Use, and Community Design) that lead implementation of the NPAP, and documented the following: work being done; progress toward goals; barriers to reaching goals; products or programs developed; practice/policy changes; lessons learned; contributions from external sources; and media coverage generated.

**RESULTS:** Across sector teams, overall efforts to advance the NPAP's strategies occurred in four key areas: 1) generating federal policies, best practice guidelines, national standards, and surveys; 2) educating state-level staff on guidelines; 3) encouraging message promotion by high-level public officials; and 4) generating relevant media coverage. Within each sector team, activities specific to their prioritized strategies were documented, including: products developed; contributions received; lessons learned; and barriers encountered.

**CONCLUSION:** Teams responsible for implementing the NPAP have made demonstrable progress and have reported barriers to advancing the NPAP's sector-specific strategies at national, state, and local levels. Results of these initial efforts may inform similar future attempts to advance physical activity policy at national, state, and local levels.

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3240 Board #205 June 1 2:00 PM - 3:30 PM

**Partnership for Active Community Environments: Translating Research to Action**

Barbara S. McClanahan<sup>1</sup>, Michelle B. Stockton<sup>1</sup>, Sue E. Clark<sup>1</sup>, Rick McClanahan<sup>2</sup>. <sup>1</sup>University of Memphis, Memphis, TN. <sup>2</sup>City of Bartlett, Bartlett, TN. (Sponsor: Healthier Chambliss, FACSM)  
(B.S. McClanahan: Contracted Research - Including Principle Investigator; PI on NIH grant.)

**PURPOSE:** PACE (Partnership for Active Community Environments) is an interdisciplinary collaborative working to increase understandings of supports and barriers to building active, vibrant neighborhoods. Using a community-based participatory research (CBPR) design a townhall meeting of diverse groups of built environment professionals (n=175) was held and action items were identified and prioritized. Encouraging the adoption and maintenance of healthy behaviors through support and increased use of the local 'greenline' (rails-to-trails) emerged as a priority action.

**METHODS:** Through observation and key informant interviews perceptions of safety risks were identified as a significant barrier to physical activity in a low-income, urban neighborhood of high crime and poverty. Using a CBPR design an elementary school adjacent to the high risk area was identified as a target of intervention. PACE members worked with stakeholders (principal, board chair, teachers) and community leaders (neighborhood development corporation, neighborhood association leaders) to identify strategies to address safety concerns, enhance physical activity and encourage the adoption of healthy lifestyles.

**RESULTS:** School leaders and community stakeholders prioritized clearing land adjacent the greenline to address safety concerns and suggested developing a school garden on the land providing 'garden to cafeteria' opportunities for learning and healthful eating. PACE identified and facilitated partnerships to support the initiative. Students worked with PACE staff, community leaders and volunteers to clear ground, prepare soil (spread 2000+ pounds lime), plant and harvest the wide variety of produce. Harvested foods were incorporated into school meals and students were invited to take additional produce home. Observations and key informant interviews revealed that perceptions of safety and student use of the greenline (physical activity) were enhanced.

**CONCLUSIONS:** PACE's collaborative efforts to encourage the adoption and maintenance of healthy behaviors through CBPR practices were successful and can serve as a model for other communities.

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3241 Board #206 June 1 2:00 PM - 3:30 PM

**Should We Treat Workplace Inactivity like Occupational Hazards such as Chemical Exposure?**

Donald E. Watenpugh. University of North Texas Health Science Center, Fort Worth, TX. (Sponsor: Peter B. Raven, FACSM)  
(No relationships reported)

**PURPOSE:** We need to redefine how workers, employers, and policymakers address workplace inactivity. People are increasingly inactive at their jobs as technological evolution reduces physical work. This chronic inactivity reduces fitness and creates risk of myriad diseases, such as obesity, sleep apnea, cardiovascular disease, diabetes, and osteoporosis. Risks of occupational inactivity rival risks of other more obvious hazards such as chemical exposure and noise, yet workers are not currently "protected" from sedentary jobs like they are from more established hazards.

**METHODS:** Our current approach to workplace inactivity dictates that workers exercise during off-hours to remain healthy. If one applies this logic to hazards like harmful chemicals or noise, those would be acceptable as long as the exposures ceased outside the workplace. Clearly, we view inactivity differently than other hazards, yet the health risks are at least as severe. Also, more people confront occupational inactivity than hazards such as chemicals. Furthermore, the culture of most workplaces fails to acknowledge risks of chronic inactivity, nor the value of sporadic workday activity for improving alertness, cognition, and thus productivity. For example, employers often provide break time and specific areas for smoking, yet to do this for exercise may be considered distracting, counterproductive, and/or too expensive.

**RESULTS:** Sufficient data exist to designate inactivity as a serious yet preventable workplace hazard that deserves workday intervention. Data also demonstrate that physically active workers are more productive, use less sick time, and experience fewer injuries, which in turn reduces medical expenses. While the ultimate responsibility to exercise remains with the individual, both employers and sedentary workers benefit if employers facilitate workday activity. Unfortunately, employers often fail to protect workers from hazards, even with clear evidence of reduced healthcare expenses and increased productivity from such protection.

**CONCLUSIONS:** Policymakers must act to require that workplaces promote and enable brief periodic workday physical activity. Designation of inactivity as a bona fide health hazard will force the issue to the level needed for meaningful action from regulators and thus workplaces.

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3242 Board #207 June 1 2:00 PM - 3:30 PM

**Policy and Environmental Assessment to Improve Community Health in Physical Activity, Nutrition, and Chronic Disease**

Janet R. Wojcik<sup>1</sup>, Hope Matthews<sup>2</sup>, Thomas Bell<sup>2</sup>, Susan Collier<sup>3</sup>, Deborah Hayworth<sup>4</sup>. <sup>1</sup>Winthrop University, Rock Hill, SC. <sup>2</sup>City of Rock Hill Parks, Recreation & Tourism, Rock Hill, SC. <sup>3</sup>South Carolina Department of Health and Environmental Control, Rock Hill, SC. <sup>4</sup>United Way of York County, Rock Hill, SC. (Sponsor: Melanie Poudevigne, FACSM)  
(No relationships reported)

South Carolina is considered one of the unhealthiest states. It ranks 1<sup>st</sup> in the nation for deaths due to stroke, 5<sup>th</sup> highest for adult obesity, 6<sup>th</sup> highest for diabetes, and 7<sup>th</sup> highest in childhood obesity (CDC, 2011; SC Budget & Control Board, 2007). In York County, 29.7% of adults are obese, 8.8% have Type 2 diabetes, and 24.4% are physically inactive (CDC, 2008). Recent BMI data collected at 13 schools on 3<sup>rd</sup> and 4<sup>th</sup> grade students revealed over 40% are either overweight or obese.

**PURPOSE:** To perform community-wide assessments across different sectors to guide the development of a three-year Community Action Plan (CAP).

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**METHODS:** The CHANGE tool (CDC, 2010) was used to rate from 1-5 the existing written policies and supportive environments for physical activity (PA), nutrition, tobacco, chronic disease management, and leadership in the Community-At-Large (CAL) (n=1), K-12 schools (n=3), worksites (n=5), community institution/organizations (n=3), and health care organizations (n=5). CHANGE data were combined with current initiatives from a community coalition and recent data on health behaviors, obesity, bikeability, and food deserts.

**RESULTS:** Scores of 0-20% are considered low, 41-60% moderate, and 81-100% high. Some of the lower scores were in PA, especially K-12 policy (36% and 40% for 2 schools) with the CAL at 55% for environment but 75% for policy. Nutrition scores, in both policy and environment, were < 40% in at least 5 sites, plus the CAL. Tobacco scores were good (10 sites >60%), mostly due to local and state smoking policies. In chronic disease management, only 1 worksite scored below 40% in both policy and environment, but overall worksites and health care agencies were higher-scoring >60%. In leadership across all sectors, environment scores (6 sectors >80%) exceed policy (6 sectors <40%), suggesting managers may be supportive of implementing new policy.

**CONCLUSION:** The initial goal for the CAP is to develop better wayfinding for bike routes and trails to increase PA. Additional goals will include increasing access to healthy food, chronic disease leadership, and tobacco-free spaces. Overall, to improve community health, there is a large need to develop sustainable written policies across all sectors.

Supported by ACHIEVE from CDC Healthy Communities and National Recreation and Park Association

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**3243** Board #208 June 1 2:00 PM - 3:30 PM

**The Benefits Of Promotion Of Physical Activity For Companies**

Vincent H. Hildebrandt<sup>1</sup>, J.H. Stubbe<sup>1</sup>, J.W. Velthuisen<sup>2</sup>, W. Van Mechelen, FACSM<sup>3</sup>. <sup>1</sup>TNO, Leiden, Netherlands. <sup>2</sup>PwC, Amsterdam, Netherlands. <sup>3</sup>VU University Medical Center, Amsterdam, Amsterdam, Netherlands.

(No relationships reported)

**PURPOSE:** To assess the benefits of promotion of physical activity for companies on macro-economic level.

**METHODS:** Data of the Dutch Monitor on Physical Activity (PA) and Health during 2006-2009 were analyzed (N=5020, total for 4 years). The monitor is a representative sample of the Dutch population, interviewed by telephone (average annual response rate: 54%). Questions were asked about demographic characteristics, PA, chronic illnesses, lifestyle factors and sickness absence. A logit model was used to estimate the probability of having a disease given the PA, socio-economic variables (gender, age, education, employment) and lifestyle variables (BMI, smoking and alcohol consumption). Furthermore, it was investigated whether these differences evolved into changes in the annual number of days of absenteeism

from work. Next, the monetary value of different physical activity stimulation scenarios was quantified. One scenario used the PA public health guideline (at least 5 days per week at least 30 minutes at least moderate intensity PA), the other used the high intensity PA guideline (at least three times per week high intensity PA during at least 20 minutes). All scenarios were compared to the 'as is' situation in order to calculate the productivity benefits or losses of changes in the level of physical activity.

**RESULTS:** Promotion of PA resulted in lower costs of absenteeism from work related to sickness. If all Dutch workers would comply with the high intensity guideline who currently do not, annual savings would be maximal: \$1280 million (moderate intensity guideline: \$550 million savings). A more realistic scenario in which promotion of PA would result in an increase of the number of Dutch workers complying with the guidelines of approximately 20-25% would still give substantial savings (\$520 million for high intensity PA and \$330 million for moderate intensity PA).

**CONCLUSIONS:** Promotion of PA results in substantial savings for companies due to less absenteeism related to sickness, in particular when high intensity PA is promoted.

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**F-34 Free Communication/Poster - Psychological Responses - Acute Exercise**

JUNE 1, 2012 1:00 PM - 6:00 PM

ROOM: Exhibit Hall

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**3244** Board #209 June 1 3:30 PM - 5:00 PM

**Effect Of Differing Intensities Of Exercise On Affect And Enjoyment**

Steven J. Petruzzello, FACSM, Annie Nekoliczak, Megan Nickrent, Tina A. Mattila. *University of Illinois at Urbana-Champaign, Urbana, IL.*

(No relationships reported)

The benefits of exercise are well-known and well-documented, yet adherence to exercise regimens is low. There is an intuitive connection between exercise enjoyment and increasing adherence to exercise programs. Exercise intensity may influence affect and enjoyment during exercise, which may help in prescribing exercise programs and increasing adherence rates.

**PURPOSE:** To examine the intensity-affect relationship and its influence on exercise enjoyment.

**METHODS:** Participants (N=14; 7 females, 7 males; M age = 21.7 ± 2.7 yrs) exercised at two different intensities [below ventilatory threshold (bVT), above ventilatory threshold (aVT)]. Heart rate (HR; Polar monitor) was assessed throughout each condition; affect was assessed pre-, immediately post-, 10-min post-, and 20-min post-exercise; enjoyment (PACES) was assessed immediately post-exercise; and Rating of Perceived Exertion (RPE) was assessed during exercise with Feeling Scale (FS) and Felt Arousal Scale (FAS) responses assessed before, during, and after exercise.

**RESULTS:** Self-reported enjoyment was significantly different between the two conditions (P = 0.049), with greater enjoyment following the bVT condition (M=110.3 vs M=105.6). Some differences in pre- to post-exercise affect were seen, with reductions in Tiredness, and Calmness following exercise regardless of intensity condition. Energy increased following bVT and aVT; Tension increased following the aVT condition relative to the bVT condition. During exercise, aVT resulted in a greater reduction in affective valence than the bVT condition, which resulted in a steady increase in valence (P<0.001). Finally, affective valence during bVT was significantly related to enjoyment (rs= 0.35 - 0.50); there were no significant correlations between the affect measured during aVT exercise and self-reported enjoyment.

**CONCLUSIONS:** The findings are consistent with previous research and extend that research by examining the link between affect and enjoyment. Exercise at intensities above the VT results in decreasing affective valence and less enjoyment. This would presumably lead to reduced adherence, although this awaits further study.

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**3245** Board #210 June 1 3:30 PM - 5:00 PM

**The Effects of an Acute Bout of Moderate Intensity Aerobic Exercise on Creative Potential**

Zachary Zenko<sup>1</sup>, Logan Keinholtz<sup>2</sup>, Michael Frank<sup>3</sup>, Christine Alozie<sup>2</sup>, Jennifer Hershelman<sup>2</sup>, Sharon Hamilton, PhD<sup>2</sup>. <sup>1</sup>University of Pittsburgh, Pittsburgh, PA.

<sup>2</sup>Edinboro University, Edinboro, PA. <sup>3</sup>University of South Florida, Tampa, FL.

(No relationships reported)

**PURPOSE:** The purpose of this study was to determine if an acute bout of exercise, at the minimum recommended exercise intensity and duration needed to elicit cardiovascular benefits, would induce significantly improved creative potential.

**METHODS:** 35 low-health risk university students (mean-Age: 19.92, SD ± 1.51; mean-QPA 3.3, SD ± .5) were randomly assigned to either a sedentary control group or an experimental group. The experimental group, immediately prior to measurement of creative potential, individually participated in the Standard Balke treadmill protocol to obtain 20 minutes of aerobic exercise at 60-80% heart rate reserve. All participants took the Abbreviated Torrance Test for Adults (ATTA) as a measurement of creative potential which yielded two reliable scores: Fluency and Flexibility. The ATTAs were coded and scored by two researchers who were not present during administration, and who were blind to the conditions. A t-test was used to compare the mean composite score of the two measures between groups, and analyzed for statistical significance (p < .05).

**RESULTS:** The control group's mean was 27.85 (SD ± 7.46) compared to the experimental group's mean of 31.17 (SD ± 3.74). This yielded non-statistically significant results (p = .103)

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**CONCLUSIONS:** Previous literature suggests a significant improvement in creative potential induced by exercise. Results of this study suggest there are no statistically significant benefits to creative potential induced by an acute bout of aerobic exercise. It is possible that the exercise intensity and duration of the current study is not enough to yield benefits to creative potential. Future research may benefit from a within groups experimental design which utilizes different measures of creative potential in order to ensure a minimal learning effect.

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**3246** Board #211 June 1 3:30 PM - 5:00 PM

**Relationships between Mood and Salivary Immunoglobulin A Level in Tailored Exercises**

Hisashi Mitsuishi, Takayuki Ishiwata, Haruyasu Kato, Shinntaro Endo, Kiminobu Yasumatsu, Hidetoshi Kano, Takashi Nigorikawa, Tetsuya Matsuo, Makoto Matsuyama, Kazuo Oishi. *Rikkyo University, Niiza-shi, Saitama, Japan.*

*(No relationships reported)*

**BACKGROUND:** It is well known that exercise is effective to improve mental health and immune functions. In particular, studies have shown evidences of tailored exercises (intensity, frequency, type, etc.) being beneficial for people with mood disorders who are not in the habit of exercising, such that their mood and mucosal immunity improves. However, psychological indicators of mood, i.e., questionnaires, and physiological indicators of immune function, i.e., salivary activity of immunoglobulin A (sIgA level), are typically evaluated individually. Therefore, it is not clear if there is a relationship between the mood and sIgA levels associated with tailored exercise programs for people who do not have the habit of exercising.

**PURPOSE:** We investigated the relationships between the mood and sIgA levels in response to tailored short-term less intense or moderately intense exercises.

**METHODS:** We examined the effects of acute exercise on the mood and sIgA levels in 10 healthy male university students who did not have the habit of exercising. A mood scale was used to evaluate the psychological responses (positive engagement, tranquility, negative affect). The sIgA levels were measured by ELISA. Data were collected at 3 different stages (before, during, and after the exercise) for 2 different types of exercises, i.e., tailored (strength training and walking) and un-tailored (step exercise and indoor hockey).

**RESULTS:** According to the Spearman rank-correlation test, there were significant relationships between the mood and sIgA levels during and after tailored exercises. In particular, significant positive correlations were observed between "positive engagement" and sIgA levels ( $r=0.82, p<0.05$ ) and between "tranquility" and sIgA levels ( $r=0.68, p<0.05$ ). There were significant negative correlations between "negative affect" and sIgA levels ( $r=-0.64, p<0.05$ ). However, there was no significant relationship between the mood and sIgA levels in the cases of un-tailored exercises.

**CONCLUSIONS:** These findings may help clarify the relationship between the mood and sIgA levels and show why tailored exercise is more effective than un-tailored exercise for evaluating stress in people who do not have the habit of exercising.

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**3247** Board #212 June 1 3:30 PM - 5:00 PM

**Exercise-Induced Dehydration Has No Effect on Alcohol Pharmacokinetics but Influences Willingness to Drive**

Chris Irwin, Alison Goodwin, Michael Leveritt, Andrew K. Davey, Ben Desbrow. *Griffith University, Gold Coast, Australia.* (Sponsor: Louise Burke, FACSM)

*(No relationships reported)*

**PURPOSE:** This study investigated the influence of exercise-induced dehydration on alcohol pharmacokinetics and subjective ratings of impairment following an acute moderate dose of alcohol.

**METHODS:** Twelve male volunteers ( $22.6\pm 4.2$  yrs,  $77.22\pm 6.85$  kg body weight,  $180.5\pm 5.0$  cm; values are mean $\pm$ SD) participated in 3 experimental trials completed in a randomised cross over design and separated by at least 7 days. In one trial, participants exercised to cause dehydration of  $\sim 2.5\%$  body weight loss (DA trial). For the other trials, participants were required to be in a rested and euhydrated state (A1 and A2 trials). A set volume of alcohol was then consumed in each trial and participants were monitored over a 4 hr period. Blood (BrAC) and breath (BrAC) alcohol samples were collected throughout and analysed to calculate pharmacokinetic variables associated with the blood alcohol curve. Total urine production, estimates of BrAC, and subjective ratings of mood, intoxication and impairment were also recorded throughout each trial.

**RESULTS:** There was no difference in the pharmacokinetics of alcohol between any of the trial conditions. BrACs were higher than BACs for 2 hrs following alcohol consumption, but lower at measures taken 3 and 4 hrs post ingestion in all of the trials. Total urine production was greater in the euhydrated trials ( $1182\pm 393$  ml vs.  $300\pm 125$  ml,  $p<0.05$ ), with significantly more urine produced in the first 2 hrs after alcohol ingestion ( $1039\pm 378$  ml vs.  $190\pm 121$  ml,  $p<0.05$ ). Participants' ratings of confusion and intoxication were significantly lower in the DA trial compared to the A2 trial, and they were also more willing to drive a car a short distance under these conditions.

**CONCLUSIONS:** These findings suggest that subtle changes in total body water as a result of exercise induced sweat loss, has no impact on alcohol pharmacokinetics. However, dehydration may influence the subjective effects of alcohol and increase the likelihood of risk-taking behaviours such as drink-driving. This may have direct implications for individuals who consume alcohol following physical activity and then consider driving a motor vehicle.

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**3248** Board #213 June 1 3:30 PM - 5:00 PM

**Optimal Categorization Of A Facial Scale For Assessing Real-time Enjoyment Of Children's Physical Activity**

Cheryl A. Howe, Danielle S. McElhiney, Brian A. Ragan. *Ohio University, ATHENS, OH.* (Sponsor: Minsoo Kang, FACSM)

*(No relationships reported)*

Enjoyment is purported to be positively correlated with physical activity participation in children. However, to truly understand the relationship between enjoyment and physical activity participation, a real-time tool to assess children's perception of enjoyment of different types of games and activities is essential. The Facial Affective Scale is thought to be a way of measuring pain and other constructs in children and has been used for measuring enjoyment.

**PURPOSE:** To optimize response categorization of the Facial Affective Scale for assessing children's real-time perception of enjoyment of various types of games and physical activities.

**METHODS:** Elementary school children ( $N = 23$ ; 8 - 12 y) volunteered to play 5 common children's games at least 4 times each during 5 - 10 sessions of an existing afterschool program. Immediately after playing each game for 9-10 min, each child independently answered questions related to the context of the game using a series of 9 facial expressions ranging from happy to sad. The Rasch Rating Scale Model was used to optimize the response categories (e.g., faces). The criteria used for optimization were: 1) the response options must be ordered; 2) each option must be most probable somewhere on the scale; and 3) each option must have outfit statistics  $< 2.0$ .

**RESULTS:** The original 9-face scale indicated poor performance. Five of the 9 faces were out of order (Thurston thresholds: 0.85, 0.18, -1.33, -0.68, 0.62, 0.06, 0.16, 0.14), only 3 faces were most probable on the scale and all had acceptable outfit statistics (MNSQ: 0.59 - 1.32). Based on these results the 9-face scale was then collapsed from 123456789 to 111112223. This collapsed scale optimized the response options with order (Thurston thresholds: -0.76, 0.76), each option was most probable somewhere on the scale, and all had acceptable outfit statistics (MNSQ: 0.84 - 1.09).

**CONCLUSIONS:** The results of the 9-face scale clearly indicated that children do not discriminate 9 different levels of enjoyment. The 3-face scale proposes a clearer measure of children's real-time perception of enjoyment of physical activity.

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**3249** Board #214 June 1 3:30 PM - 5:00 PM

**The Effect of Moderate Intensity Aerobic Exercise On Risk Preferences**

Kaylee L. Davis, David L. Dickinson, Chelsea D. Curry, Ashley N. Lightner, Scott R. Collier, FACSM. *Appalachian State University, Boone, NC.*

*(No relationships reported)*

Many physiological and psychological changes post-exercise may alter an adult's decision-making. It has been shown that physiological changes can affect decision making, therefore exercise may play a role in modulating decisions. The purpose of this study was to profile the risky choices over monetary gains and losses made by adults following a 30-minute bout of aerobic exercise versus a no-exercise control day and a return-to-baseline day.

**METHODS:** 18 subjects (40-60 years-old) made 3 visits to the Vascular Biology and Autonomic Studies Laboratory during three weekdays. Visit 1 consisted of anthropometric measures followed by a decision task battery that included a risky choice task, which was followed by a graded exercise test (VO<sub>2</sub>peak). During visit 2 the subject exercised on a treadmill for 30 minutes at 65% of their VO<sub>2</sub>peak and then took the decision task battery. Visit 3 was comprised of the decision task battery and represented a return-to-baseline. Individual trial-level data (n=120 total risky choices per subject) was analyzed using Stata statistical software (v9). A random effects probit model was used to estimate baseline and post-exercise likelihood of making riskier choices.

**RESULTS:** On baseline and return-to-baseline days, our data show subjects are risk-averse over monetary gains but risk-seeking over monetary losses. Probit estimates show a significantly increased probability of choosing a riskier gamble on a given trial in the Gains condition (p<.05) post-exercise. We find no significant post-exercise effect on risky choice in the Loss condition (p=NSD).

**CONCLUSION:** Following exercise, individuals are less risk-averse over monetary gains and the physiological changes that occur with exercise contribute to this condition. Since success on certain economic outcomes depends on one's willingness to take monetary risk, these data suggest that regular exercisers may hold an advantage in certain decision-making contexts.

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**3250** Board #215 June 1 3:30 PM - 5:00 PM

**Impact of Interval Duration on Affect in Healthy Young Adults**

Samuel J. Greeley<sup>1</sup>, Larry H. Collins<sup>1</sup>, Elizabeth A. Hubbard<sup>1</sup>, Jamie L. Ohara<sup>2</sup>, Marcus W. Kilpatrick<sup>1</sup>. <sup>1</sup>University of South Florida, Tampa, FL. <sup>2</sup>Villanova University, Villanova, PA. (Sponsor: John Bartholomew, FACSM)  
(No relationships reported)

Research investigating the dose-response relationship between exercise intensity and affect suggests that exercising at intensities above the ventilatory threshold elicits a decline in affect. The literature to date has focused almost exclusively on continuous exercise. No research to date has examined affective responses to interval training.

**PURPOSE:** Determine the impact of interval protocols differing in interval length on affective valence and enjoyment.

**METHODS:** Sixteen healthy participants (9 male, 7 female; mean age = 23 years) completed a maximal cycle ergometer test and two counterbalanced trials of interval cycling matched for work, intensity, duration, and work-to-recovery ratio. Each trial lasted 20 minutes inclusive of the warm-up and cool-down. The intensities for both trials alternated between 90% (work) and 10% (recovery) of peak power. The work-to-recovery ratio for each trial was 1:1, with one trial utilizing 30-sec intervals and the other 60-sec intervals. Affect was assessed before, during, and after exercise. Enjoyment was assessed post-exercise.

**RESULTS:** Data were analyzed using pairwise comparisons. Affect was similar between groups at baseline (p > 0.05) and steadily declined over time during the work portions of exercise (p < 0.05). The decline in affect during exercise was significantly greater during the 60-sec trial compared to the 30-sec trial (p < 0.05). Affect increased during recovery periods from work phases during both trials (p < 0.05). Affect increased back to baseline in both trials immediately following the cool-down (p < 0.05). Enjoyment was not different between trials (p < 0.05).

**DISCUSSION:** Findings suggest that although affect declined during both trials, it is somewhat preserved during the 30-sec trial compared to the 60-sec trial. Affect was also shown to rebound during recovery periods. Despite the greater decline in affect during the 60-sec trial, enjoyment was not different between trials. The results of this study suggest that the length of exercise intervals impacts affective response, but not enjoyment. Future studies should examine altering other variables (e.g. intensity, work-to-recovery ratio) to determine their role in influencing affect and enjoyment.

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**3251** Board #216 June 1 3:30 PM - 5:00 PM

**Comparison Of Psychophysiological Responses Between Self-paced Walking On Treadmill And Overground In Obese Women**

Cosme F. Buzzachera<sup>1</sup>, Kleverton Krinski<sup>2</sup>, Hassan M. Elsangedy<sup>2</sup>, Maressa P. Krause<sup>3</sup>, Luis AG Freitas<sup>4</sup>, Julia Z. Durigan<sup>4</sup>, Antonio C. Dourado<sup>4</sup>, Wagner de Campos<sup>2</sup>, Fredric L. Goss, FACSM<sup>5</sup>, Sergio G. da Silva<sup>2</sup>. <sup>1</sup>University of North Paraná, Londrina, Brazil. <sup>2</sup>Federal University of Parana, Curitiba, Brazil. <sup>3</sup>Technological University of Parana, Curitiba, Brazil. <sup>4</sup>State University of Londrina, Londrina, Brazil. <sup>5</sup>University of Pittsburgh, Pittsburgh, PA. (Sponsor: Fredric L. Goss, FACSM)  
(No relationships reported)

**PURPOSE:** To determine whether environmental settings (treadmill vs overground) influence physiological, perceptual, and affective responses of obese women to exercise at a self-selected pace.

**METHODS:** Thirty females (age 44.39±9.58 yr; BMI 34.72±8.51 kg.m<sup>-2</sup>), participated in this study. During the orientation session, individuals underwent an initial screening, anthropometric measurements, and familiarization with the experimental procedures. Next, subjects were submitted to a maximal treadmill test. In the two experimental trials, participants performed 30-min bouts of treadmill and overground walking at a self-selected pace, which were completed in a counterbalanced order. At least 48h separated experimental trials. During each 30-min walking bout at a self selected pace, physiological (oxygen uptake, VO<sub>2</sub>) responses were recorded continuously. Perceptual (6-20 Borg-RPE for the overall body) and affective (Feeling Scale) responses were determined every 5-min throughout the test. A paired t-test was used to compare physiological, perceptual and affective responses between the conditions.

**RESULTS:** The overground walking speed was significantly faster than treadmill walking (1.41±0.15 m.sec<sup>-1</sup> and 1.36±0.18 m.sec<sup>-1</sup>, respectively, p<.022) during the 30-min bout of self-paced exercise. However, subjects walked in a higher %VO<sub>2</sub>max during treadmill walking (68.18±1.87%VO<sub>2</sub>max) than overground walking (66.91±2.16 %VO<sub>2</sub>max) (p<.024). Similarly, ratings of perceived exertion were higher during treadmill walking (12.50±0.72) than overground condition (11.84±0.71) (p<.032). In addition, affective response was more positive during the session of overground walking (2.01±0.62) than during treadmill (1.53±0.74) (p<.014).

**CONCLUSIONS:** These data extend previous findings by showing that environmental setting influences physiological, perceptual, and affective responses during exercise at a self-selected pace. Self-paced exercise performed overground resulted in lower perceptual and more positive affective responses. Considering that walking at self-selected pace performed overground can lead to a sensation of "feeling good," the utilization of this strategy should be recommended for using with obese women who are seeking for engaging in an exercise training.

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**3252** Board #217 June 1 3:30 PM - 5:00 PM

**Concurrent Validity of an Exercise Enjoyment Scale Using Physiological and Psychological Criteria**

Amanda M. Haile<sup>1</sup>, Luke Haile<sup>2</sup>, Monica Taylor<sup>1</sup>, Alex Shafer<sup>1</sup>, Kris Wisniewski<sup>1</sup>, Deldin Anthony<sup>1</sup>, George Panzak<sup>1</sup>, Frederick L. Goss, FACSM<sup>1</sup>, Elizabeth Nagle, FACSM<sup>1</sup>, Robert J. Robertson, FACSM<sup>1</sup>. <sup>1</sup>University of Pittsburgh, Pittsburgh, PA. <sup>2</sup>Ferrum College, Ferrum, VA.  
(No relationships reported)

Exercise Enjoyment (EE) has been investigated using pre- and post- exercise measures. However, how EE changes throughout a progressively incremented exercise bout is unknown.

**PURPOSE:** To assess concurrent validity of a newly developed Exercise Enjoyment Scale using the following criterion variables; (1) oxygen consumption (VO<sub>2</sub>; l·min<sup>-1</sup>), (2) heart rate (HR; b·min<sup>-1</sup>), (3) power output (PO; W), (4) ratings of perceived exertion (RPE), and (5) affect (A).

**METHODS:** A multiple-observation, within subject, cross-sectional design was employed. Eleven males (22.9 ± 3.4 years), and ten females (22.1 ± 2.7 years) performed a load-incremented cycle ergometer test to obtain VO<sub>2</sub>peak (l·min<sup>-1</sup>). VO<sub>2</sub>, HR, PO, RPE, and A were recorded each minute. EE, A, and RPE were measured using the Exercise Enjoyment Scale, Feeling Scale, and OMNI-RPE Cycle Scale respectively. The EE scale is a bipolar metric with categories ranging from +5 (very enjoyable) to -5 (very unenjoyable). The center category is 0. Data for each subject at each test stage were entered into the correlation/regression model. Concurrent validity was established by correlating values of EE with VO<sub>2</sub>, HR, PO, RPE and A.

**RESULTS:** EE ranged from +5 to -5. As VO<sub>2</sub>, HR, PO, and RPE increased, on-stimulus exercise enjoyment rating decreased. A strong positive relation was noted between EE and A. (See Table).

**CONCLUSIONS:** In young female and male adults, findings demonstrated concurrent validity for a newly developed EE scale where both psychological and physiological criterion variables were employed during cycle ergometry. It is proposed that on-stimulus EE responses can be used in conjunction with affect responses and RPE to develop programs that promote exercise adoption and maintenance.

|                    | VO2 (l·min <sup>-1</sup> ) | HR (b·min <sup>-1</sup> ) | PO (W) | RPE    | A     |
|--------------------|----------------------------|---------------------------|--------|--------|-------|
| Exercise Enjoyment | -0.24*                     | -0.41*                    | -0.39* | -0.51* | 0.89* |

**3253 Board #218 June 1 3:30 PM - 5:00 PM**

**Salivary Cortisol Analysis On Infants In Different Environments, Land And Water Activities And At Rest.**

Marta Martins<sup>1</sup>, Ana Palmeira-de-Oliveira<sup>2</sup>, Nuno Garrido<sup>3</sup>, Tiago Barbosa<sup>4</sup>, Aldo Costa<sup>5</sup>. <sup>1</sup>ESDRM - CIDESE, Rio Maior, Portugal. <sup>2</sup>CICS-UBI Health Sciences Investigation Center, Covilhã, Portugal. <sup>3</sup>UTAD - CIDESE, Vila Real, Portugal. <sup>4</sup>IPB - CIDESE, Bragança, Portugal. <sup>5</sup>UBI - CIDESE, Covilhã, Portugal. (Sponsor: Carlo Baldari, FACSM)  
(No relationships reported)

A whole set of new motor skills significantly changes the ways in which the infants' body moves and interacts with the environment. Aquatic activity programs are related with the acquisition of positive effects on infants' motor development in. Infants' acute physiological response during activity, particularly the salivary cortisol, is a suitable parameter to be assessed. It can provide important information about hypothalamic-pituitary-adrenal (HPA) axis activity under normal conditions and in response to stress. The determination of cortisol in saliva has become popular for human research on stress reactions.

**PURPOSE** The aim of this study was to compare the cortisol level on infants in different environments: land activity, water activity and at rest.

**METHODS** 17 infants were included (22.5 ± 8.7 months) all had with background in a baby swimming program at least 6 months. Salivary cortisol levels were assessed with a Salimetrics® kit. Both land and swimming sessions were oriented by a professional instructor, according to a child centered method and children were constantly accompanied by their parents. The land skills performed were about motor coordination (gross and fine) and manipulation of didactic material. The aquatic skills performed were composed by immersions, jumps and displacements (in prone position, autonomous, vertical position, with didactic material and in back position). Cortisol samples were always taken at the same time of day for all (9 and 10 am) and at the same day of the week. A K-S one-sample test, Wilcoxon rank test and Spearman's rank correlation coefficient test were used to analyze data.

**RESULTS** The cortisol mean levels obtained were: water activity (WA)=0,117±0,64µg/dL; land activity (LA)=0,100±0,34µg/dL and at rest (R)=0,150±0,84µg/dL. No statistical differences were found between LA, WA and R cortisol values. Positive correlation was found between the LA and the R cortisol values (r=0,826; p=0,011).

**CONCLUSION** Salivary cortisol levels are similar for the three conditions above, demonstrating the absence of stress-related activity. After 6 months of aquatic experience, the stress level in the water looks identical to rest or other physical activity. We may also speculate that, in infants whose activity is new, or do the activity without parents, cortisol levels might be higher.

**3254 Board #219 June 1 3:30 PM - 5:00 PM**

**Comparison Of Affective Responses To Exercise When Intensity is Self-selected versus Imposed**

Kristen M. Lagally, FACSM<sup>1</sup>, Shannon O'Hara<sup>1</sup>, Anthony J. Amorose<sup>1</sup>, Liana Suhadolnik<sup>1</sup>, Jonathan Kurka<sup>2</sup>. <sup>1</sup>Illinois State University, Normal, IL. <sup>2</sup>Arizona State University, Phoenix, AZ  
(No relationships reported)

Allowing individuals to have autonomy over the intensity of their physical activity may lead to more positive affective responses about exercise when compared to situations where intensity is imposed.

**PURPOSE:** The purpose of this study was to compare affective responses between two exercise conditions: 1) where intensity is imposed (i.e. low autonomy) and 2) where intensity is self-selected (i.e. high autonomy).

**METHODS:** Eleven subjects (6 women, 5 men; age = 22.2±3.8 years, VO<sub>2</sub>max = 53.1±12.1 ml·kg<sup>-1</sup>·min<sup>-1</sup>) performed a maximal exercise test to allow determination of relative workloads in the subsequent experimental sessions, which involved 30 minutes of treadmill exercise. During the first experimental session, participants were asked to self-select a speed and grade that they would prefer for a workout and were permitted to adjust intensity at 5-minute intervals. For the second session, the speed and grade were imposed by the investigator, but were the same as in the self-selected session. Speed, grade and heart rate responses were hidden from participants in both sessions.

**RESULTS:** Participants self-selected intensities that ranged from 68-91% (M±SD=80.7±7.3%) of measured maximal heart rate. Manipulation checks found no significant differences in intensity (i.e. heart rate and RPE) between sessions but found that perceived autonomy was significantly higher in the self-selected session. Repeated-measures ANOVA (Session: self-selected vs. imposed X Time: pre- vs. post-exercise) indicated a significant interaction for positive affect (partial Eta squared = .31). Positive affect increased over time in both sessions, but there was a greater increase in the self-selected session (self-selected=2.15 vs. 3.12; imposed=2.06 vs. 2.70).

**CONCLUSIONS:** These results suggest that perceived autonomy is related to affective responses to exercise.

**3255 Board #220 June 1 3:30 PM - 5:00 PM**

**Tracking Cardiovascular Responses To Anticipation Of An Exercise Test In Cardiac Rehabilitation: A Preliminary Test**

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(No relationships reported)

Cardiovascular reactivity (CVR) refers to relatively high heart rate (HR) and blood pressure (BP) increases in the face of a mental stressor. CVR may be a concern for heart patients since it may precede ischemic events and CVR may be an indicator of relatively poor prognosis. Anticipation of an exercise tolerance test (ETT) results in rapid increases in HR and BP and has been used as a stressor in heart patient to study CVR. However, it is not clear how CVR changes associated with an ETT change after a course of cardiac rehabilitation (CR).

**PURPOSE:** To examine CVR, specifically HR and systolic (SBP) and diastolic blood pressure (DBP) responses, to anticipation of an exercise tolerance test before and after a course of CR.

**METHODS:** CVR was recorded for 76 patients at baseline and for a subsample of 23 patients who completed 6 weeks of CR. Identical procedures were used for baseline and post-CR data collection. Resting HR and BP were measured 3 times, 1 minute apart, by an automated oscillometric BP monitor after the patient had been seated quietly and alone for 5 minutes. The patient was then prepped for an ETT and met in the exercise stress testing lab by the researcher. Standing HR and BP measures were taken by the same automated BP device after 1 and 3 minutes of standing on the treadmill immediately prior to beginning exercise. The mean of the 3 seated measures was considered the resting BP and HR. Peak BP and HR standing were used to calculate the cardiovascular response to anticipation of exercise. CVR was defined as peak BP and HR minus resting BP and HR, respectively.

**RESULTS:** Anticipation of exercise resulted in significant increases (all p's < .002) in CV parameters with an average CVR at baseline for HR, SBP and DBP of 4.0 bpm, 16.6 mmHg, and 13.5 mmHg, respectively. CVR after a course of CR for HR, SBP and DBP were 4.3 bpm, 15.9 mmHg, and 9.2 mmHg (ps < .001). Differences between baseline and post-CR CVR was significant only for the change in DBP (p = .05).

**CONCLUSION:** Patients responded with a predictable increase in HR and BP in anticipation of an ETT before and after a course of CR. After CR, DBP increases in anticipation of an ETT were lower in magnitude than before CR. Future research should investigate specific components of CR that may help reduce CVR.



**3256 Board #221 June 1 3:30 PM - 5:00 PM**  
**The Effect Of A 45-minute Exercise Session On Neural Responses To Pictures Of Food In Normal-weight And Obese Women**

James D. LeCheminant, FACSM, Bliss Hanlon, Jenny Roberts, Michael Larson, Bruce W. Bailey. *Brigham Young University, Provo, UT.*  
(No relationships reported)

**PURPOSE:** This study examined the effect of acute exercise on neural responses to pictures of food in normal-weight and obese women. Strong neural responses to pictures of food may be an index of food motivation. Participants of both groups were matched (except for BMI) and conditions (exercise vs. non-exercise) were randomized and counter-balanced.

**METHODS:** Fifteen normal-weight ( $31.6 \pm 9.6$  y;  $22.6 \pm 1.3$  kg/m<sup>2</sup>) and 15 obese ( $32.5 \pm 9.5$  y;  $34.3 \pm 5.1$  kg/m<sup>2</sup>) women completed an exercise and non-exercise day, each performed on the same day of the week. During the exercise condition, each participant completed an early morning (8-9am) exercise session on a motor-driven treadmill at 3.8 mph and 0% grade for 45 continuous minutes. During the non-exercise condition, participants were tested for body composition between 8-9am. Each participant was immediately tested for food motivation subsequently for both conditions. To test for food motivation, participants were shown a continuous stream of pictures of food and flowers (control) matched for picture intensity and while neural activity was monitored, via electroencephalogram. Data were analyzed using a 2-group x 2-exercise condition x 2-picture type repeated measures analysis of covariance on event-related potential (ERP) amplitudes.

**RESULTS:** There was not a significant group\*exercise condition\*picture type interaction ( $P > 0.05$ ). However, when the normal-weight and obese women were combined, there was a significant exercise condition\*picture type interaction for late positive potential ( $F = 4.62$ ,  $P = 0.04$ ) with participants showing less neurological response to food pictures (-15%) following a 45-minute exercise bout.

**CONCLUSIONS:** The sample of women studied did not show neurological differences in response to pictures of food based upon BMI. However, exercise decreased neurological responses to food, which may indicate lower food motivation.

**3257 Board #222 June 1 3:30 PM - 5:00 PM**  
**Effect Of Capillary Blood Sampling On Psychological And Perceptual Responses During Load Incremented Cycle Ergometry**

Anthony R. Deldin, Alex B. Schafer, Wisniewski Kris, Haile Amanda, Robertson J. Robert, FACSM, Nagle F. Elizabeth, FACSM, Goss L. Fredric, FACSM.  
*University of Pittsburgh, Pittsburgh, PA.*  
(No relationships reported)

Blood sampling that occurs in medical and research settings can produce adverse psychological reactions. Whether a similar response occurs during exercise testing has not been investigated.

**PURPOSE:** The purpose of this investigation was to determine the effect of capillary blood sampling on psychological and perceptual responses at the ventilatory breakpoint (V<sub>pt</sub>).

**METHODS:** A multiple observation, within subject, cross-sectional design was employed. Eleven males (age  $21.5 \pm 3.3$  years), and ten females (age  $22.7 \pm 2.7$  years) performed two load incremented cycle ergometer tests (Trial A and Trial B) to determine VO<sub>2peak</sub> (l\*min<sup>-1</sup>). Trial A included capillary blood lactate (BLA) measurements taken during the last minute of each stage. Trial B used an identical protocol without the BLA measurements. The order of administration of Trial A and Trial B was counter-balanced. The psychological/perceptual dependent variables measured during the last 30 seconds of each stage were: 1) Affect Valence (AV); 2) Felt-Arousal (FAS); 3) Rating of Perceived Exertion for the overall body (RPE-O); 4) Exercise Enjoyment (EE); and 5) Perceived intensity level (INT). A paired samples t test was used to examine between trial differences in psychological and perceptual variables measured at the V<sub>pt</sub>.

**RESULTS:** There were no statistically significant between trial differences found for AV, FAS, RPE-O and EE measured at the V<sub>pt</sub>. The perceived INT at the V<sub>pt</sub> was significantly ( $*p < 0.05$ ) higher in Trial A than Trial B (Table 1).

**CONCLUSIONS:** The inclusion of capillary blood sampling during a load incremented cycle ergometer exercise test does not adversely affect psychological or perceptual responses to exercise.

Table 1

|         | AV          | FAS         | RPE-O       | EE          | INT*       |
|---------|-------------|-------------|-------------|-------------|------------|
| Trial A | 1.29 ± 1.87 | 3.30 ± 1.22 | 5.14 ± 1.42 | 1.14 ± 1.96 | 2.81 ± .75 |
| Trial B | 1.43 ± 1.57 | 3.25 ± 1.21 | 4.67 ± 1.53 | 1.24 ± 1.48 | 2.38 ± .74 |

**3258 Board #223 June 1 3:30 PM - 5:00 PM**  
**Response Normalized Affect, Enjoyment, And RPE At The Ventilatory Breakpoint In Recreationally Active Young Adults**

Alex Shafer, Kristofer Wisniewski, George Panzak, Erik Willis, Elizabeth Nagle, FACSM, Robert Robertson, FACSM, Fredric Goss, FACSM. *University of Pittsburgh, Pittsburgh, PA.*  
(No relationships reported)

Response normalized ratings of perceived exertion (RPE) corresponding to the ventilatory breakpoint (V<sub>pt</sub>) have been identified in children and adults using the OMNI Scale of Perceived Exertion, and can be used for exercise prescription. However, empirical support for response normalized affect and enjoyment associated with the V<sub>pt</sub> is lacking. A better understanding of affect and enjoyment of exercise may lead to more positive exercise experiences, and enhance long term exercise adherence.

**PURPOSE:** To determine the response normalized affect (A), exercise enjoyment (EE), and RPE-Overall corresponding to the V<sub>pt</sub> during cycle ergometer exercise.

**METHODS:** Ten males ( $21.7 \pm 3.4$  yrs) and ten females ( $22.7 \pm 2.6$  yrs) completed a load incremented cycle ergometer protocol to measure peak oxygen uptake (VO<sub>2peak</sub>). The V<sub>pt</sub> was determined for each subject as the %VO<sub>2peak</sub> at which Ve:VO<sub>2</sub> increased without an accompanying increase in Ve:VCO<sub>2</sub>. The exercise time associated with the V<sub>pt</sub> was then used to determine the corresponding A, EE, and RPE. A, EE, and RPE were measured each minute of exercise using the Feeling Scale, Exercise Enjoyment Scale, and OMNI RPE-Cycle Scale, respectively.

**RESULTS:** Values are means ± SD. The V<sub>pt</sub> corresponded to  $69.3 \pm 8.4$  %VO<sub>2peak</sub> and a heart rate of  $155.3 \pm 12.8$  beats·min<sup>-1</sup> for the combined sample. Ratings at the V<sub>pt</sub> were: A ( $+1.4 \pm 1.8$ ), EE ( $+1.5 \pm 1.6$ ) and RPE ( $4.8 \pm 1.1$ ) for males, and A ( $+1.4 \pm 1.8$ ), EE ( $+1.4 \pm 1.7$ ) and RPE ( $5.4 \pm 1.5$ ) for females. There was no difference ( $p > 0.05$ ) in A, EE, or RPE at V<sub>pt</sub> between males and females.

**CONCLUSION:** Response normalized OMNI RPE-V<sub>pt</sub> noted presently is consistent with previous reports involving progressively incremented cycle ergometer exercise. Exercise intensities corresponding to the V<sub>pt</sub> produce positive affect and enjoyment responses in recreationally active young adult males and females. These easily measured, non-invasive perceptual analogs of the V<sub>pt</sub> may be used to self-select exercise intensity. This may lead to improved compliance to exercise programs designed to enhance health-fitness.

**3259 Board #224 June 1 3:30 PM - 5:00 PM**  
**Impact Of Aerobic Exercise Of Varying Intensities On Craving In Cannabis-dependent Adults**

Stephen P. Bailey, FACSM, Evan Adler, Laura Hamilton. *Elon University, Elon, NC.*  
(No relationships reported)

Acute aerobic exercise has been shown to reduce craving for cigarettes in smokers; however, exercise intensity does not appear to have a unique impact on craving for cigarettes. While there is very limited evidence suggesting that regular exercise reduces cannabis craving in cannabis-dependent adults, it is unclear if acute exercise impacts cannabis craving in a manner similar to craving for cigarettes..

**PURPOSE:** The purpose of this investigation is to determine if aerobic exercise of varying intensities changes cannabis craving in cannabis-dependent adults.

**METHODS:** Ten cannabis-dependent adults (Age = 33±2 years; BMI=29.3±2.7) completed 3 randomly applied experimental trials at the same time of day. All subjects were currently enrolled in an outpatient treatment program for addiction and had been abstinent from cannabis use for at least 30 days prior to participation as determined by urinalysis. Experimental trials consisted of 30 minutes of rest, light aerobic exercise (45-50% predicted maximal heart rate), or moderate aerobic exercise (65-70% predicted maximal heart rate). Craving for cannabis, was recorded before, immediately after, 15 minutes after exercise, and 30 minute after exercise using a 20 cm visual analog scale. Subjects also completed the Marijuana Craving Questionnaire (MCQ-SF) before, immediately after, 15 minutes after, and 30 minute after exercise.

**RESULTS:** Craving for cannabis was unchanged as a result of light exercise. In comparison, craving for cannabis was reduced ( $p<0.05$ ) as a result of moderate exercise at IPE (-59.6 +7.5%), 15 minutes post exercise (-53.8+7.8%), and 30 minutes post exercise (-34.6+4.5%). Craving for cannabis actually increased during the resting condition ( $p<0.05$ ) (IPE=90.4+24.5%; 15 Post=120.6.1 +28.5%; 30 Post=160.9+58.6%). Exercise had no impact on responses to the MCQ-SF.

**CONCLUSIONS:** The results of this investigation suggest that craving for cannabis in cannabis-dependent adults is reduced by aerobic exercise at a moderate intensity and this positive effect is present for at least 30 minutes after the cessation of exercise.

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## F-35 Free Communication/Poster - Resistance Exercise III

JUNE 1, 2012 1:00 PM - 6:00 PM

ROOM: Exhibit Hall

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### 3260 Board #225 June 1 3:30 PM - 5:00 PM

#### Effects Of Drop Landing Height On Bilateral Asymmetry On Ground Reaction Forces During Depth Jumps

Nathan Tamargo, William Thomsen, George Davies, Bryan L. Riemann. *Armstrong Atlantic State University, Savannah, GA.* (Sponsor: T. Jeff Chandler, FACSM)  
(No relationships reported)

Previous research considering depth jumps at heights of .2m, .4m and .6m demonstrated greater bilateral vertical ground reaction force (vGRF) and time asymmetry at lower heights compared to higher. Because depth jumps are often conducted from heights greater than .6m, there is a need for further research.

**PURPOSE:** To determine the effect of height on vGRF differences and temporal differences between dominant and nondominant limbs during depth jumps.

**METHODS:** Twenty-nine physically-active male college-age subjects (22.7±2.6yrs, 1.78±0.07m, 80.5±14.3kg) with prior plyometric training experience performed DJ from heights of .30m, .45m, .60m, .75m, and .90m in random order. Four trials from each height were completed. Subjects dropped onto two forceplates, immediately performed a maximal jump and then landed back onto the forceplates a second time. Peak vGRF difference between the limbs for both the drop and second landing phases were determined and expressed in body weight units. Ground contact (GC) and ground off (GO) time differences (TD) between the dominant and nondominant limbs for the depth phase were also computed. Two factor (phase by height) analysis of variance (ANOVA) was conducted for peak vGRF difference, while separate one factor (height) ANOVA were conducted on GC and GO TD.

**RESULTS:** A significant phase by height interaction was revealed for peak vGRF difference ( $P<.001$ ). Post hoc comparison between phases, within each level of height, revealed drop peak vGRF to be significantly less ( $P=.001$ ) than the second landing peak vGRF at .30m, whereas the drop peak vGRF was significantly greater than the second landing peak vGRF at .75m ( $P<.001$ ) and .90m ( $P<.001$ ). Post hoc comparisons within the drop phase demonstrated peak vGRF to be significantly greater at each level of height. There were no height differences within the second landing phase. GC TD became significantly more symmetrical as drop height increased ( $P<.001$ ). There were no significant height differences for GO TD.

**CONCLUSIONS:** As DJ height increases, the peak forces became more asymmetrical between limbs (dominant>nondominant). This may have implications on training adaptations and increase risk of impact related injuries. Future research should consider changes to exercise execution and instructions given to clients.

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### 3261 Board #226 June 1 3:30 PM - 5:00 PM

#### A Comparative Electromyographic Analysis Of The Shoulder Muscles During Elevation In The Scapular Plane

Hayato Yamamoto<sup>1</sup>, Masanori Takemura<sup>2</sup>, Koji Kurita<sup>3</sup>, Yuji Kanoh<sup>4</sup>, Mitsuharu Kaya<sup>5</sup>, Motoaki Tsuchiya<sup>6</sup>, Junzo Tsujita<sup>2</sup>. <sup>1</sup>*Yamamoto Trainers Project, Kyoto, Japan.* <sup>2</sup>*Hyogo College of Medicine, Nishinomiya, Japan.* <sup>3</sup>*Physical Conditioning Production, Osaka, Japan.* <sup>4</sup>*Riseisha College of Medicine and Sports, Osaka, Japan.* <sup>5</sup>*Hyogo University of Health Science, Kobe, Japan.* <sup>6</sup>*MJ Consultant, Osaka, Japan.*  
(No relationships reported)

**BACKGROUND:** Although previous studies have reported EMG activities of the supraspinatus muscle (SS) during shoulder elevation in the scapular plane with humeral internal rotation (Empty can; EC) and with humeral rotation in neutral (Full can; FC), the better exercise for functional strengthening SS has not yet been clearly established. In addition, there were only few reports that prescribed to define a glenohumeral joint rotation angle.

**PURPOSE:** To clarify whether supraspinatus muscle activity was reinforced more in the EC position than FC position using EMG analysis, and to verify the effectiveness of functional exercise of SS for baseball player.

**METHODS:** Thirty-one baseball players (means (SD) age: 19.5 (0.8) yrs) participated in this study. Each subjects performed scapular plane abduction (60 degree, 5 sec isometric contraction) with two positions (EC and FC) and 7 loads (0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0 kg) at random. Surface EMG was recorded from the muscle belly of SS, infraspinatus (the upper portion; IS), middle deltoid (MD), and posterior deltoid (PD) muscles, and mean integrated EMG [iEMG; normalized as the relative exercise loads (kg)] was analyzed. Each position was determined by the lateral, medial epicondyle and head of humerus position. A 3-way repeated-measures ANOVA was used for statistical analysis. **RESULTS:** In all muscles for both position, gradual increases in iEMG were observed with load increases [ex. SS; in EC: 0.06 (0.55), 0.43 (0.30), 1.03 (0.43), 1.65 (0.48), 1.89 (0.31), 2.93 (0.84), 3.29 (0.74), and in FC: 0.81 (0.51), 1.59 (0.76), 2.53 (1.15), 3.51 (1.16), 4.23 (1.4), 5.61 (1.78), 6.90 (2.02), respectively 0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0 kg load]. At SS, MD, and PD, the interactions between position and loads were significant effects ( $F=52.83$ ,  $p<.01$ ), the EMG activity in EC were higher than in FC at all loads. Then, the ratio of increase of SS activity with increased of the loads was lower than a ratio of deltoid activity increase. The difference between positions in IS was not recognized.

**CONCLUSION:** The result of this study showed that SS activity was reinforced in EC. But this position did not selectively activate SS. However, we think that it is useful to exercise in EC as SS exercise of the baseball player because of effective use of shoulder muscles, included deltoid muscle.

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### 3262 Board #227 June 1 3:30 PM - 5:00 PM

#### Impact of Load on Resistance Training Circuit Volume and Energy Expenditure

Peter M. Magyari, Caleb Williams. *University of North Florida, Jacksonville, FL.* (Sponsor: Peter Ronai, FACSM)  
(No relationships reported)

**The use of resistance training (RT) in comprehensive exercise programs designed to address weight loss has gained widespread popularity. The impact of load on circuit RT volume and energy expenditure (EE) is less broadly understood.**

**PURPOSE:** To determine the impact of load on volume and EE during circuit RT.

**METHODS:** Nineteen college aged male subjects with a minimum of two months RT experience completed 1RM testing on eight pieces of RT equipment. Subjects were subsequently randomized to perform a RT circuit at either 60 or 80% of 1 repetition maximum (1RM), returning to perform the remaining protocol after a minimum of 72 hours rest. Each exercise in the circuit was performed to maximal volitional fatigue. Rest between exercises was standardized at two minutes. Total volume was calculated by multiplying load by repetitions and EE in joules (J) was calculated by multiplying the force (newtons) by the vertical displacement of the weight stack (meters) by the number of repetitions. A t-test was utilized to determine if a difference exists between group means at 60 and 80% of 1RM. Significance was set at  $p < 0.05$ .

**RESULTS:** Both mean RT volume (12,655 kg ± 2085) and EE (68.0 kJ ± 10.8) at 60% 1RM were significantly greater than RT volume (8,741 kg ± 1675) and EE (46.8 kJ ± 8.4) at 80% 1RM.  
**CONCLUSIONS:** In this study, a 20% reduction in circuit RT load from 80 to 60% 1RM increased total RT volume and calculated EE by about 45%.

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**3263** Board #228 June 1 3:30 PM - 5:00 PM

**Shoulder Muscle Activation of Novice and Experienced Weightlifters during Dumbbell Bench Press Exercises**

Adrianne L. Phillips, Joshua Luczak, George Davies, Bryan L. Riemann, *Armstrong Atlantic State University, Savannah, GA.* (Sponsor: T. Jeff Chandler, FACSM)  
(No relationships reported)

Bench press exercises are commonly used for development of chest and shoulders muscles. Altering the trunk inclination angle changes the angle of the resistive force relative to the body and therefore changes the resistive force line of action. Whether the effects occur similarly for both experienced and novice weightlifters remains unknown.

**PURPOSE:** To compare muscle activity of the anterior deltoid (AD), clavicular (CPM) and sternal (SPM) portions pectoralis major, and upper trapezius (UT) by surface electromyography (sEMG) between horizontal (HBP), incline (IBP), and military (MBP) bench press in experienced and novice women weightlifters.

**METHODS:** sEMG data were recorded at the dominate arm UT, AD, CPM and SPM for 12 experienced female weightlifters (64.33±10.08kg, 1.69±0.07m, 23.0±2.8yrs) and 12 novice (64.58±8.02kg, 1.69±0.04m, 22.6±1.7yrs) female weightlifters. Five repetitions each were performed at horizontal (0°), incline (45°), and military (85°) bench presses. Exercise order was randomized between participants. Average sEMG amplitude for each repetition phase (concentric, eccentric) was computed and averaged across the five repetitions. Separate group by exercise by phase analyses of variance were conducted.

**RESULTS:** No significant differences were found between experienced and novice weightlifters. For both UT and AD, within both phases, the MBP was significantly greater than IBP which in turn was significantly greater than the HBP. For SPM during both phases HBP and IBP were significantly greater than MBP. For CPM, during the concentric phase HBP was significantly greater than IBP which in turn was significantly greater than MBP, however, during the eccentric phase IBP was significantly greater than both the HBP and MBP.

**CONCLUSIONS:** While there were no differences related to lifting experience, as expected there were differences revealed between the three bench presses. Of the three bench presses, the MBP targeted the UT and AD during both the concentric and eccentric phases. For the pectoralis major, the HBP and IBP equally worked the sternal part during both phases, whereas the CPM was targeted during the concentric phase by the HBP and the IBP during the eccentric phase. These results provide evidence for selecting exercises in resistance and rehabilitation programs.

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**3264** Board #229 June 1 3:30 PM - 5:00 PM

**Effects Of Blood Flow-restricted Low-intensity Muscle Contractions Using An Elastic Band On Muscle Activation**

Tomohiro Yasuda<sup>1</sup>, Kazuya Fukumura<sup>1</sup>, Takayuki Ohtsuka<sup>1</sup>, Taira Fukuda<sup>1</sup>, Yusuke Uchida<sup>1</sup>, Haruko Iida<sup>1</sup>, Yugo Chujo<sup>1</sup>, Yoshiaki Sato<sup>2</sup>, Tatsuya Yamasoba<sup>1</sup>, Toshiaki Nakajima<sup>1</sup>. <sup>1</sup>The University of Tokyo, Tokyo, Japan. <sup>2</sup>KAATSU International University, Rajagiriya, Sri Lanka.  
(No relationships reported)

Low-load resistance exercise with blood flow restriction (BFR), named as Kaatsu training, leads to increased muscle activation and its response is an important factor of muscle hypertrophy. Compared with machines or free weights, an elastic band is an effective tool for resistance training in older subjects or patients with a lower level of activities. However, Kaatsu exercise using an elastic band has not been explored.

**PURPOSE:** To examine the effect of BFR contractions using an elastic band on muscle activation.

**METHODS:** Nine healthy men (ages 23-41 yrs) performed elbow extension and flexion contractions (four sets respectively) by using an elastic band (Thera-Band) with BFR or CON (unrestricted blood flow). During the BFR session, subjects wore pressure cuffs on the proximal region of both arms which were inflated to 170-260 mmHg. Surface electromyography (EMG) was recorded from the triceps brachii and biceps brachii muscles, and mean integrated EMG (iEMG) was analyzed. Blood lactate concentration was obtained before and immediately after both exercises. Ratings perceived exertion (RPE) was measured immediately after the last set of each contraction.

**RESULTS:** For elbow extension contractions, iEMG increased (p<0.05) progressively during the contractions in the BFR (~46%), which was greater (p<0.05) than those in the CON at the last set. For elbow flexion contractions, there was a progressive increase (p<0.05) in iEMG during the contractions in the BFR (~69%), which was greater (p<0.05) than those in the CON from 2nd to last set. No significant changes in muscle activation were observed in the CON for elbow extension (~12%) and flexion contractions (~23%). Blood lactate concentration increased (p<0.05) in both sessions and was greater (p<0.05) than the CON with the BFR (2.1 and 3.6 mmol/L, respectively). Following the contraction bout, increased iEMG was correlated with blood lactate concentration and RPE in elbow extension (r=0.65 and 0.60, both p<0.01) and flexion contractions (r=0.52, p<0.05 and r=0.68, p<0.01).

**CONCLUSIONS:** Our results suggest that Kaatsu training using an elastic band enhances muscle activation during muscle contractions, which may be an effective method to promote muscle hypertrophy in older subjects or patients with a lower level of activities.

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**3265** Board #230 June 1 3:30 PM - 5:00 PM

**The Effects Of Intensity On Blood Glucose Concentration In Lower Body Free Weight Resistance Training**

Cardyl Trionfante, Gregory R. Davis, Arnold G. Nelson, FACSM. *Louisiana State University, Baton Rouge, LA.*  
(No relationships reported)

Previous studies have found that resistance training can significantly affect blood glucose and lactate concentrations (pre/post-ex). Observations also suggest that high intensity low volume (HILV) sets with low rest time can result in lower post-ex blood lactate levels compared to low intensity high volume (LIHV) sets. It has been theorized that low volume sets increase the amount of time under tension (TUT) utilizing the immediate phosphagen (PCr) pathways while high volume sets increase the amount of TUT utilizing glycolytic pathways. If TUT is matched for both protocols, then one can theorize that increased time in glycolysis would increase blood lactate levels to the point of stimulating hepatic glucose output, resulting in increased blood glucose (BG) concentration.

**PURPOSE:** The purpose of this study is to find the effects of treatment (HILV, LIHV) on BG concentration during lower body resistance training.

**METHODS:** Ten healthy college age subjects selected for the study. A one repetition max (1RM) test determined workloads for each protocol (HILV=80%, LIHV=55%). The box squat was chosen for the exercise protocols. Subjects participated in both protocols (HILV, LIHV) with a week separating trials. In order to match TUT and total workout time (rest time + TUT), each protocol had a different rest time (HILV- 30 sec, LIHV- 180 sec) to accommodate the difference in repetitions completed per set. Immediately before and after the box squat protocols, a finger prick test was administered to measure BG (Pre, Post-ex).

**RESULTS:** An effect for time (Pre-86, Post-92) was found statistically significant (p=.006). The effects of treatment (HILV/LIHV) did not have any statistical significance (p=.52).

**CONCLUSION:** This study along with others have shown that resistance training sessions can increase BG (Pre-86, Post-92) concentration regardless of treatment (HILV, LIHV). A possible cause for increased BG is that build-up of metabolic byproducts (ex: lactate, H+ via glycolysis) can increase sympathetic nervous activity (increasing anaerobic metabolism further) which can stimulate hepatic glucose output.

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**3266** Board #231 June 1 3:30 PM - 5:00 PM

**Natural Bodybuilding Contest Preparation - A Six-Month Case Study**

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(No relationships reported)

A detailed examination of the physiological changes that accompany preparation for a drug-free, "natural," bodybuilding competition has never been performed.

**PURPOSE:** The purpose of this study was to provide a comprehensive physiological profile of a natural professional male bodybuilder as he prepared for competition.

**METHODS:** Before (baseline) and during each month of six months of contest preparation, the following measurements were performed: brachial blood pressure (bBP), pulse wave velocity (PWV), pulse wave analysis, calf and forearm blood flow, cardiac ultrasound, dual-x-ray absorptiometry (DXA), 3-site skinfolds, and Profile of Mood States (POMS). At baseline, 3-months, and 6-months into preparation, blood and resting energy expenditure (REE) were assessed. Every other month, 1-RMs and VO2max were assessed. Diet was recorded daily.

**RESULTS:** Results from the first month (March) to the last measurement date are presented in Table 1. Due to the subject's low heart rate (HR) in the later months, several cardiovascular measurements could not be obtained. If a measurement was unable to be obtained in the sixth month of contest preparation, September, the last month of measurement is stated.

**CONCLUSION:** As the bodybuilder prepared for competition, in general, he experienced desirable cardiovascular and body composition changes along with a decrease in strength and resting energy expenditure.

**Table 1.**

| Measurement                              | March (Baseline) | Last Measurement |
|--|------------------|------------------|
| bBP (mmHg)                               | 132/69           | 104/56           |
| Aortic BP (mmHg)                         | 105/69           | 88/67 July       |
| HR (bpm)                                 | 53               | 27               |
| Stroke Volume Index (ml)                 | 44               | 69               |
| Cardiac Output Index (L/min)             | 2.4              | 1.9              |
| Calf Blood Flow (ml/min/100ml tissue)    | 1.7              | 1.6              |
| Forearm Blood Flow (ml/min/100ml tissue) | 2.4              | 1.6              |
| Central PWV                              | 5.8              | 3.8              |
| Femoral-Tibialis Posterior PWV           | 9.2              | 8.4              |
| Carotid-Radial PWV                       | 7.8              | 7.4 August       |
| Augmentation Index (%)                   | -11              | 4 July           |
| Time to Wave Reflection (ms)             | 150              | 142 July         |
| Weight (kg)                              | 103              | 89               |
| %Body Fat by DXA                         | 12.8             | 3.9              |
| Lean Mass (kg) by DXA                    | 86.68            | 84.01            |
| Daily Energy Intake (kcal)               | ~2800            | ~2500            |
| Sum of 3-Skinfolds (mm)                  | 31               | 12               |
| POMS Total Mood Disturbance              | 6                | 43               |
| VO2max (ml/kg/min)                       | 42               | 45 August        |
| 1-RMs: Squat, Bench, Deadlift (kg)       | 211, 161, 260    | 183, 148, 242    |
| HDL (mg/dl)                              | 49               | 79               |
| LDL (mg/dl)                              | 146              | 147              |
| TG (mg/dl)                               | 62               | 63               |
| Glucose (mg/dl)                          | 83               | 72               |
| Creatine Kinase (U/L)                    | 582              | 495              |
| Resting Energy Expenditure (kcal/d)      | 2424             | 1283             |

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**Effects on Leg Muscle Activity using the Compression Belt on Squat Exercise**

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(No relationships reported)

Resistance training at low loads with blood flow restricted by the use of specific compression belt has been shown to induce muscle hypertrophy and strengthening. However, it is unclear that acute effects on muscle activity with the use of specific compression belt.

**PURPOSE:** To compare the EMG activity of directly compressed muscle (multi joints muscles) and indirectly compressed muscle (single joint muscles) with and without specific compression belt on femoral proximal region.

**METHODS:** A cross-over interventional study. Nine healthy adults (5 women and 4 men), mean age (SD) age: 29.4 (8.8) yrs, performed 3 sets (5sec. set interval: 15sec) of static squat position (bilateral squat (BS) and single leg squat (SS)) during three different conditions; pre non-compressed (Pre), compressed on femoral proximal region (Comp) and post non-compressed (Post). In the condition of Comp, a specially designed elastic compression cuff belt (30 mm wide) was placed at the most proximal position of the upper leg, and inflated to a pressure calculated by the individual's maximum pulse wave at resting condition. Surface EMG was recorded from the muscle belly of the rectus femoris (RF; a directly compressed muscle), and vastus lateralis (VL; an indirectly compressed muscle) muscles, and mean integrated EMG: iEMG; normalized as the relative exercise intensity (%) was analyzed (used a 3-way repeated measures analysis of variance, and a Least Significant Difference (LSD) multiple post hoc test).

**RESULTS:** The activity of muscles in BS (54.6 (10.3) %) were higher than in SS (84.9 (14.1) %) (F=96.6, p<0.01). The interaction between muscles and squat positions was not significant (F=5.24, p>.05). The interactions between compressive condition and muscles had significant effects (F=6.23, p<0.01), and Pre (71.4 (%)) and Post (67.1%) non-compressed were higher compared to Comp (60.7%) in the RF (F=16.72, p<0.01). However, activity in the VL was not different (Pre=76.4%, Comp=72.2%, Post=70.7%, F=3.00, p>.05).

**CONCLUSION:** Decreases in activity of the directly compressed upper leg muscle during static squat exercise with a compression belt on femoral proximal region might be influenced by mechanical effect.

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**Reliability Of An Instrument To Determine Power In The Bench Press**

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(No relationships reported)

Power is an attribute often measured in athletics by sport scientists, coaches and teachers; therefore, it is important to have reliable options to quantify it.

**PURPOSE:** The purpose of this investigation was to examine the reliability of a commercially available optical wire encoder based device with digital readout for assessing power during the bench press.

**METHODS:** Six male (height: 186.4±3.6 cm, weight: 128.0±12.4 kg) and six female (height: 163.5±6.7 cm, weight: 65.3±14.6 kg) NCAA division 1 track and field athletes volunteered for the investigation. Participants underwent two testing sessions, each consisting of a dynamic warm-up followed by three maximum power bench presses at 50% of a one repetition maximum (1RM) previously determined a week prior to data collection. Data were analyzed for reliability within each session, and also between two testing dates, separated by one week using intraclass correlations coefficients (ICC) and Anova.

**RESULTS:** Results indicated very strong reliability between the three measurements for the first session ( $F = 0.752$ ,  $p = 0.482$ ,  $ICC=0.985$ ) and second session ( $F = 1.642$ ,  $p=0.217$ ,  $ICC=0.984$ ). In examining the test-retest reliability between the separate test dates, the average power was significantly different ( $F=5.666$ ,  $p=0.036$ ) but participants' peak power did not differ ( $F=1.140$ ,  $p=0.309$ ).

**CONCLUSIONS:** Results suggest that the device demonstrated reliability within testing sessions and also when assessing peak power over a period of one week.

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**3269 Board #234 June 1 3:30 PM - 5:00 PM**  
**Effect of Footwear on Impact Absorption from a Vertical Jump**

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(No relationships reported)

**PURPOSE:** The purpose of this study was to examine the effect of footwear on impact absorption while landing from a vertical jump.

**METHODS:** Twenty-seven recreationally trained females (23±2.2 yrs, 162.94±7.37 cm, and 62.02±8.79 kg) participated in this study. Following a 5-minute cycling warm-up, each subject completed three vertical jumps while wearing one of two different types of footwear: bare feet (BF) or minimalist shoes (MS; Fila Skeletons). The order in which the footwear was worn was randomized until each subject had jumped with both conditions in the same visit. All counter-movement vertical jumps were performed on a force plate with hands placed on the hips. Thirty seconds of rest was given between trials and 2 minutes were allotted between conditions. Impact absorption rate (IAR) was calculated by dividing the peak impact force by the time from foot contact to peak impact force. Relative impact absorption rate (RIAR) and relative peak impact force (RPIF) were also calculated.

**RESULTS:** Paired-samples t-tests revealed no differences in IAR between the BF (38640.01±22296.11 N/s) and MS (39158.95±22044.76 N/s) conditions. There were also no differences in RIAR between the BF (63.75±34.23 N/s/N) and MS (64.82±34.65 N/s/N) conditions or in RPIF between the BF (4.28±1.23 times body weight) and MS (4.24±1.28 times body weight) conditions.

**CONCLUSIONS:** The results of this study indicate that while landing from a vertical jump, the absolute and relative impact forces experienced while barefoot or wearing minimalist shoes were similar. Additionally, the rate of absorption was not different between minimalist shoes and being barefoot. Therefore, wearing minimalist shoes may not be warranted in an attempt to affect impact absorption during plyometric activities.

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**3270 Board #235 June 1 3:30 PM - 5:00 PM**  
**The Efficacy Of Combining Weight-bearing Exercises With A Newly-developed Perceived Exertion Scale In Middle-aged Men**

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(No relationships reported)

**PURPOSE:** The rate of perceived exertion is an easy and practical way to monitor the intensity of resistance exercise in a field setting. The weight-bearing exercise is safer than a resistance training using the weight for in middle-aged person. The purpose of this study was to investigate the effect of exercises with one's own bodyweight by measuring exercise intensity with the newly-developed perceived exertion Japanese scale (S-scale, on a 4-point scale) in middle-aged Japanese men.

**METHODS:** Twenty-five healthy men (age range, 40-69 years) were randomly and equally assigned to an exercise training intervention group (EG, n = 13) or a control group (CG, n = 12). EG members performed a structured exercise regimen consisting of group-based and home-based training with their own bodyweight, performing repetitions until they reached a perceived exertion intensity of 3 out of 4 (S-scale). Participants performed one set of each exercise, which included resistance training of the upper (push-up) and lower (squat) limbs and abdominal (sit-up) muscles, 3 times a week for 12 weeks. The outcome measures were body composition, abdominal girth, and blood pressure, as well as the 30-second chair-stand test (CS-30), vertical force in sit-to-stand movement from a chair, vertical jump (VJ), shoulder horizontal adduction (SHA, a test of muscle strength), 30-second sit-up test, leg muscle power using the bicycle ergometer, center of foot pressure (a static equilibrium function test), 2-min step test, and chair sit-and-reach test.

**RESULTS:** There were no incidents of injury or musculoskeletal damage because of the exercise program. At baseline, each group was well matched in physical characteristics. After 12 weeks of intervention, the EG showed significantly greater improvements ( $p < 0.05$ ) in measures of CS-30 (+11%), VJ (+20%), and SHA (+15%). The CG experienced no significant changes. We identified a statistically significant two-factor interaction between the exercise and control groups in the CS-30 ( $F = 19.8$ ,  $p < 0.01$ ) and VJ ( $F = 34.4$ ,  $p < 0.01$ ).

**CONCLUSION:** These results suggest that weight-bearing exercises performed in conjunction with the newly-developed perceived exertion scale provide safe and effective resistance training in middle-aged men.

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**3271 Board #236 June 1 3:30 PM - 5:00 PM**  
**Kinetic Comparison Of Free Weight Bench Press And Slow Velocity Isokinetic Chest Press**

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(No relationships reported)

There is limited knowledge comparing maximal force production on free weight bench press to isokinetic horizontal chest press machines, especially machines that operate at slow speeds (<2 m/s) that purport to result in greater forces.

**PURPOSE:** To compare force development on a free weight 1 repetition maximum (1 RM) bench press and an isokinetic chest press machine (Exerbotics, Tulsa, OK) in recreationally trained men.

**METHODS:** Recreationally trained males participated in the study ( $X \pm SD$ ; n=10, age =22.8±2.6 yrs, ht =1.83±0.06 m, body wt =81.3±7.9 kg). Subjects performed the exercise sessions in random order. One session was a free barbell bench press performed on a ProSpot bar (FW; Prospot Fitness Inc. Pompano Beach, FL) while on a 1-D force plate (Rough Deck, Rice Lake, WI) to measure force at 1000 Hz using a Biopac (Goleta, CA) acquisition system. 1RM FW bench presses were determined, after a brief warm up, followed by regular load increments until a maximal effort was achieved. Kinetic variables (maximum and mean force, time to maximum force) during the 1 RM lift were then determined. During the other session, subjects performed a max effort bench press on an isokinetic chest press (CP) using an interfaced acquisition system sampling at 252 Hz/ROM. Sessions were performed one week apart.

**RESULTS:** Max FW force = 2998.5±686.0 N, mean FW force = 2203.8±662.3 N compared to max CP force = 2887.9±527.3 N and mean CP force = 2203.7±371.4 N for the concentric action. For the eccentric action, Max FW force = 2806.2±642.7 N and mean FW force = 2135.4±766.7 N, compared to max CP force = 2948.4±657.9 N, and mean CP force = 1980.6±521.5 N. There was no significant difference between any of the concentric or eccentric force measures using independent t-tests ( $p>0.05$ ). Mean time to peak force was 0.026±0.0180 s for FW and 3.390±.7110 s for CP, which was significantly different.

**CONCLUSIONS:** These data indicate there is no difference in maximal or average force produced during either modality, but there is a difference in where maximum force occurs in the range of motion based on the time to maximum force. Both FW and CP produce similar forces, but the time to maximum force is significantly faster using FW.

This project is supported in part by Exerbotics.

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**Does Vibration Counteract the Static Stretching-induced Deficit on Muscle Force Development?**

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(No relationships reported)

**INTRODUCTION:** The maintenance of both neural activation and intrafusal mechanical sensitivity state are hypothetically implicated in the counteraction of the static stretching-induced impairment on power performance when muscle vibration is simultaneously imposed.

**PURPOSE:** To determine the residual acute vibration-stretching effect on ground reaction forces, muscle pre-activation levels, short latency stretch reflex responses, and performance during execution of depth jumps (DJ).

**METHODS:** Eleven amateur athletes performed a set of three 45cm-DJs before and immediately after three 30s-sets of static stretching exercise with (VSTR) and without (STR) simultaneously imposed muscle vibration (45 Hz, 5mm). DJ height (DJH), contact time (CT), ground reaction force peak (GRFP), time to peak (TP), and electromyographic data including Vastus Lateralis onset/levels of pre-activation and short latency stretch reflex onset (SLRO) and amplitude (SLRA) were recorded.

**RESULTS:** No changes were induced on DJH after both VSTR ( $32.1 \pm 2.2$  vs.  $32.3 \pm 3.5$  cm) and STR ( $32.7 \pm 2.1$  vs.  $32.1 \pm 2.6$  cm). However, STR-induced decrements on GRFP ( $2161.9 \pm 52.0$  vs.  $2144.9 \pm 46.3$  N,  $P = .031$ ) and TP ( $22.8 \pm 7$  vs.  $25.4 \pm 9$  ms,  $P = .050$ ) as well as an increment in CT when compared to VSTR post measurements (STR  $271.9 \pm 84.9$  vs. VSTR  $250.5 \pm 74.2$  ms,  $P = .046$ ) followed a delay in SLRO ( $25.2 \pm 5.7$  vs.  $29.8 \pm 5.4$  ms,  $P = .032$ ) and reduced pre-activation levels ( $29.3 \pm 20.3$  vs.  $23.11 \pm 20.3$  % maximal isometric voluntary contraction [MIVC]) of Vastus Lateralis. When vibration was simultaneously imposed to stretching, there was no evidence of significant changes in high-speed force production variables such as GRFP ( $2154.2 \pm 51.5$  vs.  $2156.5 \pm 41.3$  N), TP ( $24.4 \pm 6.7$  vs.  $23.1 \pm 7.0$  ms) and CT ( $256.9 \pm 72.7$  vs.  $250.5 \pm 74.2$  ms). Vastus Lateralis SLRO ( $26.7 \pm 4.8$  vs.  $27.7 \pm 5.4$  ms), SLRA ( $60.2 \pm 17.5$  vs.  $59.1 \pm 14.4$  % Maximal SLRA) and pre-activation onset ( $86.9 \pm 39.9$  vs.  $86.5 \pm 31.9$  ms) and levels ( $27.4 \pm 17.6$  vs.  $24.4 \pm 19.61$  % MIVC) remained unchanged after VSTR.

**CONCLUSION:** Mechanical vibration, when applied simultaneously to static-stretching exercise, appeared to be effective in counteracting decreased MTU stiffness-induced high-speed force production deficit during stretch shortening cycle performance.

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**Postactivation Potentiation Improves Sprint Performance in Collegiate Football Players**

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(No relationships reported)

Recently, researchers reported that 100-m sprint performance improved significantly following a preload stimulus of 4 repetition maximum parallel back half-squats in collegiate women (Linder, E.E. et al., *J. Strength Cond. Res.* 24:1184-1190, 2010). However, it is unknown whether a similar preload stimulus will elicit improvement in sprint performance in collegiate football players.

**PURPOSE:** The purpose of this study was to determine the effects of postactivation potentiation (PAP) on 36.6 m sprint performance after a preload set of 3 repetition maximum (3RM) parallel back half-squat exercises in collegiate football players.

**METHODS:** Seven healthy resistance trained National Collegiate Athletic Association Division II male football players that included defensive backs, wide receivers, and running backs (mean  $\pm$  SD; age:  $20.4 \pm 1.6$  y; weight:  $87.81 \pm 8.25$  kg; height:  $184.3 \pm 7.2$  cm; body composition:  $10.6 \pm 3.1$  %) volunteered to participate in the study. Subjects were randomly assigned to two 36.6 m sprint warm-up protocols to include: 1) Control (C) protocol which consisted of a 5 min warm-up on a cycle ergometer at 25 W, 5 min rest, 36.6 m sprint test, a second 5 min rest interval followed by a second 36.6 m sprint and 2) PAP protocol which consisted of a 5 min warm-up on a cycle ergometer at 25 W, 5 min rest, 36.6 m sprint test, a second 5 min rest interval, a warm-up of 8 repetitions at 50% 1RM squat, 2 min rest, 3RM squat, 8 min rest, and a final 36.6 m sprint test. All 36.6 m sprint times were assessed on an indoor track using a touch pad activated Brower TC timing system.

**RESULTS:** Paired t-tests showed that 36.6 m sprint performance was significantly ( $p < 0.05$ ) lower following the PAP (4.6014 .17995 sec) versus the best sprint trial for the C (4.6714 .18050 sec) protocol and the first sprint trial (4.6557 .19603 sec) completed prior to the PAP treatment.

**CONCLUSIONS:** We conclude that a preload 3RM parallel back half-squat warm-up significantly improves sprint performance compared to a general cycle warm-up. Our data suggests that postactivation potentiation produced by a 3RM parallel back half-squat improves sprint performance in collegiate football players.

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**Response Of Individual Muscles To Neuromuscular Electrical Stimulation Training Of Knee Extensors**

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(No relationships reported)

Neuromuscular electrical stimulation (NMS) is one of the most popular advanced methodologies for athletes to gain muscle strength. Usually, NMS uses a pair of large electrodes to stimulate one muscle group (Group Stimulation, GS) instead of stimulating individual muscles. To design effective training protocols, the response of individual muscle to GS must be examined.

**PURPOSE:** 1) To identify the unique force vector produced by individual knee extensors, and 2) to investigate the contribution of individual knee extensors to the force vectors produced by GS in NMS training.

**METHODS:** Six subjects ( $30.0 \pm 8.9$  yrs) sat on a chair and three knee extensors (vastus medialis, vastus lateralis, and rectus femoris) were individually stimulated. Additionally, knee extensors were stimulated simultaneously as a group using regular NMS electrodes at three different locations (GS1-3). The unit force vectors in the isometric condition were calculated for individual muscles and for GS1-3. The relative contribution of individual muscles to GS1-3 was estimated based on an assumption that the force vector measured during each GS was a linear vector summation of force vectors of the three individual muscles.

**RESULTS:** Fig. 1 and Fig. 2 shows the unit force vectors and the contribution for individual muscles, respectively. The unit force vector was statistically different among the three knee extensors (MANOVA,  $p < 0.001$ ). The contributions of the three knee extensors were statistically different among muscles (ANOVA,  $p < 0.001$ ), while not different among GS1-3 ( $p = 0.09$ ).

**CONCLUSIONS:** Each knee extensor has a unique force vector. Distinct contributions from individual muscles were found, suggesting that NMS training may unevenly affect knee extensors.

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3275 Board #240 June 1 3:30 PM - 5:00 PM

**A Comparison of EMG Activity Between Dumbbell Bench, Barbell Bench and Vertical Chest Press**

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(No relationships reported)

**PURPOSE:** In a resistance-training program, increasing upper body strength is important if the participant is currently involved in a sport in which body-to-body contact is necessary. Therefore, it is necessary to discover which exercises are the most effective at developing upper body strength. Although there have been several studies examining the effects of the dumbbell bench press and barbell bench press as well as the barbell bench press and machine bench press on electromyographic (EMG) activity, few studies have compared the EMG activity of all 3 types of exercise. Therefore, the purpose of this study is to compare the effects of the dumbbell bench press, barbell bench press and vertical chest press on EMG of the anterior deltoid and the pectoralis major.

**METHODS:** Thirteen recreationally trained (exercise individually 2-3 times per week and bench press a minimum of 61.4 kg), college age males height (178±6.2cm), weight (84.2±15.3kg), barbell bench press max (109.95±20.41kg) students from the HLES department at UWF volunteered for this study. All volunteers were randomized to perform a barbell bench press, dumbbell bench press or a vertical chest press exercise at 70% of their 1RM on barbell bench press while wearing EMG electrodes. A repeated measures ANOVA was used to analyze the data.

**RESULTS:** Dumbbell bench produced the greatest anterior deltoid activity (1254.6 ± 377.7 Hz) while the vertical bench recorded the greatest pectoralis major activity (615.0 ± 162.3 Hz). There were no significant differences in muscle EMG activity between the 3 exercises for either muscle groups ( $p < 0.05$ ).

**CONCLUSIONS:** The results of this study were consistent with the findings in earlier studies indicating no significant differences between barbell bench-press and dumbbell bench. Vertical chest press seems to have a slightly greater mean activation of the pectoralis major when compared to the other two exercises.

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**Electromyographic Analysis of the Infraspinatus Muscle during Several Shoulder Elevation Tasks**

Shunsuke Fujitake<sup>1</sup>, Masanori Takemura<sup>2</sup>, Tetsuji Ishida<sup>3</sup>, Chihiro Dehara<sup>4</sup>, Junzo Tsujita<sup>2</sup>. <sup>1</sup>Tachiiri Orthopedics, Kyoto, Japan. <sup>2</sup>Hyogo College of Medicine, Nishinomiya, Japan. <sup>3</sup>Shiga Medical Center for Children, Moriyama, Japan. <sup>4</sup>Gakkenotshi Hospita, Seika, Japan.  
(No relationships reported)

The shoulder muscles recruitment pattern during shoulder elevations at several initial arm positions has not yet been clearly understood.

**PURPOSE:** To compare the activity in shoulder muscles, particularly the infraspinatus muscle during shoulder elevation at several initial arm positions.

**METHODS:** Ten healthy without shoulder diseases adults (3 female and 7 male), means (SD) age: 25.5 (5.4) years, height: 166.5 (9.1) cm, weight: 58.6 (12.1) kg, participated in this study. Each subjects performed maximal voluntary isometric contractions (MVIC) of shoulder flexion, abduction, external rotation (1st position). Then they performed 3 times isometric contractions (5 sec) of shoulder elevation at 30 degrees with 3 kg weight loads, within frontal plane (abduction; [ABD]), scapula plane [Scaption], sagittal plane (flexion; [Flex]), diagonal plane (flexion and abduction) with shoulder external rotation [DiaER], diagonal plane with shoulder internal rotation [DiaIR], and external rotation with therapeutic band load of equivalent of 3 kg weight loads at 1st position (0 degrees of shoulder flexion and abduction, with elbow flexion; [1stER]). Surface EMG was recorded from the muscle belly of infraspinatus (the upper portion; [ISup], and the lower portion; [ISlo]), supraspinatus [SS], upper trapezius [T], anterior deltoid [DA], and middle deltoid [DM] muscles, and mean integrated EMG [iEMG; normalized as MVIC; (%)] was analyzed. A 3-way repeated-measures ANOVA was used for statistical analysis.

**RESULTS:** The activity (%iEMG) of ISlo were 37.6 (24.9) at ABD, 41.9 (19.6) at Scaption, 47.3 (14.9) at Flex, 57.5 (15.8) at DiaER, 80.5 (29.6) at DiaIR, and 48.7 (12.7) at 1stER, then DiaIR was significantly higher than other positions ( $p < .05$ ). In the activity of ISup, DiaIR [47.2 (17.8)] and 1st ER [48.7 (12.0)] were significantly higher ( $p < .05$ ) than ABD [35.9 (16.2)], Scaption [39.3 (13.5)], Flex [41.3 (12.3)], and DiaER [39.5 (13.2)], however DiaIR and 1stER was not difference.

**CONCLUSION:** The result of this study showed that ISlo activity at DiaIR was higher than at 1stER. Although 1stER exercise is popular training method, we think that diagonal (flexion and abduction) and spiral (internal to external rotation) pattern is more useful as functional exercise pattern in infraspinatus muscle.

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**Neuromuscular Responses to Power Exercise Using Weight Stack Device With and Without Rubber Band Resistance**

Heikki Peltonen, Keijo Häkkinen, Janne Avela. University of Jyväskylä, Jyväskylä, Finland.  
(No relationships reported)

Power training improves the ability to produce explosive muscle strength or/and contractile rate of force development. During a single explosive repetition, when using weight-based resistance, reduced force, velocity, power, and muscle activity during the latter range of movement occurs. This suggests that the stress of loading occurs over a brief part of the range of motion.

**PURPOSE:** To determine whether additional rubber band resistance will induce greater neuromuscular fatigue compared to typical WS power loading.

**METHODS:** 15 physically active men (20-35 yrs) without systematic weight training background acted as subjects. A knee extension loading protocol, which consisted of 5 x 5 x 40% 1RM load with 3 min rest between sets, was performed with each extension as fast as possible. Subjects used the same weight stack (WS) device during both loadings; the only difference being a rubber band (WS+RB) attached between the weight stack and the ground during the other loading. Acute neuromuscular responses were assessed by measuring force (F100ms and Fmax), rate of force development (RFD) and muscle activity (EMG100ms, EMGmax and frequency) during maximal isometric voluntary contraction before and after the loading. Electrical stimulation was used to measure resting (RT) and superimposed twitch forces (to determine activation level, AL) and M-wave parameters. In addition, blood samples were drawn and lactate levels (La) were analyzed.

**RESULTS:** Fmax decreased after both loadings (WS+RB -13±4%,  $p < 0.01$ , WS -9±8%,  $p < 0.05$ ). Large decreases occurred in F100ms (WS -27±26%,  $p < 0.01$ , WS+RB -16±10%,  $p < 0.001$ ). The decline in maximal RFD was also similar ( $p < 0.001$ ) after both loadings. However, AL declined significantly only after WS+RB loading (-5±7%,  $p < 0.05$ ), while EMG100ms declined only in WS (-24±22%,  $p < 0.01$ ; WS vs. WS+RB  $p < 0.01$ ). La was higher ( $p < 0.01$ ) after WS+RB than WS loading. No changes were observed in RT, EMGmax, frequency, or M-wave parameters after either loading.

**CONCLUSION:** Both power loading models induced clear signs of neuromuscular fatigue, in which the greatest decreases occurred in rapid force production. However, since in WS+RB AL reduced significantly, and RT was unaffected, additional rubber band resistance with WS may alter the neural properties more efficiently as compared to loading with WS only.

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**3278** Board #243 June 1 3:30 PM - 5:00 PM

**Growth Of Rpe During Resistance Exercise**

John P. Porcari, FACSM, Carl Foster, FACSM, Jos J. de Koning, FACSM, Jeena Lucas-Kormarek, Glenn Wright, Scott Doberstein. University of Wisconsin-La Crosse, La Crosse, WI.  
(No relationships reported)

**PURPOSE:** RPE grows in a scalar manner during sustained, whole body ambulatory exercise such as running and cycling. This study was conducted to determine whether RPE increases in a similar way during resistance exercise.

**METHODS:** Resistance trained men (N=21) performed 4 sets of bench press & leg press with resistance calculated to cause fatigue in 5, 10, 20 or 30 repetitions pm 4 days separated by at least 48 hr. RPE was measured after each repetition using the category-ratio scale.

**RESULTS:** Regardless of the number of repetitions completed, RPE increased throughout each set in a linear fashion. Normalized to the % maximal repetitions across all levels of resistance, RPE had scalar properties, and there was a strong relationship between RPE and % repetitions ( $R^2=0.93$ ).

**CONCLUSION:** This study supports the concept that RPE increases in a scalar manner with relative fatigue during resistance exercise just as it does during whole-body ambulatory activity.

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**3279** Board #244 June 1 3:30 PM - 5:00 PM

**Shoulder Muscle Activation Of Novice And Weight-trained Females During Push-ups On An Unstable Surface**

Brittany E. Russell, Jennifer Lindsay Newsome, Bryan L. Riemann. Armstrong Atlantic State University, Savannah, GA. (Sponsor: T. Jeff Chandler, FACSM)  
(No relationships reported)

Performing closed kinetic chain exercise on an unstable surface increases the muscle stability demands. In contrast to the research conducted considering lower extremity and muscle activation during training on unstable surfaces, there is a lack of research on the upper extremity. Furthermore whether acute responses differ between weight-trained versus untrained subjects is unknown.

**PURPOSE:** To compare shoulder muscle activation of novice (untrained) and experienced weight lifters during three different push-up variations.

**METHODS:** Muscle activity of the dominant arm biceps brachii (BI), triceps (TR), upper trapezius (UT), anterior deltoid (AD), sternal (SPM) and clavicular (CPM) portions of the pectoralis major and the serratus anterior (SE) were measured by way of surface electromyography (EMG) in 12 novice 64.33±10.08kg, 1.69±0.07m, 23.0±2.8yrs and 12 experienced (64.58±8.02kg, 1.69±0.04m, 22.6±1.7yrs) weight lifters. Subjects performed five repetitions of three push-up variations, stability discs under hands, stability discs under feet, no stability disc, in a random order. Average EMG amplitude during the concentric phase of each push up variation repetition was computed and averaged across the five trials. Separate group by push up variation analysis of variance was used for each muscle with statistical significance considered at P<.05.

**RESULTS:** With the exception of the BI, exercise had significant effects on muscle activity. Four muscles, SPM, CPM, AD and TR, demonstrated significantly higher activity during PUH and SPU compared to PUF. UT demonstrated significantly greater activity during PUH compared to SPU and PUF. SA demonstrated significantly greater activity during SPU compared to PUH. SPM, CPM, and TR, demonstrated group effects with the novice group eliciting significantly greater activity than the experienced lifters.

**CONCLUSIONS:** Performing push-ups with the hands on the discs did not increase muscle activity compared to standard push-ups. This suggests that PUH can be used to promote stabilizer activity without compromising prime mover activation. Perhaps explaining the reduction in activation for PUF compared to SPU was a change in center of mass position. Higher activation in novices is likely explained in differences in push-up execution.

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## G-29 Free Communication/Poster - Body Composition II

JUNE 2, 2012 7:30 AM - 11:00 AM

ROOM: Exhibit Hall

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3280 Board #1 June 2 8:00 AM - 9:30 AM

### Validity of Bioelectrical Impedance Measurement in Predicting Fat-Free Mass of Chinese Children and Adolescents

Lin Wang, Stanley Sai-Chuen Hui, FACSM. *The Chinese University of Hong Kong, Hong Kong, Hong Kong.*

(No relationships reported)

The validity of bioelectrical impedance analysis (BIA) equations for estimating fat-free mass from in Chinese children and adolescents has not been verified.

**PURPOSE:** The study aims to develop BIA equations for the estimation of fat-free mass (FFM) that are appropriate for Chinese children and adolescents.

**METHODS:** A total of 255 healthy Chinese children and adolescents aged 9-19 years old (127 males and 128 females) participated in the bioelectrical impedance measurement at 50 kHz between the hand and the foot, as well as the criterion measure of FFM using dual-energy X-ray absorptiometry (DEXA). Multiple regression analysis was employed to develop prediction equations for FFM from BIA measurement. A double cross-validation approach was used to determine the predictive accuracy of developed BIA equations. Differences between measured and predicted FFM were examined by Bland-Altman analysis. Bland-Altman plots were also generated to illustrate the residual errors.

**RESULTS:** Using multiple linear regression and cross-validation against DEXA measurement, a FFM prediction equation was produced as follow: FFM (kg) = 1.613 + 0.742 × height (cm)<sup>2</sup>/impedance (Ω) + 0.151 × body weight (kg); R<sup>2</sup> = 0.95; SEE = 2.45kg; CV = 6.5%. The mean difference between DEXA-measured and predicted FFM was 0.02 ± 2.45 kg; 95% limits of agreement was -4.78 to 4.82 kg FFM.

**CONCLUSIONS:** From the data collected in the present study, a BIA equation for predicting FFM of Chinese children and adolescents has been developed. The equation is applicable over a larger range of body sizes and age. With the use of appropriate BIA equation, BIA can provide a practical and valid measurement of body composition among Chinese children and adolescents.

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3281 Board #2 June 2 8:00 AM - 9:30 AM

### Regression Models to Predict Abdominal Obesity With Waist Circumference in Children

João P. Magalhães<sup>1</sup>, Diana A. Santos<sup>1</sup>, António Palmeira<sup>2</sup>, Sandra Martins<sup>2</sup>, Fátima Baptista<sup>1</sup>, Ezequiel M. Gonçalves<sup>1</sup>, Cláudia S. Minderico<sup>2</sup>, Luís B. Sardinha<sup>1</sup>.

<sup>1</sup>Faculty of Human Kinetics technical University of Lisbon, Lisbon, Portugal. <sup>2</sup>Lusofona University, Lisbon, Portugal.

(No relationships reported)

**BACKGROUND:** Waist circumference (WC) is positively correlated with abdominal fat content, and it is considered a good anthropometric indicator for diagnosing abdominal obesity across different age groups, including children. Investigation has confirmed that early obesity in childhood is associated with an increased risk of chronic diseases in adult ages.

**PURPOSE:** To develop and cross-validate prediction equations to estimate abdominal obesity based on waist circumference, independently for boys and girls in children.

**METHODS:** Abdominal body fat (ABF) was assessed using Dual Energy X-ray Absorptiometry (DXA) in 271 boys and 241 girls aged 10.3 ± 0.6 years. ABF was measured in a region of interest between L2-L4. WC was measured according to the NIH protocol (on the superior border of the iliac crest), to the WHO protocol (between the lower rib and iliac crest), and to Lohman's protocol (on the narrowest part of the torso). Prediction equations were established, independently for boys and girls, using a cross validation method. One hundred and eighty boys and 161 girls were used to develop the two prediction equations (2/3 of the sample). Cross validation was performed on a representative hold-out sample of 91 boys and 80 girls (1/3 of the sample). Cross-validation included paired samples t-tests and analysis of Pearson Correlation Coefficient (r), and standard error of estimate (SEE).

**RESULTS:** Because the NIH protocol yielded the highest correlation coefficient with ABF, we selected this variable to develop and validate the prediction models. Mean values for ABF in the hold-out sample were 0.7 (± 0.54) kg and 0.86 (± 0.56) kg, for boys and girls, respectively. Both equations cross-validated very well, for girls (r=0.92 and SEE=0.225 kg) and for boys (r=0.92 and SEE=0.211 kg). There were no differences in the mean values between both equations and ABF assessed with DXA (p >0.05). The new prediction equation for boys was ABF = 0.058 \* WC - 3.053 and for girls ABF = 0.061 \* WC - 3.192.

**CONCLUSIONS:** These results indicate that the prediction equations perform very well to predict ABF assessed with DXA for both boys and girls. With these models including a very simple measurement such as WC, one can readily estimate a fatness atherogenic phenotype.

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3282 Board #3 June 2 8:00 AM - 9:30 AM

### Comparison of Waist Circumference Measurements Using Different Protocols in Children

Diana A. Santos<sup>1</sup>, João P. Magalhães<sup>1</sup>, Analiza M. Silva<sup>1</sup>, António Palmeira<sup>2</sup>, Sandra Martins<sup>2</sup>, Fátima Baptista<sup>1</sup>, Ezequiel M. Gonçalves<sup>1</sup>, Cláudia S. Minderico<sup>2</sup>, Luís B. Sardinha<sup>1</sup>. <sup>1</sup>Faculty of Human Kinetics, Technical University of Lisbon, Cruz-Quebrada, Portugal. <sup>2</sup>Lusofona University, Lisboa, Portugal.

(No relationships reported)

**BACKGROUND:** An atherogenic phenotype can be identified using a practical anthropometric measure such as the waist circumference (WC), as it is strongly associated with abdominal fatness. However, there is no agreement between studies on the location of this measurement, mainly when considering national reference percentiles.

**PURPOSE:** We aimed to compare three different protocols in the assessment of WC in children, independently for boys and girls.

**METHODS:** A total of 512 children (271 boys and 241 girls), aged 10-11 years (10.3 ± 0.6) were evaluated. WC was measured according to the NIH protocol (on the superior border of the iliac crest), to the WHO protocol (between the lower rib and iliac crest) and to Lohman's protocol (measured on the narrowest part of the torso). Statistical analysis included repeated measures and regression analysis.

**RESULTS:** Mean values for WC in girls were: NIH, 66.6 ± 8.6 cm; WHO, 63.5 ± 7.9 cm; and Lohman's, 62.5 ± 7.5 cm. In boys the mean values for WC were: NIH, 65.2 ± 8.8 cm, WHO, 63.5 ± 8.1 cm, and Lohman's, 62.8 ± 7.6 cm. Significant differences between protocols were observed in both genders, and these differences remained significant even adjusting for body mass index (BMI). Further we tested if the differences between protocols were related with the mean of WC measured by the different protocols. In all cases a significant association (p<0.001) was observed (Girls: NIH/WHO, r = 0.32; NIH/Lohman, r = 0.39; WHO/Lohman, r = 0.38. Boys: NIH/WHO, r = 0.53; NIH/Lohman, r = 0.57; WHO/Lohman, r = 0.42). A positive association was also observed between the difference of the protocols and BMI for all measurements and genders.



**CONCLUSIONS:** In this sample of children aged 10 and 11 years old, there are differences in the WC mean values when using different protocols. Moreover, the differences between measures were dependent on the BMI and WC values, meaning that in children with higher BMI and WC the differences of choosing different locations may be amplified. Our results reinforce the importance of accurately choosing the location of the WC measurement, mainly if considering reference values as a criterion for health outcomes.

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**3283** Board #4 June 2 8:00 AM - 9:30 AM

**Modification Of School Adiposity According To Nutritional Status: An Analysis Of 20 Years**

Tatiane K. Ferrari, Gerson Luis M. Ferrari, João Pedro Silva Júnior, Leonardo Silva, Luis Carlos Oliveira, Victor K. Matsudo. *Physical Fitness Research Center from São Caetano do Sul, São Caetano do Sul, Brazil.*

(No relationships reported)

**PURPOSE:** To analyze the adiposity changes over 20 year-period, according to the nutritional status in schoolchildren.

**METHODS:** Sample is part of the Ilhabela Mixed-Longitudinal Project on Growth, Development and Physical Fitness\*, which is held since 1978. From a data base of 16.000 schoolchildren of both sexes, 1096 students, 488 males and 606 females, from 7 to 10 years-old of both sexes, in the prepubertal stage of sexual maturation. The project was approved by the Ethics Committee. The selected data were part of a database from 1990/1991 (Initial), 2000/2001 (10 years) and 2010/2011 (20 years). The variables analyzed were: body mass (kg), body height (cm) and fatness (mm): average of seven skinfolds (biceps, triceps, subscapular, suprailiac, midaxillary, abdominal and calf). Children were classified in normal, overweight and obesity. The statistical analysis used was Kruskal-Wallis test for nonparametric data and ANOVA one-way for parametric data, followed by post-hoc Scheffé. The level of significance adopted was  $p < .01$ .

**RESULTS:** In a period of 20 years, adipose tissue increased significantly in both sexes, markedly in boys. In males, there was a significant increase in subcutaneous adipose tissue in overweight and obesity groups after a period of 20 years. Among females, there was a significant increase in the normal weight and overweight groups after a period of 20 and 10 years, respectively.

**CONCLUSIONS:** During the 20 years analyzed, there were changes in adiposity, even when analyzed for nutritional status. It showed that individuals may have similar body mass indexes, although may vary in proportion and distribution of subcutaneous adipose tissue.

\*Supported by FAPESP process number 2010/20749-8

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**3284** Board #5 June 2 8:00 AM - 9:30 AM

**Comparison Of Percent Body Fat And BMI In Tracking Of Body Composition Among Adolescents**

Wenhao Liu, Randall A. Nichols, Traci D. Zillifro. *Slippery Rock University, Slippery Rock, PA.*

(No relationships reported)

**PURPOSE:** To examine the extent to which differences may exist between percent body fat (%BF, converted from triceps and calf skinfolds) and BMI in tracking of adolescents' body composition.

**METHODS:** BMI and %BF (from the two-site skinfold) were assessed for 102 boys (mean age = 11.6 ± .58) and 112 girls (mean age = 11.47 ± .51) at the beginning of their 6<sup>th</sup> grade (baseline), the end of the 6<sup>th</sup> grade (follow-up 1), the end of the 7<sup>th</sup> grade (follow-up 2), and the end of the 8<sup>th</sup> grade (follow-up 3). Spearman rank correlations and percentage agreements in extreme quartiles were calculated to estimate the stability in body composition measured with the two different methods across the three academic years. Chi-square tests were used to examine differences in the percentage agreements between sexes. In addition, body composition scores at the baseline and the follow-up 3 were compared using paired-samples t tests.

**RESULTS:** Spearman rank correlations for BMI between baseline and each of the three follow-ups were .96, .88, and .88 for boys and .97, .94, and .89 for girls, with little difference between sexes. The corresponding coefficients for %BF were .82, .73, and .66 for boys and .82, .83, and .75 for girls, and they were relatively low in relation to those for BMI and girls had higher tracking of %BF than did boys in the last two follow-ups. As for the percentage agreements in extreme quartiles, the results of chi-square indicated that boys had significantly lower stability in staying in lower quartiles of %BF than girls ( $p < .001$ ). That is, at the last two follow-ups, only 36.8% and 38.9% boys initially in the lower quartiles of %BF remained in the same quartiles, whereas 60.0% and 63.6% of girls remained in the lower quartiles during the same period. Further, t tests revealed that boys' %BF decreased significantly ( $p < .001$ ) during the three years, from 25.70 ± 19.95 to 20.84 ± 10.78, whereas boy's BMI and girls' %BF and BMI all increased significantly.

**CONCLUSIONS:** The study indicates that tracking levels in %BF (from the two-side skinfold) are lower than those in BMI for adolescents, especially for boys. This may due to the fact that boys tend to become less fat as they gain more muscle compared with girls during the puberty period. We suggest that %BF and BMI not be used interchangeably when measuring body composition for male adolescents.

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**3285** Board #6 June 2 8:00 AM - 9:30 AM

**Evaluation Of Body Fat Patterning In Children With Non-Syndromal and Syndromal Pediatric Obesity**

Pamela M. Wright, Daniela A. Rubin, Diobel Castner, Daniel A. Judelson, FACSM. *California State University Fullerton, Fullerton, CA.*

(No relationships reported)

Prader-Willi Syndrome (PWS) is the most characterized form of congenital obesity presenting with hypogonadism and growth hormone deficiency. Adults with PWS typically show increased fat mass in the limbs compared to non-syndromal obese adults who tend to have increased fat mass in the trunk. To our knowledge, these differences in fat patterning have not been studied in children.

**PURPOSE:** To describe fat patterning in children with PWS as it compares to children with non-syndromal obesity.

**METHODS:** Thirteen children with PWS and 43 obese (OB=body fat >95th percentile) children ages 8-11 y participated. Children completed measurement for body mass, stature, and waist circumference (WC), in addition to a total body dual x-ray absorptiometry. Body fat percentage was derived for total, trunk, gynoid, and android fat. Body mass index (BMI) was calculated.

**RESULTS:** Independent t-tests showed that children with PWS and non-syndromal OB children had similar BMI (PWS: 26.0 ± 8.0 kg/m<sup>2</sup>; OB: 27.0 ± 5.0 kg/m<sup>2</sup>) and WC (PWS: 89.0 ± 18.0 cm; OB: 90.0 ± 13.0 cm) ( $p > 0.05$ ). In addition, no significant differences ( $p > 0.05$  for all) were observed for total body fat (PWS: 47.1 ± 9.2%; OB: 43.2 ± 6.0%), trunk fat (PWS: 46.1 ± 11.1%; OB: 45.1 ± 6.2%), gynoid fat (PWS: 54.1 ± 6.0%; OB: 50.3 ± 5.0%), and android fat percentage (PWS: 52.3 ± 11.2%; OB: 52.4 ± 6.0%).

**CONCLUSION:** Our results showed that children with non-syndromal obesity had similar body fat percentage and distribution as those with syndromal obesity. The differences between our findings and previous results in adults may be explained by 1) the frequent use of growth hormone replacement therapy (which changes body composition) in children with PWS or 2) a presumed lack of circulating sex hormones in this young sample.

Supported by USAMRAA Award W81XWH-08-1-0025

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**3286** Board #7 June 2 8:00 AM - 9:30 AM

**Bmi Growth Curve of Children In Jiangsu, China: 6-18 Yr. Old**

Peiyu Chen<sup>1</sup>, Yuling zou<sup>1</sup>, Shusheng Shi<sup>1</sup>, Weimo Zhu<sup>2</sup>. <sup>1</sup>Nanjing Normal University, Nanjing, China. <sup>2</sup>University of Illinois at Champaign-Urbana, Champaign, IL.

(No relationships reported)

**PURPOSE:** Growth curves are used widely to evaluate the growth status of individuals or a population. Using the 2010 data of by the National Physical Fitness Surveillance of Jiangsu province, China (JPC), the purposes of this study was to construct body mass index (BMI) growth curves.

**METHODS:** Height and weight of 38,047 boys and 38,255 girls of JPC, 6-18 yr. old were measured in 2010. Their BMI were computed and growth curves were fitted with the Cole's LMS method for boys and girls, respectively. The 3<sup>rd</sup>, 5<sup>th</sup>, 10<sup>th</sup>, 15<sup>th</sup>, 25<sup>th</sup>, 50<sup>th</sup>, 75<sup>th</sup>, 85<sup>th</sup>, 90<sup>th</sup>, 95<sup>th</sup> and 97<sup>th</sup> centiles were constructed and the results were compared with reference values of CDC in 2000 and WHO in 2006.

**RESULTS:** At the age of 6 years old, the medians were 16.08 kg/m<sup>2</sup> and 15.42 kg/m<sup>2</sup> for boys and girls, respectively. The 50<sup>th</sup> centile curves increased with age by gender and reached to 19.68 kg/m<sup>2</sup> for boy and 19.66 kg/m<sup>2</sup> for girl at age of 14. After that age, the curve of the boy still increased, but the trend became stable for the girls. They reached to 21.08 kg/m<sup>2</sup> and 20.18 kg/m<sup>2</sup> at age 18, respectively. The 50<sup>th</sup> centile curve and 85<sup>th</sup> centile of JPC boys differed in shape from those by CDC and WHO. JPC boys were fatter in early to mid-childhood but less so in adolescence. For JPC girl, 50<sup>th</sup> and 85<sup>th</sup> centile curves had almost the same trend with those by CDC and WHO before mid-childhood, but after age of 15, JPC girls became leaner (Figure).

**CONCLUSION:** The reference centile curves of BMI clearly described the children growth status. The prevalence of overweight and obesity among children of JPC have been becoming more and more serious, especially for the boys before 15 years old.

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**3287** Board #8 June 2 8:00 AM - 9:30 AM

**Correlates of Relative Skeletal Muscle Index in Young Males: Lower-Limb Strength and Body Composition Measures.**

T. Brock Symons, Jody L. Clasey, FACSM. University of Kentucky, Lexington, KY.

(No relationships reported)

Relative skeletal muscle index (RSMI), the sum of appendicular mineral free lean mass divided by height squared (kg/m<sup>2</sup>), has been found to correlate with strength and body bone density measures in young females. The associations between RSMI and lower-limb muscle function and measures of body composition is less well understood in young males and may be body site specific.

**PURPOSE:** To explore the potential relationship between RSMI and measures of lower-limb muscle function and total body and regional measures of body composition in 21 young males (age 25 ± 4 yrs).

**METHODS:** Total body and right and left proximal femur dual energy x-ray absorptimetry (DXA) scans were used to determine RSMI and total body and regional measures of mineral free lean mass (MFL), bone mineral content (BMC), and bone mineral density (BMD). Right lower-limb muscle function was evaluated with knee extensor isometric (MVC; knee angle 90°) and isokinetic concentric (CON; at 90°/s and 180°/s) peak torque (PT), peak work (PW), and peak average power (PP). Pearson's zero-order correlation coefficients were computed to determine significance (p<0.05).

**RESULTS:** RSMI (9.7 ± 0.9 kg/m<sup>2</sup>) was significantly correlated to both total body MFL mass and BMD (66.1 ± 8.9 kg; r=0.80 and 1.3 ± 0.5 g/cm<sup>2</sup>; r=0.43), but not total body BMC. Right and left total proximal femur BMC was found to be related to RSMI (45.1 ± 6.0 g; r=0.54 and 45.7 ± 5.5 g; r=0.55); whereas, right and left total proximal femur BMD was not. Right and left femoral neck BMC correlated with RSMI (6.6 ± 1.0 g; r=0.55 and 6.6 ± 0.9 g; r=0.52); however, no relationship was found between RSMI and BMD. Only right greater trochanter BMC was related to RSMI (16.6 ± 2.9 g; r=0.55). RSMI correlated with MVC (343.0 ± 78.1 Nm; r=0.65) and CON PT at 90°/s and 180°/s (234.8 ± 45.3 Nm; r=0.64 and 182.8 ± 38.9 Nm; r=0.60). CON PW was associated with RSMI at both angular velocities (90°/s: 254.4 ± 53.7 J; r=0.54 and 180°/s: 209.2 ± 46.2 J; r=0.57). RSMI was not associated with CON PP.

**CONCLUSION:** Previously, RSMI was found to correlate with lower-limb muscle function and BMD in young females. Our results in young males are in agreement regarding lower-limb muscle function but differ with respect to BMD. Supported in part by the University of Kentucky PEP Laboratory Endowment Fund, and grant number UL1RR033173 to the University of Kentucky CCTS

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**3288** Board #9 June 2 8:00 AM - 9:30 AM

**Accuracy Of Obesity Cut-off Values Of BMI and Waist-to-hip Ratio For Koreans With Intellectual Disabilities**

Miyoung Lee<sup>1</sup>, Haeja Chun<sup>2</sup>, Bo Fernhall, FACSM<sup>3</sup>. <sup>1</sup>Koomin University, SEOUL, Korea, Republic of. <sup>2</sup>Soon Chun Hyang University, SEOUL, Korea, Republic of. <sup>3</sup>University of Illinois at Chicago, Chicago, IL. (Sponsor: Bo Fernhall, FACSM)

(No relationships reported)

**PURPOSE:** The obesity cut-off value of Koreans is typically a body mass index (BMI) of ≥25kg/m<sup>2</sup>. In addition, a waist-to-hip ratio (WHR) of >0.8 for females and >0.9 for males increases the risk of health. These cut-off values have not been validated for Koreans with intellectual disabilities (ID). The purpose of study was to examine the accuracy of cut-off values of BMI and WHR for persons with intellectual disabilities in Korea.

**METHODS:** A total of 93 healthy individuals with intellectual disabilities in Korea (ages 18-50yrs; 65 males, 168.07±9.78cm, 70.13±14.79kg vs. 28 females, 154.24±8.27cm, 56.65±10.73kg) participated. Body fat % (BF%) was estimated by DXA (Hologic, USA) as the criterion measure, and the cut-off values of the obesity was set at 25% for male and 32% for females. To examine the accuracy of cut-off values for BMI and WHR, *R* adjusted for gender was calculated from the linear regression analysis, and ROC analyses were conducted to determine the true-positive (Sensitivity; ST) and false positive (1-specificity; SF) rates utilizing SPSS 19 (IBM SPSS Inc., USA).

**RESULTS:** BMI and WHR were highly correlated with BF% (*R* =.86 and .73, respectively). In terms of the area of ROC curves, BMI was .93 (95%CI: .91-1.00) for males and .89 (.76-1.00) for females, which is an excellent agreement. WHR showed .93(.87-.99) and .67(.44-.93) for males and females, respectively. Based on cut-off values, the ST and SF of BMI at ≥25kg/m<sup>2</sup> were .96 vs. .19 for males and 1.00 vs. .53 for females, respectively. On the other hand, ST and SF of WHR were 1.00 vs. .56 for males and .67 vs. .41 for females.

**CONCLUSIONS:** The standard cut-off values of BMI for both males and females are relatively accurate to determine the obesity for Koreans with ID, but false positive rates are less acceptable. With the obesity cut-off of BMI ≥30kg/m<sup>2</sup>, ST and SF are increased up to 1.00 vs. .78 and 1.00 vs. .82 for both genders, respectively. On the other hand, WHR is less accurate than BMI, especially for females with ID. Larger sample size is required to generalize the findings from this study to the target population.

This work was partially supported by the new faculty research program 2010 of Kookmin University and Soon Chun Hyang University in Korea.

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**3289** Board #10 June 2 8:00 AM - 9:30 AM

**Body Composition For Health And Performance: A Survey By The Working Group Of The IOC**

Nanna L. Meyer<sup>1</sup>, Jorunn Sundgot-Borgen<sup>2</sup>, Timothy G. Lohman<sup>3</sup>, Timothy R. Ackland<sup>4</sup>, Ronald J. Maughan, FACSM<sup>5</sup>, Arthur D. Stewart<sup>6</sup>, Suzanne Smith<sup>7</sup>, Wolfram Mueller<sup>8</sup>. <sup>1</sup>University of Colorado and United States Olympic Committee, Colorado Springs, CO. <sup>2</sup>The Norwegian School of Sport Sciences, Oslo, Norway. <sup>3</sup>University of Arizona, Tucson, AZ. <sup>4</sup>University of Western Australia, Perth, Australia. <sup>5</sup>Loughborough University, Loughborough, United Kingdom. <sup>6</sup>Robert Gordon University, Aberdeen, United Kingdom. <sup>7</sup>University of Colorado, Colorado Springs, CO. <sup>8</sup>Karl-Franzens University and Medical University of Graz, Graz, Austria.

(No relationships reported)

Low body mass (BM) and lean physique to enhance performance are the norm in weight-sensitive sports.

**PURPOSE:** To assess current use of body composition (BC) methods and identify problems and solutions with current BM and BC approaches.

**METHODS:** A 24-item survey was developed, including demographic and content questions related to BC methods. Content validity was obtained by review of the Ad Hoc Research Working Group on BC for Health and Performance of the IOC Medical Commission (n=7). The survey was distributed among international sporting organizations in electronic format. Frequencies and Chi-square analyses were computed.

**RESULTS:** 216 individuals responded, from 33 countries, representing various institutions, sports, and competitive levels. Of the sample, 86% currently assess BC, most frequently using skinfolds (ISAK: 50%; conventional: 40%; both: 28%), DXA (38%), BIA (29%), ADP (17%), and hydrostatic weighing (10%). Of those using skinfolds, more use ISAK at the international level, whereas conventional approaches are more common at regional/national level (p=0.006). The physiologist/sport scientist (54%) and sports dietitian/nutritionist (57%) were most frequently the professionals assessing BC, followed by MDs and ATCs, with some reporting the coach (5%). 36% of 116 respondents assess hydration status: more do so at international than regional/national level (p=0.028). Of 125 subjects answering the question of whether they thought that BC assessment raised problems, 69% said "yes", with most providing ideas for solutions. The most compelling solutions appeared to center around alternatives to BM and BC, such as frame size and height but most responses were sport-specific.

**CONCLUSIONS:** Results show a high use of BC, variable standardization, and high perception of problems related to BM and BC in sport. Future work should emphasize BC standardization and sport-specific use of parameters other than BM and BC.

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3290 Board #11 June 2 8:00 AM - 9:30 AM

**Evaluation of Contributions Fitness and Health Behaviors to Predict Body Composition of US College Students**

Daniel C. S. Yeung, Rickie Lee Marker-Hoffman, Matthew G. Hinman, Jeanne D. Johnston. *Indiana University, Bloomington, IN.* (Sponsor: Georgia C. Frey, FACSM)

(No relationships reported)

**PURPOSE:** Evaluate the relative contributions physical fitness and health behaviors to predict body composition of US college students.

**METHODS:** College students from a mid-Western university were recruited via face-to-face contact, email, and fliers. Physical fitness was assessed with three measures: PACER multi stage 20-meter shuttle run, modified pull-up (MPU), and one-minute sit-up. Anthropometric assessment included height, weight, and average of 3 waist circumference measurements. Body composition (BC) was measured by bioelectrical impedance analysis (BIA). Self-reported questionnaire of health behaviors included physical activity, eating, sleeping and drinking habits. Outliers were identified and variables were transformed to ensure normality, where necessary. A stepwise regression analysis was performed to determine which variables are effective when predicting BC.

**RESULTS:** A total of 352 students were recruited. With 4 of them excluded as outliers, 149 males and 199 females were included in analysis. The best model included the following predictors: sex, square root of body mass index, MPU, logarithmic transformation of total physical activity, waist circumference and number of days having breakfast ( $R^2=0.84$ ,  $SEE=3.27$ ). An alternative model which did not include fitness testing variables was tested. Significant predictors of this model were sex, perceived general health, logarithmic transformation of alcohol consumption, square root of sleeping problems ( $R^2=0.55$ ,  $SEE=5.53$ )

**CONCLUSIONS:** Sex, physical fitness measures and health behaviors were significant predictors of BC in US college students. The alternate model which included just sex and health behaviors, without anthropometric measurements and fitness testing, was also effective when predicting BC.

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3291 Board #12 June 2 8:00 AM - 9:30 AM

**Effects Of Telephone Intervention On Maintaining Fat Loss And Fitness Level Following Summer Intervention Program**

David A. Martinez<sup>1</sup>, Christopher R. Lopez<sup>1</sup>, Alejandra Cantu<sup>1</sup>, Areli Garcia<sup>2</sup>, Kyung-Shin Park<sup>2</sup>. <sup>1</sup>J. B. Alexander High School, Laredo, TX. <sup>2</sup>Texas A&M International University, Laredo, TX.

(No relationships reported)

**It is known that children gain most of extra weight and lose physical fitness during summer months due to physical inactivity and an increase in food intake. Summer intervention may reduce the prevalence of obesity in children; however reduction in body fat may be regained after finishing summer intervention.**

**PURPOSE:** The purpose of this study was to determine the effects of 8 week summer lifestyle intervention and 10 month follow-up telephone intervention on changes in body composition and level of physical fitness in Hispanic Children.

**METHODS:** 21 overweight or obese students (over 85 percentile in BMI score) aged 9-16 yrs completed 8 week summer intervention including 15 hour physical activity and 2 hour nutritional education per week and bi-weekly diet program. Students were later randomly assigned to follow-up telephone intervention for 10 months (TI) and control (CON). Physical characteristics, sit and reach (flexibility), grip strength (muscular strength), and 1 mile walking (estimated  $VO_{2max}$ ) were obtained before, a week after (POST) and 10 months following 8 week summer intervention (YEAR).

**RESULTS:** We previously reported (*Med Sci Sports Exerc* 43(5): S624, 2011) that eight week summer lifestyle intervention significantly reduced % body fat and improved flexibility, muscular strength, and estimated  $VO_{2max}$  in 21 students. TI statistically maintained % body fat (POST:23.7±2.1%→ YEAR:25.9±2.3, Mean±SE,  $P=.134$ ), flexibility (31.9±1.4cm→30.4±1.8,  $P=0.43$ ), and estimated  $VO_{2max}$  (44.1±1.66ml·kg<sup>-1</sup>·min<sup>-1</sup>→42.7±1.4,  $P=.215$ ). during 10 month telephone intervention period. CON lost all improvement during 10 month follow-up period: %body fat (22.2±2.0%→26.9±1.8,  $P=.001$ ), flexibility (32.7±1.7→27.3±1.2,  $P=.03$ ), and estimated  $VO_{2max}$  (45.9±1.8→39.8±2.0,  $P=.005$ ). Muscular strength was slightly increased in both TI and CON, but it was not significant.

**CONCLUSIONS:** 8 week summer lifestyle intervention improved body composition and level of physical fitness in Hispanic children. Results indicate that telephone intervention is an effective tool to maintain the improvement in body composition and levels of fitness obtained from an intensive summer lifestyle intervention program.

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3292 Board #13 June 2 8:00 AM - 9:30 AM

**Variations in Regional and Total Adiposity in Active Individuals**

Kelli A. Carlson, David Q. Thomas, Adam Morris, Jillian Barnas, Laura Cooley, Laura Matter, Elizabeth Boyer. *Illinois State University, Normal, IL.*

(No relationships reported)

Physical activity has been demonstrated to be one of the best countermeasures to increasing overweight and obesity. However, the relationship between the type of physical activity one participates in and regional and total adiposity has not been adequately studied. Additionally, the distribution of adipose tissue has been linked to diabetes and cardiovascular and metabolic diseases.

**PURPOSE:** To determine the variations in regional and total adiposity in active individuals.

**METHODS:** Fifty college aged students participated in the study. The men comprised groups of recreationally competitive athletes (RCA; n = 13) and recreationally active men (RCM; n = 13). The women comprised groups of collegiate athletes (CA; n = 12) and recreationally active women (RAW; n = 12). Body composition measures included height, weight, waist circumference, truncal (subscapular, abdominal, mid-axillary, suprailiac crest) and appendicular skinfolds (anterior thigh, medial calf, tricep and bicep), and whole body adiposity via air-displacement plethysmography.

**RESULTS:** Descriptive data (means and standard deviations) were calculated for each group (RCA - Age: 20.2 ± 1.36; Waist: 79.9 ± 3.84; Trunk: 43.5 ± 11.91; App 32.9 ± 8.99; BF 10.1 ± 3.85; RCM - Age: 21.3 ± 1.84; Waist 80.4 ± 4.03; Trunk, 39.8 ± 7.89; App 31.7 ± 9.25; BF 10.4 ± 3.62; CA - Age: 20.1 ± 0.67; Waist: 69.7 ± 6.89; Trunk: 55.3 ± 21.40; App: 59.6 ± 12.75; BF: 21.6 ± 5.0; RAW - Age 20.1 ± 0.51; Waist 71.0 ± 3.32; Trunk: 66.7 ± 25.07; App 77.3 ± 24.93; BF: 25.3 ± 5.25). Paired-sample t-tests showed no significant differences (alpha = 0.05) for any score when comparing the two men's groups together or the two women's groups together except for the women's sum of appendicular skinfolds ( $t = 2.07$ ;  $p \leq 0.05$ ).

**CONCLUSION:** Variations in physical activity classification does not appear to effect total or regional adiposity in active college age individuals with the exception of the sum of appendicular skinfolds between female collegiate athletes and recreationally active females. Potential explanations for this include that at this age, active individuals are similar in body composition regardless of the reason for why they are active. Further investigation into why recreationally active females store more adipose appendicularly than collegiate female athletes is necessary..

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3293 Board #14 June 2 8:00 AM - 9:30 AM

**Comparisons of Body Composition and Self-Perception of Body Type Among College Students**

Mark W. Baldis<sup>1</sup>, Tim Anderson<sup>2</sup>, Michael Coles<sup>2</sup>, Felicia Greer<sup>2</sup>. <sup>1</sup>Rocky Mountain University of Health Professions, Provo, UT. <sup>2</sup>California State University Fresno, Fresno, CA.

(No relationships reported)

Previous research suggests that individual perception of body size varies by gender and race, and that some cultural groups are more accepting of overweight body types. If particular groups of individuals positively value a specific body type, or erroneously classify their own body weights as acceptably healthy, when in fact they are deemed to be clinically overweight or obese, then they may be unreceptive to typical approaches toward weight management. This may result in an increased risk for the development of obesity-related chronic diseases.

**PURPOSE:** To examine the relationship between perceived body image and actual body composition, across race and gender, in a group of 240 college-aged students.

**METHODS:** Participants underwent skinfold body composition assessment and completed a questionnaire designed to elicit perceptions of body image and body weight status. Data summary of this cross-sectional study design included comparative descriptive statistics, frequencies, and relative frequencies.

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**RESULTS:** Results suggested that one in four females, regardless of race, categorized as in the acceptable range for body fat percentage, identified themselves as overweight. Nearly 22% of males and 38% of female participants were categorized as overweight or obese, with 14 females and one male categorized as obese. Overweight and obese female participants were more than twice as likely as men to misperceive their overweight status. Only 44% of overweight and obese women correctly identified their weight category, whereas nearly 8 of 10 overweight and obese male participants accurately identified themselves as overweight or obese. Over half of all Asian (56%), Black (50%), and Hispanic (67%) males, categorized as in the acceptable range for body fat percentage, identified themselves as overweight. Over half of White males (57%) and females (80%), and Black females (50%), categorized as overweight, perceived themselves to be of "about the right weight". A far greater percentage of males (48%) compared to females (28%) fell into the lean category.

**CONCLUSION:** The results of this study suggest that there is a great deal of heterogeneity in the perception of body type. Clearly, men and women, and different ethnic groups, perceive their own body types quite differently, and incongruity exists even within groups.

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3294 Board #15 June 2 8:00 AM - 9:30 AM

**Can Self-reported BMI Be Used As A Valid Measure Among Novice Runners?**

Martin S. Juul, Rasmus O. Nielsen, Sten Rasmussen. Aarhus University Hospital - Aalborg Hospital, Aarhus, Denmark.  
(No relationships reported)

There is an increased risk of running related injuries (RRI) among novice runners with a Body Mass Index (BMI) above 25. Information about BMI can be collected through questionnaires, when studies investigate if there is an association between BMI and RRI among novice runners. But can self-reported BMI be used as a valid measure compared to BMI measured with a calibrated weight.

**PURPOSE:** To determine the validity of self-reported BMI among novice runners.

**METHODS:** Data on BMI was obtained from a prospective follow-up study investigating the link between training exposure and the development of RRI. Healthy novice runners between the age of 18 to 65 and without lower extremity injuries were able to participate in the study. During July and August 2011 the participants were included in the study based on an online questionnaire. 1532 persons completed the questionnaire, of these, 970 were invited to a test at baseline after meeting the requirements for participation. Information about BMI was obtained in two ways; firstly, from the online based questionnaire where the participants had to report height and weight themselves. Secondly, the weight was measured with calibrated weight (Tanita SC-330) while their height was measured with a tape measure. Based on these data BMI were calculated based on the equation:  $BMI = \text{mass (kg)} / (\text{height (m)})^2$ . Paired t-test was used to compare mean difference between self-reported BMI and measured BMI. Bland Altman limits of agreement were used to calculate the 95 % prediction limits.

**RESULTS:** A total of 931 participants were measured and eligible to participate, of these, 2 were excluded due to data loss. The gender distribution was; 464 women with a mean age of  $36.8 \pm 10.0$  and a measured BMI of  $25.4 \pm 4.2$  and 465 men with a mean age of  $37.6 \pm 10.6$  and a measured BMI of  $26.6 \pm 3.8$ . Compared with measured BMI both men and women had a significant lower mean self-reported BMI of  $-0.23 [-0.34; -0.12]$ ,  $p < 0.001$  and  $-0.41 [-0.51; -0.31]$ ,  $p < 0.001$ , respectively. Among men and women the 95% limits of agreement were from  $-2.63$  to  $2.72$  and from  $-2.56$  to  $1.74$ , respectively.

**CONCLUSION:** Based on the findings from current study, BMI based on self-reported height and weight should be used with caution if the association between BMI and RRI is investigated.

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3295 Board #16 June 2 8:00 AM - 9:30 AM

**The Relationships between Stress, Physical Activity and Body Composition in Women**

Jenelle R. Walker, Darith James, Pamela Swan, FACSM. Arizona State University, Phoenix, AZ.  
(No relationships reported)

**Stress can affect the intention-behavior relationship for physical activity (PA)** and elicit physiological responses that can affect health (Logan & Barksdale, 2008; McEwen & Lasley, 2003). Central or visceral obesity is now accepted as an independent risk factor for many chronic diseases. The physiological stress response has been shown to increase central body fat. PA may have an influence on this relationship.

**PURPOSE:** To describe the relationships between stress, body fat distribution and PA in women.

**METHODS:** This cross sectional study recruited women (25-65 years; N = 78) from the local Phoenix metropolitan area. A subgroup was randomly selected for objective measures of stress (morning saliva cortisol samples: 4 samples-15 min time periods), PA (Actigraph GT1M-7 day period), estimated VO<sub>2</sub> (submaximal Treadmill Test), %body fat (%BF-Bioelectrical Impedance) and waist circumference (WC).

**Analysis:** Subjects were grouped by cortisol levels into tertiles using area under the curve values. Data were analyzed using Pearson correlations, one-way ANOVA and Post Hoc analyses with PASW 18.

**RESULTS:** Descriptive statistics of the subgroup (N = 26) were mean age ( $41 \pm 10$  y), %BF ( $32 \pm 10.8$ ), WC ( $79.6 \pm 12.9$  cm), minutes of PA ( $141.85 \pm 114.8$ ) and estimated VO<sub>2</sub> ( $34.2 \pm 6.4$  ml/kg/min). A positive association was shown for stress level and %BF ( $r = .359$ ,  $p = .029$ ) and WC ( $r = .379$ ,  $p = .056$ ). An inverse association was shown for %BF and estimated VO<sub>2</sub> ( $r = -.785$ ,  $p = .000$ ) and minutes of PA ( $r = -.363$ ,  $p = .068$ ). Significant between group differences were found when comparing stress to %BF between the lowest and highest stress groups ( $p = .031$ ). Significant between group differences were found when comparing stress to estimated VO<sub>2</sub> ( $p = .024$ ) and to PA level ( $p = .034$ ) in the two highest stress groups.

**CONCLUSION:** Stress had a positive association with %BF and WC. %BF had an inverse association with PA and level of fitness. Participants with the lowest level of stress had higher %BF. Stress values were lower for those who had higher fitness levels and greater minutes of PA per week. These results indicate that PA can affect stress and %BF in women. Considering the increasing rates of metabolic diseases associated with inactivity properly coping with stress may be a key factor in improving health.

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3296 Board #17 June 2 8:00 AM - 9:30 AM

**Does the Body Adiposity Index (BAI) Predict Change in CVD Risk Factors in Obese Women?**

Anne E. Mishler, John M. Kacicic, FACSM. University of Pittsburgh, Pittsburgh, PA.  
(No relationships reported)

Excess adipose tissue increases risk for cardiovascular (CVD) and other chronic diseases. The Body Adiposity Index (BAI), computed with measures of height and hip circumference, has recently been recommended for estimating adiposity. However, whether BAI is more predictive of change in CVD risk factors following weight loss compared to traditional measures of adiposity (weight and waist circumference) is unclear.

**PURPOSE:** To examine the association between change in BAI, weight, and waist circumference and change in CVD risk factors in overweight and obesity adults across a 6 month weight loss intervention.

**METHODS:** 184 female subjects (BMI:  $32.6 \pm 4.2$  kg/m<sup>2</sup>; Age:  $37.7 \pm 5.6$  kg/m<sup>2</sup>) participated in a 6-month behavioral weight loss intervention. Subjects were prescribed a reduced calorie diet (1200-1500 kcal/d). Subjects were also prescribed structured home-based exercise of 150-300 min/wk at a moderate-to-vigorous intensity. Weight, waist circumference (WC), BAI, along with fasting total cholesterol (CHOL), HDL cholesterol (HDL), LDL cholesterol (LDL), triglycerides (TRIG) were assessed at 0 and 6 months.

**RESULTS:** Weight ( $-8.3 \pm 4.8$  kg), WC ( $-6.5 \pm 8.3$  cm), and BAI ( $-3.5 \pm 2.3$ ) significantly decreased from 0 to 6 months ( $p < 0.05$ ). Weight change was significantly ( $p < 0.001$ ) associated with change in WC ( $r = .51$ ) and BAI ( $r = .79$ ). CHOL ( $-5.7 \pm 21.7$  mg/dl), TRIG ( $-16.4 \pm 41.1$  mg/dl), and LDL ( $-10.3 \pm 25.9$  mg/dl) decreased, whereas HDL increased ( $+1.3 \pm 7.0$  mg/dl). Change in weight ( $\beta = 1.708$ ,  $t = 6.230$ ,  $p < .001$ ), but not WC or BAI, predicted change in CHOL. Change in BAI ( $\beta = 0.513$ ,  $t = 2.333$ ,  $p = 0.021$ ), but not change in weight or WC, predicted change in HDL ( $R^2 = 0.024$ ,  $p < 0.05$ ). Neither change in weight, WC, or BAI predicted change in LDL or TRIG.

**CONCLUSIONS:** The weight loss intervention was effective at reducing weight, WC, and BAI, and this was accompanied by reductions in CHOL, TRIG, and LDL, and improvement in HDL. While BAI was more predictive of change in HDL than either weight or WC, BAI was not predictive of change in LDL or TRIG. BAI was not superior to change in weight to predict change in CHOL. Thus, further investigation is necessary to determine the utility of the BAI for predicting changes in risk factors with the context of a behavioral weight loss intervention. Supported by the National Institutes of Health (HL64991)

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3297 Board #18 June 2 8:00 AM - 9:30 AM

**Dehydration and Acute Weight Gain in Mixed Martial Arts Fighters Prior Competition.**

Adam Jetton<sup>1</sup>, Alan Utter, FACSM<sup>1</sup>, Marcus Lawrence<sup>1</sup>, Tracie Haines<sup>1</sup>, Marco Meucci<sup>2</sup>. <sup>1</sup>*Appalachian State University, Boone, NC.* <sup>2</sup>*The "Università degli Studi di Roma Foro Italico", Rome, Italy.*  
(No relationships reported)

**PURPOSE:** The purpose of this investigation was to characterize the magnitude of dehydration and acute weight gain (AWG) in mixed martial arts (MMA) fighters prior competition.

**METHODS:** Urinary measures of hydration status and body mass were determined at ~24 h prior and then again ~2 h prior to competition in 40 MMA fighters (mean ± SD, age: 25.2 ± 4.1 yr, height: 1.77 ± 0.07 m, body mass: 75.80 ± 9.17 kg). AWG was defined as the amount of body weight the fighters gained in the ~22 h period between the official weigh-in and the actual competition.

**RESULTS:** On average, the MMA fighters gained 3.40 ± 2.18 kg or 4.4% of their body weight in the ~22 h period prior to competition. Urine specific gravity (Usg) significantly decreased ( $p < 0.001$ ) from 1.028 ± 0.007 to 1.020 ± 0.009 during the rehydration period. 40 % of the MMA fighters presented with a Usg of greater than 1.021 immediately prior to competition indicating significant or serious dehydration.

**CONCLUSIONS:** MMA fighters undergo significant dehydration and fluctuations in body mass (4.4 % avg) in the 24 h period prior to competition. Urinary measures of hydration status indicate that a significant proportion (40%) of MMA fighters are not successfully rehydrating prior competition and subsequently competing in a dehydrated state.

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3298 Board #19 June 2 8:00 AM - 9:30 AM

**Determinant Factors To Discriminate The Efficiency Index For Achieving A Body Mass Index Of 25**

Miguel A. Rojo-Tirado, Ana B. Peinado, Pedro J. Benito, on behalf of the PRONAF Study Group. *Technical University of Madrid, Madrid, Spain.*  
(No relationships reported)

Most studies have described how the body weight loss is when different treatments are compared, while others have also compared it by sex, or have taken into account psychosocial and lifestyle variables. However, it would be interesting to know how much body weight a person could lose before initiating an intervention, only knowing the body composition variables.

**PURPOSE:** To create a model to estimate the efficiency index for achieving a body mass index (BMI) of 25 (EIBMI25), determining the importance of each variable.

**METHODS:** One hundred eighty-five overweight and obese people (BMI: 25-34.9 kg•m<sup>-2</sup>), aged from 18 to 50 years, participated in the study. Four types of treatments were randomly assigned: strength training (S), endurance training (E), strength and endurance training (SE), and control group (C). All participants followed a 25% caloric restriction diet. The EIBMI25 expresses the way in which the participants achieved the BMI of 25, representing this goal the 100% of efficacy. A multivariate discriminant model including the variables age, sex, height, type of treatment (T), initial body weight (BW), initial fat mass (FM), initial muscle mass (MM) and initial bone mineral density (BMD) were performed having into account the groups above and below the mean of the EIBMI25. The discriminant model was built using the inclusion method in SPSS PASW 18 allowing us to find a function that could predict the efficiency index that an overweight or obese person could achieve in a 6 months weight loss intervention.

**RESULTS:** The discriminant model obtained would discriminate between the two groups of EIBMI25 with 84.3% of correct classification. The discriminant function obtained was (Wilks' Lambda=0.499,  $p < 0.001$ ):

Discriminant score = 9.015 - (0.018 x age) + (0.631 x sex [0=female; 1=male]) - (12.684 x height) - (0.202 x T [1=S; 2=E; 3=SE; 4=C]) + (0.077 x BW) + (0.118 x FM) + (0.021 x MM) + (1.189 x BMD).

**CONCLUSION:** The developed model could predict the EIBMI25 in the following way: if the discriminant score is close to 0.95 the range of EIBMI25 will be from 68.55 to 90.76 %, and if it is close to -1.05 the range will be from 90.76 to 117.35 %.

PRONAF Study was supported by *Ministerio de Ciencia e Innovación, Convocatoria de Ayudas I+D 2008, Proyectos de Investigación Fundamental No Orientada, del VI Plan de Investigación Nacional 2008-2011.*

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**G-30 Free Communication/Poster - Cardiovascular III**

JUNE 2, 2012 7:30 AM - 11:00 AM

ROOM: Exhibit Hall

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3299 Board #20 June 2 9:30 AM - 11:00 AM

**Reduction In Muscle Capillary Is Inversely Associated With Vegf Expression In Non-obese Type 2 Diabetic Rats**

Hiroyo Kondo<sup>1</sup>, Hidemi Fujino<sup>2</sup>, Shinichiro Murakami<sup>2</sup>, Fumiko Nagatomo<sup>3</sup>, Naoto Fujita<sup>2</sup>, Akihiko Ishihara<sup>3</sup>. <sup>1</sup>*Nagoya Women's University, Nagoya, Japan.* <sup>2</sup>*Kobe University, Kobe, Japan.* <sup>3</sup>*Kyoto University, Kyoto, Japan.*  
(No relationships reported)

**PURPOSE:** Capillary regression is a major risk factor for complications in type 2 diabetes. In diabetic skeletal muscle, the angiogenesis would impair and involve multifactorial processes with both pro- and/or anti-angiogenic factors. Therefore, the purpose of the present study was to observe the muscle capillary architecture and to investigate changes in pro- and anti-angiogenic gene expressions within the soleus muscle of non-obese type 2 diabetic rats.

**METHODS:** Goto-Kakizaki (GK) type 2 diabetic (9 weeks old) and age-matched wild-type Wistar (Con) rats were used in this study. Plasma glucose, glycosylated haemoglobin (HbA1c), insulin level, and succinate dehydrogenase activity (SDH) were measured. The three-dimensional capillarization in soleus muscle was visualized and VEGF protein was measured by immunoblotting. Furthermore, the expression levels of HIF1 $\alpha$ , angiogenic factors (VEGF and angiopoietin-Tie2 pathways) and anti-angiogenic factor were quantified by TaqMan probe using real-time PCR.

**RESULTS:** Plasma glucose and HbA1c levels were significantly higher in GK than in Con rats. Insulin level in GK was lower than that of Con rats. Fiber cross-sectional area and capillary density in the soleus muscles were not significantly different between GK and Con rats. Visually, the capillaries had a smaller diameter in GK than Con rats and the mean capillary volume of GK was significantly low by 47% relative to the Con in soleus muscle. The SDH activities in muscle fiber of GK were lower than those in Con rats. The expression level of VEGF protein was not different between the GK and Con rats. Additionally, the mRNA expression levels of angiogenic factors (HIF-1 $\alpha$ , Flt-1, angiopoietin-1, and Tie2) were down-regulated in the GK, whereas VEGF and angiopoietin-2 were unaffected. These results suggest that the vasculature was destabilized in diabetic muscle. Furthermore, thrombospondin-1 level was higher in the GK than the Con.

**CONCLUSIONS:** These results indicate that a decrease in angiogenic and an increase in anti-angiogenic factor expressions may play an important role in capillary regression in skeletal muscle associated with diabetes.

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3300 Board #21 June 2 9:30 AM - 11:00 AM

**Subcellular Localization And Differential Expression Of Two Novel Anti-hif-1 $\alpha$  Variants**

Suzan Tug, Hendrik Forster, David Callau, Dirk Moser, Perikles Simon. *Social Science, Media and Sports, Mainz, Germany.*  
(No relationships reported)

Hypoxia Inducible Factor 1 (HIF-1 $\alpha$ ) is the most eminent Transcription Factor in the context of cellular response to hypoxia. To date, there have been identified more than 100 HIF-regulated genes. HIF-1-mediated pathways influence angiogenesis, metabolic adaptation, innate immune response and survival and apoptosis of cells. Although the structure of HIF-1 $\alpha$  and its

mechanisms are well known, the knowledge about the regulation of HIF-1 $\alpha$ , especially transcriptional and post-transcriptional, is still incomplete. Especially the expression of natural antisense transcripts (aHIF-1 $\alpha$ -variants) has not been studied in detail so far.

**PURPOSE:** We aimed to explore expression and localization of two so far unknown aHIF-1 $\alpha$ -variants under defined conditions *in vitro* and *in vivo* to enlarge the state of knowledge of the posttranscriptional regulation of HIF-1 $\alpha$ .

**METHODS:** We broadly analyzed the HIF-1 $\alpha$  gene locus on chromosome 14 by dint of UCSC genome browser. We considered several aspects, in particular mRNAs and *Expressed Sequence Tags*, CpG-islands, Poly-A-signals and transcription factor binding sites. *In silico* analysis, was followed by selection of primers to explore the expression of aHIF-1 $\alpha$  variants. Two unknown aHIF-1 $\alpha$ -variants emerged which were analyzed in *in vivo* and *in vitro* trials.

**RESULTS:** Expression of the two novel aHIF-1 $\alpha$  variants, terminating in exon 2 (aHIF-1 $\alpha$ Ex2) and exon 14 (aHIF-1 $\alpha$ Ex14) was confirmed in different cell lines. We verified them as spliced antisense variants of the HIF1 $\alpha$ -gene locus by sequencing and *in silico* analysis. Expression analysis of cellular fragments with GAPDH and 7sk as housekeeping genes allowed us to identify aHIF-1 $\alpha$ Ex2 as nuclear and aHIF-1 $\alpha$ Ex14 as cytoplasmatic variant. *In vitro* trials revealed that both variants are differentially expressed after induced hypoxia (CoCl<sub>2</sub>) and that aHIF-1 $\alpha$ Ex14 expression correlates significantly with the HIF-1 $\alpha$  splice variants with and without exon 14 ( $r=0.953$  and  $0.949$ , respectively). However, exercise induced hypoxia *in vivo* (half marathon) showed no effect on expression of the two antisense RNAs.

**CONCLUSION:** Due to their specific localization, ubiquitary and differential expression in response to hypoxia, both aHIF-1 $\alpha$ -variants are presumably associated with the regulation of HIF1 $\alpha$  and thereby with the regulation of HIF-1.

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3301 Board #22 June 2 9:30 AM - 11:00 AM

### The Effect Of Short-term Exercise On VEGF And Vessel Growth Of Middle-aged Brain

Jo-Ping Lee<sup>1</sup>, Chin-Lung Fang<sup>1</sup>, Chia-Hua Kuo<sup>2</sup>. <sup>1</sup>National Taiwan Normal University, Taipei, Taiwan. <sup>2</sup>Graduate Institute of Sports Science, Taipei, Taiwan.  
(No relationships reported)

**PURPOSE:** A determinant onset of aging in hippocampus has been evident at middle age. Angiogenesis, critical for maintaining brain health, was known to be enhanced by exercise. However, the expression of angiogenic and age-related inflammatory factors in response to exercise was not well-clarified in hippocampus. This study investigated the effects of acute and short-term exercises on the capillary density and expression of angiogenic and inflammatory factors of young and middle-aged brain regions.

**METHODS:** 3- and 12-month old male Sprague-Dawley rats were assigned to young control (YC), young exercise (YE), old control (OC) and old exercise (OE). Hippocampus and motor cortex were collected after single and 3-week swimming exercise. The protein expression of VEGF, VEGF receptors, Angiopoietin and its receptor, RAGE and CD68 with capillary density were analyzed.

**RESULTS:** Comparing to YC, ~2-fold expressions of partial angiogenic factors (Flt-1 and Ang-1) and CD68 were determined in OC motor cortex but not hippocampus. Only for young, angiogenic factors in both brain regions significantly responded to acute exercise but with no further changes observed after 3-week swimming. Meanwhile, capillary density was significantly higher in YE than YC for both brain regions after 3-week swimming but not in the middle-aged (Motor cortex:  $316.6 \pm 19.5$  vs.  $492.6 \pm 41.0/\text{mm}^2$ ; Hippocampus:  $303.3 \pm 24.5391.2 \pm 20.2/\text{mm}^2$ ). Otherwise, the inflammatory response expressed by CD31 was noted in OE, particularly in hippocampus.

**CONCLUSIONS:** These findings suggested angiogenic factors can be modulated to perform the appropriate vascular network following the exercise challenge in the brain. Importantly, exercise might accomplish an environment for middle-aged brain toward angiogenesis.

Key words: angiogenesis, age, swimming exercise, hippocampus

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3302 Board #23 June 2 9:30 AM - 11:00 AM

### The Influence of Resistance Training on Primary Hemostatic Responses

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(No relationships reported)

**OBJECTIVE:** The growing incidence of acute cardiovascular diseases (CVD) has propelled the investigation of potential ways to help combat this epidemic. The likely connection between platelet activity and the development of CVD has raised the question of whether or not platelet function varies in exercising individuals. Prolonged resistance training has been linked to a possible reduction in hyperaggregability of platelets, especially following acute strenuous exercise. The present investigation was designed to explore the effects of an acute resistance exercise test (AERET) and recovery on the primary hemostatic system in both resistance trained and untrained individuals.

**METHODS:** Ten resistance trained (RT) (mean  $\pm$  SE, age,  $26.0 \pm 1.4$  yr; height,  $175.1 \pm 2.7$  cm; weight,  $79.6 \pm 4.3$  kg) and ten untrained (UT) individuals (age,  $26.4 \pm 2$  yr; height,  $170.3 \pm 2.4$  cm; weight,  $67.9 \pm 5.4$  kg) performed an AERET (6 sets of 10 repetitions of heavy squats @ 80% 1-RM). Blood samples were obtained before, immediately after and at 15, 60 and 120 minutes following the AERET. Blood samples were analyzed for platelet count, von Willebrand Factor (vWF), Beta Thromboglobulin ( $\beta$ -TG) and Platelet Factor 4 (PF4).

**RESULTS:**  $\beta$ -TG showed differences ( $P < 0.05$ ) between RT and UT at +15 min ( $32.8 \pm 2.6$  IU/ml vs.  $46.2 \pm 3.1$  IU/ml) and +60 min ( $28.2 \pm 2.6$  IU/ml vs.  $39.0 \pm 3.6$  IU/ml), respectively. Both groups showed a main effect for time in platelet count, vWF and  $\beta$ -TG following the AERET, whereas PF4 remained unchanged. All blood variables returned to baseline values by 120 minutes following exercise.

**CONCLUSION:** RT individuals demonstrated reduced platelet activation *in vivo* in response to an acute bout of heavy resistance exercise compared to UT individuals. Reduced platelet activation could be attributed to training status as shown by reduction in plasma levels of  $\beta$ -TG measured in the RT group.

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3303 Board #24 June 2 9:30 AM - 11:00 AM

### A 12 Week Of Aerobic Exercise Training On VEGF Related Proteins After 3 Month Detraining In Human Skeletal Muscle

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(No relationships reported)

The VEGF gene may be directly linked to angiogenesis with a higher specificity for stimulating vascular endothelial cells. Increased expression of VEGF may play an important role in the primary mechanism responsible for increasing the capacity of aerobic metabolism within cardiac and skeletal muscles. Hypoxia-inducible factor-1 $\alpha$  (HIF-1 $\alpha$ ) can also be a factor when skeletal muscle cells are exposed to hypoxic environment.

**PURPOSE:** The present study was performed to investigate the effect of long-term endurance training on VEGF and HIF-1 $\alpha$  protein expressions in skeletal muscles after 3 month detraining.

**METHODS:** Five female aerobic athletes and age matched five untrained subjects were participated in the present study. All subjects refrained regular physical activities for three months before this study. The exercise program, for the experimental group, consisted of 10-minute stretching and 60-minute treadmill walking with 60-80% of  $\text{VO}_2\text{max}$  for 12 weeks. Muscle samples obtained from vastus lateralis before and after training, and analyzed a relevant protein expressions using SDS-PAGE and Western blotting.

**RESULTS:** There were no differences between the two groups in total VEGF protein expression. The protein expression of VEGF 165 isoform increase by 37.5% ( $p = .014$ ) in untrained group, whereas unchanged in trained group. The same trend was demonstrated that HIF-1 $\alpha$  protein expression in untrained group increased by 69.4% ( $p = .015$ ), whereas unchanged in trained group.

**CONCLUSIONS:** A 12 week of aerobic training may not induce an increase in vascular endothelial cell growth related protein expression in well-trained athletes even after 3 month detraining.

3304 Board #25 June 2 9:30 AM - 11:00 AM

**High-Intensity Endurance Training but not Vitamin C Changes Vascular Responsiveness in Diabetic Rats**

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(No relationships reported)

Type I diabetes is associated with endothelial dysfunction and reduced bioavailability of nitric oxide (NO), resulting in impaired vasodilation. High-intensity endurance training improves endothelium-dependent vasodilation. Additionally, antioxidants are likely to reduce oxidative stress and increase NO bioavailability.

**PURPOSE:** To examine the effects of short-term high-intensity endurance training and Vitamin C on endothelium-dependent vasodilation in different arteries within the vasculature.

**METHODS:** Twenty male Sprague-Dawley rats were assigned to a control diabetic (CD; n=10) or a high-intensity endurance training (HI; n=10) group. Diabetes was induced with Streptozotocin and insulin pellets were implanted to maintain glucose concentration within 9-15 mM. HI exercised on a treadmill with a 6% grade at 27 m/min, 5 times a week, 1 h a day for 6 weeks. Rats were sacrificed 15 h after their last bout of exercise. Femoral and aorta arteries were excised, cleaned of connective tissue and rings of ~2 mm length were mounted onto a myography system. Vasorelaxation responses to acetylcholine (ACh  $10^{-4}$ , (ACh)) and ACh  $10^{-4}$  plus Vitamin C  $10^{-4}$  (VIT C) were measured and modeled as a mono-exponential function using non-linear regression.

**RESULTS:** The adjustment for the vasorelaxation response ( $\tau$ ) was faster in HI (6.1s) compared to CD (9.2s) ( $p<0.05$ ). The  $\tau$  of the femoral artery was shorter (6.0s) than that of the aorta artery (9.3s). Adding vitamin C resulted in no significant changes in the responsiveness of the vessels (overall response 7.6s and 7.8s for ACh and VIT C, respectively with no interaction effects). The time delay (TD) before the onset of vasorelaxation did not differ between groups or vessels but was shorter in ACh (4.1s) compared to the VIT C (4.5s) condition ( $p<0.05$ ). Thus, the mean response time ( $\tau$ +TD) remained the same in both conditions (ACh, 11.7s and VIT C, 12.3s) but it was still shorter in HI (10.3s) compared to CD (13.7s) and in the femoral (10.4s) compared to the aorta (13.5s).

**CONCLUSION:** Although vascular responsiveness was faster in response to HI in both the aorta and femoral arteries, the rate of adjustment in the femoral was always faster than in the aorta. Finally, adding vitamin C as an antioxidant resulted in no further changes in the dynamic adjustment of the vessels.

Supported by: CIHR, OMRI

3305 Board #26 June 2 9:30 AM - 11:00 AM

**Effects Of Exercise Training On Endothelium-Dependent Vasodilation In Cerebral Arteries**

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(No relationships reported)

Endothelium-dependent vasodilation and endothelial nitric oxide synthase (eNOS) protein expression are enhanced with exercise training in the peripheral vasculature. However, the effect of exercise training on endothelium-dependent vasodilation of the cerebral vasculature has not been well established.

**PURPOSE:** The purpose of this study was to test the hypothesis that exercise training enhances endothelium-dependent vasodilation of large cerebral arteries.

**METHODS:** Dose-response relationships for endothelium-dependent and endothelium-independent vasodilation were determined in posterior communicating arteries (PCoA) of sedentary (SED) and exercise-trained (ET) male rats. ET rats ran on a motorized rodent treadmill at 15 m/min (15° incline), 60 min/day, 5 d/wk for 10 wk. PCoA were isolated from the brain of both SED and ET rats, cannulated, and pressurized to 90 cm H<sub>2</sub>O via hydrostatic reservoirs. Luminal diameter changes were determined in response to the endothelium-dependent vasodilator, Bradykinin (BK) ( $10^{-13}$  -  $10^{-7}$  M) and the endothelium-independent, direct vascular smooth muscle dilator, sodium nitroprusside (SNP,  $10^{-10}$  -  $10^{-4}$  M).

**RESULTS:** Responsiveness to BK was greater in PCoA of ET rats ( $83 \pm 3\%$  of maximal possible vasodilation) compared to SED rats ( $50 \pm 8\%$  of maximal possible vasodilation), whereas responsiveness to the endothelium-independent vasodilator SNP was not different between PCoA of SED and ET rats ( $91 \pm 3\%$  vs.  $89 \pm 4\%$  of maximal possible vasodilation, respectively).

**CONCLUSION:** These data demonstrate that exercise training results in enhanced endothelium-mediated vasodilation in PCoA, whereas vascular smooth muscle sensitivity of PCoA to nitric oxide is unaffected by exercise training.

3306 Board #27 June 2 9:30 AM - 11:00 AM

**Impact of Training Status on Vascular Health in Young Adult Males**

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(No relationships reported)

The benefits of physical activity for cardiovascular health are irrefutable. Aortic stiffness and cardiovagal baroreceptor sensitivity (BRS) are strong predictors of cardiovascular disease risk and mortality. Lower pulse wave velocity (PWV; an index of arterial stiffness) and higher BRS have been shown in habitually active individuals in comparison to their physically inactive counterparts. In addition, endurance training has been shown to improve PWV and BRS in both apparently healthy and clinical populations. However, the effects of chronic high volume and intensity exercise (as typically performed by highly trained endurance athletes) on vascular health is not clear.

**PURPOSE:** To assess various indicators of vascular health in highly trained cyclists and normally active young adults.

**METHODS:** Eleven male category 1/2 road racers (ET; Age =  $28 \pm 6$  (SD) yr) and eleven normally active males (NA; Age =  $32 \pm 6$  (SD) yr) participated in this study. Measures included self-reported training volume/intensities and directly assessed vascular function (PWV, BRS and arterial compliance), maximal aerobic power ( $VO_{2max}$ ), and body composition (DEXA).

**RESULTS:** The groups did not differ in age, body composition, or blood pressure. The ET group had significantly higher  $VO_{2max}$  and power output ( $59.7 \pm 6.2$  vs.  $46.8 \pm 5.1$  mL·kg<sup>-1</sup>·min<sup>-1</sup> and  $405 \pm 61$  vs.  $327 \pm 48$  W, respectively;  $p<0.01$ ). Of the vascular measures, large artery compliance (LAE) and BRS were significantly higher in ET ( $23.2 \pm 6.1$  vs.  $18.8 \pm 3.0$  mL·mmHg<sup>-1</sup> and  $35.7 \pm 17.0$  vs.  $22.7 \pm 9.5$ , respectively). However, no significant differences were evident for PWV, heart rate variability, or small artery compliance. There were significant relationships between resting LAE and the ratio of spectral analysis of RR interval ( $r=0.57$ ;  $p<0.01$ ) and LAE with BRS ( $r=0.56$ ,  $p<0.01$ ). All measures were within published norms for healthy young adults.

**CONCLUSIONS:** The results of this study suggest that training status in healthy young adults may affect arterial compliance and BRS; however, PWV does not appear to be as affected. The impact of a dose response on vascular health requires further research.

3307 Board #28 June 2 9:30 AM - 11:00 AM

**The Effect Of Cerebral Blood Flow On Central Chemoreflex During Orthostatic Stress**

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(No relationships reported)

**PURPOSE:** Central respiratory chemoreflex is reset during orthostatic stress, such that minute ventilation ( $V_E$ ) is greater for a given end tidal carbon dioxide ( $P_{ET}CO_2$ ). However, the underlying physiological mechanism(s) for this remains unclear. We hypothesized that postural reductions in cerebral blood flow (CBF) modify the central ventilatory chemoreflex.

**METHODS:** To test this hypothesis, we examined the relationship between changes in middle cerebral artery mean blood velocity (MCA  $V_{mean}$ ) and  $V_E$  in subjects breathing different levels of inspired  $CO_2$  (0, 3.5, 5%  $CO_2$ ) while in the supine position and undergoing simulated orthostatic stress (lower body negative pressure; LBNP, -40mmHg). Ten healthy men with a mean age of  $23.6 \pm 1.9$  yr (mean  $\pm$  S.D.) voluntarily participated in this study.

**RESULTS:** LBNP decreased MCA  $V_{mean}$  and tended to increase  $V_E$ , regardless of the level of inspired  $CO_2$ . As expected, the regression line relating  $V_E$  to  $P_{ET}CO_2$  was shifted leftwards from supine to LBNP. The average sensitivity (i.e. slope) of the  $V_E$ - $P_{ET}CO_2$  relationship was enhanced during LBNP ( $0.40 \pm 0.02$  at supine to  $0.44 \pm 0.03$  l/min/mmHg during LBNP; mean  $\pm$  S.E.;

P=0.003). In contrast, cerebral CO<sub>2</sub> reactivity (the sensitivity of the MCA  $V_{\text{mean}}\text{-P}_{\text{ET}}\text{CO}_2$  relationship) was significantly decreased during LBNP from  $1.43 \pm 0.18$  to  $1.36 \pm 0.17$  cm/s/mmHg (P=0.001). Orthostatic stress induced-changes in  $V_E$  were significantly associated with decreases in MCA  $V_{\text{mean}}$  from supine to LBNP (P=0.018), but were not associated with changes in  $P_{\text{ET}}\text{CO}_2$  (P=0.2).

**CONCLUSIONS:** These findings support our hypothesis that postural reductions in CBF modify the central ventilatory chemoreflex by moving its point of operation. We speculate that orthostatic stress induced decreases in CBF attenuate the “washout” of CO<sub>2</sub> from the brain and result in augmented increases in  $V_E$  via the central chemoreflex.

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**3308** Board #29 June 2 9:30 AM - 11:00 AM

**Low-dose Aspirin Attenuates Heart Rate but not Blood Pressure Increase during Isometric Exercise in Humans**

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(No relationships reported)

Muscle afferent feedback is known to contribute towards the increased heart rate (HR) and mean arterial blood pressure (MAP) observed during exercise. Group III and IV afferent nerve fiber endings (muscle mechanoreceptors and metaboreceptors, respectively) can both be stimulated by metabolites produced during muscular work. However, the role of one such metabolite, thromboxane A<sub>2</sub>, in causing the increased HR and MAP during exercise in humans is unknown.

**PURPOSE:** Therefore, we sought to determine the effects of blocking thromboxane A<sub>2</sub> production via low-dose aspirin on HR and MAP during isometric calf exercise in humans.

**METHODS:** Nine young, healthy subjects (4 male) attended on 2 separate days and performed 2 trials on each day; a 2-min baseline followed by either 1.5mins of further rest (0% maximal voluntary contraction (MVC)), or 1.5mins of one-legged isometric calf exercise at 70% MVC (70% MVC). One visit was after having taken a placebo (Pla) for 7 days, and one visit after taking low-dose (81mg) aspirin (Asp) for 7 days. The order of visits was counterbalanced, as was the order of trials within each visit. HR (ECG) and MAP (Finapres) were continuously recorded during all trials.

**RESULTS:** Baseline HR was similar in all trials over both visits ( $59 \pm 2$ ,  $61 \pm 2$ ,  $61 \pm 3$  and  $63 \pm 3$  b.min<sup>-1</sup> for 0% Pla, 70% Pla, 0% Asp and 70% Asp, respectively). HR did not change significantly from baseline during either of the 0% MVC trials. However, the HR increase from baseline observed during 70% MVC with aspirin ( $11 \pm 3$  b.min<sup>-1</sup>) was significantly lower than during 70% MVC with placebo ( $15 \pm 3$  b.min<sup>-1</sup>) (P=0.046). Baseline MAP was similar in all trials over both visits ( $87 \pm 2$ ,  $86 \pm 3$ ,  $85 \pm 2$  and  $85 \pm 3$  mmHg for 0% Pla, 70% Pla, 0% Asp and 70% Asp, respectively). MAP did not change significantly from baseline during either of the 0% MVC trials. The MAP increase from baseline observed during the 70% MVC with aspirin ( $93 \pm 3$  mmHg) was similar during 70% MVC with placebo ( $93 \pm 3$  mmHg).

**CONCLUSION:** These results suggest that low-dose aspirin attenuates the increase in HR but not MAP during isometric calf exercise in humans. This is likely due to reduced metabolite stimulation of muscle afferents during exercise when thromboxane A<sub>2</sub> production is inhibited, which affects the control of HR more than MAP.

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**3309** Board #30 June 2 9:30 AM - 11:00 AM

**Muscle Metaboreflex Modulates Dynamic Cardiovascular and Cerebrovascular Responses to Acute Hypotension in Humans**

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(No relationships reported)

During heavy exercise, the arterial baroreflexes and the muscle metaboreflex are hypothesized to be activated, and to interact in ways that lead to modulation of the primary cardiovascular reflex responses. However, the interaction of these two reflexes in cerebral circulation has never been investigated.

**PURPOSE:** We aimed to investigate whether the muscle metaboreflex modulates arterial baroreflex-mediated cardiovascular responses as well as cerebrovascular responses to acute hypotension in humans.

**METHODS:** Acute hypotension was induced nonpharmacologically in six healthy subjects by releasing bilateral thigh cuffs after nine minutes of suprasystolic resting ischemia with and without muscle metaboreflex activation (via post exercise muscle ischemia after one minute static handgrip exercise at 50% MVC). We simultaneously measured beat-to-beat mean arterial blood pressure (MAP), heart rate (HR), cardiac output (CO), forearm blood flow (FBF) and middle cerebral artery mean blood velocity (MCAVM). Changes in measured variables induced via thigh cuff release were determined relative to their concomitant baseline values.

**RESULTS:** The thigh cuff release evoked rapid reductions in MAP, FBF, forearm vascular conductance and MCAVM and rises in HR, CO, TVC and cerebrovascular conductance index to similar extent in control and during muscle metaboreflex activation. The muscle metaboreflex activation enhanced the arterial baroreflex mediated peripheral vasoconstriction as evidenced by an earlier start of MAP recovery (control vs. muscle metaboreflex activation; length of time before the start of MAP recovery,  $11.5 \pm 1.1$  vs.  $5.8 \pm 0.7$  s,  $p < 0.05$ ) and faster returns of MAP and TVC to the baseline ( $0.9 \pm 0.2$  vs.  $2.3 \pm 0.5$  and  $-5.4 \pm 1.1$  vs.  $-9.8 \pm 1.1$  %,  $p < 0.05$ ). In addition, the rate of regulation, an index of cerebral autoregulation, was enhanced during muscle metaboreflex activation ( $0.189 \pm 0.018$  vs.  $0.310 \pm 0.020$ /s,  $p < 0.05$ ). Furthermore, MCAVM recovered faster with muscle metaboreflex activation ( $1.3 \pm 0.1$  vs.  $4.3 \pm 0.6$  %,  $p < 0.05$ ).

**CONCLUSION:** These results suggest that during muscle metaboreflex activation, the arterial baroreflex mediated peripheral vasoconstriction as well as the cerebral autoregulation to acute hypotension are augmented and result in a faster recovery for the cerebral blood flow.

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**3310** Board #31 June 2 9:30 AM - 11:00 AM

**Contribution of Endothelin-1 to Skeletal Muscle Blood Flow and Oxygen Consumption during Exercise**

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(No relationships reported)

**PURPOSE:** Although it has been documented that endothelin-1 (ET-1) - mediated vasoconstriction is attenuated during exercise in an intensity-dependent manner, the role of endogenous ET-1 in regulating skeletal muscle blood flow and its ultimate effect on oxygen consumption (VO<sub>2</sub>) over a large spectrum of exercise intensities is unknown.

**METHODS:** Six healthy men and women ( $25 \pm 2$  yrs) performed knee-extensor exercise at 20, 40, 60, 80, and 90% of maximal work rate (WR<sub>max</sub>) before and after local ET-1 receptor subtype A (ET<sub>A</sub>) blockade (intra-arterial infusion of BQ-123 at 10 nmol/min/l thigh volume). Arterial blood pressure (femoral arterial catheter), heart rate (3-lead ECG), single-leg blood flow (Doppler ultrasound), single-leg arterial-venous oxygen difference (a-VO<sub>2diff</sub>) (blood gases), and single-leg VO<sub>2</sub> were determined at rest and during all levels of exercise.

**RESULTS:** At rest, ET<sub>A</sub> receptor inhibition did not alter leg blood flow, a-VO<sub>2diff</sub>, or single-leg VO<sub>2</sub> (P>0.05). In contrast, ET<sub>A</sub> receptor inhibition during exercise induced an ~18% increase in leg blood flow of the exercising limb across all levels of exercise (P<0.05). This increase in leg blood flow was accompanied by a ~10% increase in single-leg VO<sub>2</sub> (P<0.05) across all work rates, in light of an unaltered a-VO<sub>2diff</sub> (P>0.05) between control and BQ-123 trials. Heart rate and arterial blood pressure increased in an intensity-dependent manner during exercise, but did not differ between the control and BQ-123 trials (P>0.05).

**CONCLUSION:** These data reveal, for the first time, an ET<sub>A</sub> receptor-mediated restraint of skeletal muscle blood flow during knee-extensor exercise in young, healthy humans, and further suggests that altering blood flow will directly augment VO<sub>2</sub>.

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**3311** Board #32 June 2 9:30 AM - 11:00 AM

**ATP<sub>γ</sub>S Does Not Potentiate the Muscle Chemoreflex Response to Lactic Acid**

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(No relationships reported)

**PURPOSE:** Birdsong et al. (Neuron 68: 739-749, 2010) have shown that acute exposure to ATP potentiated acid sensing ion channel (ASIC) evoked currents from single dorsal root ganglion cells innervating hindlimb muscles of rats. This finding prompted us to determine whether the results seen in a freshly dissociated single cell preparation in vitro would translate to an in vivo preparation.



**METHODS:** We measured the pressor and cardioaccelerator responses to injecting lactic acid (24mM; 0.4mL), an ASIC agonist, into the femoral artery of decerebrated, unanesthetized rats (N=6) whose hindlimbs were freely perfused both before and after administration of ATP $\gamma$ S (200mg/kg), a stable agonist of purinergic 2 receptors.

**RESULTS:** We found that the increase in mean arterial pressure evoked by lactic acid after ATP $\gamma$ S was not different from the increase evoked by lactic acid before ATP $\gamma$ S (15 $\pm$ 2mmHg vs. 14 $\pm$ 2mmHg, respectively;  $p>0.05$ ). The increase in heart rate evoked by lactic acid after ATP $\gamma$ S was significantly but modestly greater than the increase evoked by lactic acid before ATP $\gamma$ S (3 $\pm$ 1 beats per min vs. -2 $\pm$ 1 beats per min, respectively;  $p<0.05$ ).

**CONCLUSION:** ATP $\gamma$ S does not appear to potentiate the muscle chemoreflex evoked by lactic acid in rats with freely perfused hindlimbs. Supported by NIH RO1-HL030710 and P01 HL096570.

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**3312** Board #33 June 2 9:30 AM - 11:00 AM

**Sex Differences In Cardiac Autonomic Modulation And Baroreflex Sensitivity Following Differential Exercise Training**

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(No relationships reported)

Maintained balance between sympathetic and parasympathetic tone within the cardiac autonomic systems is a vital component of cardiovascular regulation. Heart rate variability (HRV) and baroreflex sensitivity (BRS) are non-invasive clinical measures used to assess cardiac autonomic modulation and pressor sensitivity. Aerobic exercise (AE) training has been shown to increase HRV and BRS; however, little is known concerning a sex specific response following AE or resistance exercise (RE) training. The purpose of this study was to assess short-term AE training versus RE training on HRV and BRS in a mixed-sex hypertensive cohort.

**METHODS:** Forty pre- to stage-1 essential hypertensives between the ages of 33 and 60 years old (20 men, 20 women) underwent either AE training [30 minutes of treadmill exercise, 3 days per week at 65% of peak oxygen consumption] or RE training (3 sets of 10 repetitions for 9 major muscle groups, 3 days per week at 65% of 10 repetition maximum). Demographics, electrocardiogram (ECG) recordings, beat-to-beat blood pressure (BP), and a heads-up tilt test were performed at baseline, pre and post-4 week training period. A rmANOVA was employed to determine differences (mode (resistance vs. aerobic) x time (pre- vs. post) x sex (male vs. female)).

**RESULTS:** A significant increase in BRS was shown in males and females (7.98  $\pm$  1.49 to 8.95  $\pm$  1.72 ms mm<sup>-1</sup> Hg<sup>-1</sup>, 4.54  $\pm$  1.59 to 5.97  $\pm$  1.83 ms mm<sup>-1</sup> Hg<sup>-1</sup>, respectively) following AE training; however, RE training, showed decreases in BRS in males and no change in females. Following RE training a significant increase in LF:HF ratio was shown in males, yet decreases in females (286.56  $\pm$  149.24 to 417.25  $\pm$  175.8 ms<sup>2</sup>, 86.5  $\pm$  247.48 to 40.6  $\pm$  291.54 ms<sup>2</sup>, respectively).

**CONCLUSIONS:** The increase in LF:HF may explain the decreases seen in BRS in men following RE training, deriving a better benefit for RE training for women.

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**3313** Board #34 June 2 9:30 AM - 11:00 AM

**Calf Muscle Oxygen Saturation In Peripheral Artery Disease Patients With Different Types Of Leg Pain**

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(No relationships reported)

**PURPOSE:** To compare calf muscle hemoglobin oxygen saturation (StO<sub>2</sub>) and exercise performance during standardized treadmill exercise in patients with peripheral artery disease (PAD) who describe different types of exertional leg pain, and to compare secondary outcomes consisting of daily ambulatory activity and exercise performance during a 6-minute walk test.

**METHODS:** One hundred fourteen PAD patients were evaluated on leg pain symptoms using the San Diego claudication questionnaire, which defined patients as having atypical exertional leg pain (n = 31), claudication (n = 37), or leg pain on exertion and rest (n = 46). Patients were evaluated on a standardized, graded treadmill test during which calf muscle StO<sub>2</sub> was continuously monitored, 6-minute walk test, walking impairment questionnaire (WIQ), and ambulatory activity monitored during one week.

**RESULTS:** All patients experienced symptoms during the treadmill test consistent with claudication. The groups were not significantly different on the primary outcomes of time to reach the minimum calf muscle StO<sub>2</sub> (p = 0.350) and peak walking time (p = 0.238) during treadmill exercise. Patients with atypical leg pain had the highest daily ambulatory activity for total strides per day (p = 0.032), average daily cadence (p = 0.010), maximum cadences for durations between 5 min (p = 0.035) and 60 min (p = 0.029), speed score on the WIQ (p = 0.006), and lowest rating of perceived exertion at the end of the 6-minute walk test (p = 0.017).

**CONCLUSIONS:** PAD patients with atypical leg pain have vascular-mediated limitations in exercise performance during standardized treadmill testing similar to patients with claudication, but they have higher levels of daily ambulatory activity in the community setting and higher perceived ambulatory function. The clinical significance is that all symptomatic PAD patients, irrespective of their leg pain type, should be treated to improve symptomatology.

Supported by: NIA(R01-AG-24296); and OCAST(HR09-035).

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**3314** Board #35 June 2 9:30 AM - 11:00 AM

**Evidence That Meal Fat Content Does Not Impact Hemodynamic Reactivity to Repeated Mental Stress Tasks**

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(No relationships reported)

Psychological stress is known to evoke physiological responses, including increases in mean arterial blood pressure (MAP). There is some evidence that both a single high fat (HF) meal and short-term elevations in dietary fat intake enhance hemodynamic reactivity to laboratory stressors. Stress reactivity has been shown to relate to cardiovascular risk, and interactions with diet may be important.

**PURPOSE:** To determine the impact of a HF meal on the magnitude and stability of reactivity to varied mental stressors, as assessed by the peak changes in MAP and its constituents (i.e. cardiac output and total peripheral resistance) from baseline to during stress ( $\Delta$ MAP<sub>peak</sub>,  $\Delta$ CO<sub>peak</sub>,  $\Delta$ TPR<sub>peak</sub>).

**METHODS:** On two different days, separated by 14  $\pm$  5.4 days, 10 healthy males (23.2  $\pm$  3.3 yrs) consumed either a HF (48g fat) or low fat (LF; 0g fat) meal (~940 calories each). On each day, subjects performed 4 hourly STs (10 mins each in duration). STs consisted of mental arithmetic (3 tasks) or a speech (5 tasks), and were interspersed with the intention of providing a varied stimulus to minimize habituation.

**RESULTS:** Data are mean  $\pm$  SD. Postprandial lipemia was greater following consumption of the HF vs LF meal (HF vs LF: 1.37  $\pm$  0.87 vs 0.87  $\pm$  0.38 mmol/L, P=0.03). Pre-ST MAP did not differ within (P=0.27) or between (P=0.69) HF and LF meals.  $\Delta$ MAP<sub>peak</sub> did not differ between meals (HF vs LF: 19.6  $\pm$  10.6 vs 21.3  $\pm$  7.4 mmHg, P=0.41), however within meals, reactivity was attenuated by the 4<sup>th</sup> ST ( $\Delta$ MAP<sub>peak</sub> ST-1 vs ST-4: 22.1  $\pm$  8.8 vs 16.8  $\pm$  8.1 mmHg, P=0.02). There was also no significant difference in  $\Delta$ CO<sub>peak</sub> or  $\Delta$ TPR<sub>peak</sub> either within or between meals (HF vs LF:  $\Delta$ CO<sub>peak</sub> 1.9  $\pm$  0.92 vs 2.0  $\pm$  0.96 L/min, P=0.60;  $\Delta$ TPR<sub>peak</sub> 3.1  $\pm$  3.4 vs 3.2  $\pm$  2.3 mmHg/L/min, P=0.94). There was considerable within-subject variability in reactivity to the range of tasks presented (within-subject  $\Delta$ MAP<sub>peak</sub> range of 14.6 mmHg  $\pm$  7.3 across STs), however the range of reactivity did not differ between HF and LF meals (P=0.36).

**CONCLUSIONS:** Contrary to previous reports, meal fat content did not impact hemodynamic reactivity to laboratory stressors. These data also provide evidence of minimal habituation in hemodynamic responses to varied mental STs performed 8 times over 2 laboratory visits, with wide variation in reactivity within individuals.

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3315 Board #36 June 2 9:30 AM - 11:00 AM

**Left Ventricular Mechanics Following Ultra-endurance Exercise - Impact Of Dehydration**

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(No relationships reported)

Previous studies have shown a significant reduction in left ventricular (LV) twist and strain ('LV mechanics') following ultra-endurance exercise, however, this may be caused by accompanying dehydration and not exclusively reflect cardiac impairment.

**PURPOSE:** To examine the influence of dehydration upon LV mechanics following ultra-endurance exercise.

**METHODS:** Six male cyclists (age: 30±6 years) performed two 6h cycling trials, one with maintained hydration (EUHY) and one with ~2% dehydration (DEHY). Exercise intensity was fixed at 15% below a lactate concentration of 4 mmol. In both the EUHY and DEHY trial, LV volumes and mechanics were measured at three time points: i) pre, ii) post and iii) 24h post cycling exercise. Significant effects of exercise or dehydration as well as their interaction were identified using 2-way repeated measures ANOVA.

**RESULTS:** End-diastolic volume (EDV) and stroke volume (SV) decreased significantly post 6h cycling in both EUHY and DEHY ( $\Delta$ EDV: ~-18±10 ml,  $\Delta$ SV: ~-16±7 ml) while heart rate was significantly higher post exercise in both trials ( $\Delta$ : ~-21±10 bpm). The ratio of early to late diastolic filling velocity (E/A) declined post exercise in both trials ( $\Delta$ -0.70±15). Radial strain was unaltered while circumferential strain was mildly reduced post EUHY and DEHY ( $\Delta$ -4±2%). In contrast, diastolic basal rotation velocity was significantly enhanced post DEHY compared with EUHY (74±21 vs. 63±22 deg·sec<sup>-1</sup>,  $P=0.03$ ). All values returned to pre exercise levels 24h post exercise. **Discussion:** The decline in EDV and SV observed in the present study was similar to that seen in previous investigations ( $\Delta$ 20ml and  $\Delta$ 17ml, respectively). However, post ultra-endurance exercise LV strain and twist indices were not reduced further in the DEHY compared with the EUHY trial. In fact, diastolic basal rotation velocity was significantly enhanced post DEHY.

**CONCLUSION:** Moderate dehydration (2%) does not exacerbate the change in LV volumes, heart rate or LV mechanics post ultra-endurance exercise. Therefore, the present data provide evidence that previously shown reductions in LV mechanics following competitive ultra-endurance events are likely caused by reductions in LV function and not by hydration status.

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3316 Board #37 June 2 9:30 AM - 11:00 AM

**Non-invasive Assessment From Micro- To Macro Circulation: A Feasibility Study**

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(No relationships reported)

The Erythrocyte-Endothelial (EE) gap, pulse wave analyses and velocity (PWV), and large conduit artery flow mediated dilation (FMD) are considered independent barometers of vascular health. Few studies exist that have examined each of these measures in the same individual.

**PURPOSE:** To determine the feasibility of assessing micro- to macrovascular function in young individuals with varying degrees of fitness.

**METHODS:** Ten subjects (male=2, female= 8, age= 23.0±5.08 years) participated in this study. Subjects rested for 10 minutes in the supine position prior to determining microvascular structure, arterial stiffness, and changes in brachial artery diameter before and after forearm occlusion (FMD). Red blood cell velocity (RBCV) and EE-Gap were examined in sublingual capillaries using OPS-imaging (Capiscope, KK technology, Exeter, UK). To assess arterial stiffness, a carotid-to-radial pulse wave velocity (PWV) was performed using tonometry. FMD was defined as the peak change in brachial artery diameter, which was determined by ultrasonography. In addition, subjects participated in a 12-minute run to measure fitness.

**RESULTS:** RBCV and EE-gap values were similar to healthy populations (84.58±25.23µm/sec and 0.86±0.15µm, respectively). Average aortic SBP, DBP, and PWV were 101.3±9.25mmHg, 71.5±8.44mmHg and 6.91±0.93m/sec, which are considered average for this population. The mean BAFMD was 5.84±3.27%, [Range: 1.19-10.34]. The average rank for the 12-min run was 35.65±32.06%.

**CONCLUSION:** The vascular measurements of this study are indicative of an apparently healthy population and in line with current literature. Non-invasive measurement of micro- and macro vessel function may lead to a more comprehensive understanding of vascular health, and appreciation for possible interrelationships between biomarkers.

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3317 Board #38 June 2 9:30 AM - 11:00 AM

**Acute Dietary Nitrate Supplementation on Resting and Exercising Muscle Hemodynamic Control in the Rat**

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(No relationships reported)

Nitric oxide (NO) bioavailability modulates both O<sub>2</sub> supply and demand within the O<sub>2</sub> transport pathway. A nitrate-rich diet has been shown to elevate NO bioavailability following its reduction to nitrite and NO via NO synthase-independent pathways. Recently, dietary nitrate supplementation has been shown to reduce blood pressure and reduce the O<sub>2</sub> cost of submaximal exercise in humans (Bailey et al, 2009, J Appl Physiol). Despite these observations, the effects of dietary nitrate supplementation on skeletal muscle blood flow (BF) at rest and during exercise remain unknown.

**PURPOSE:** To test the hypothesis that acute dietary nitrate supplementation decreases resting and exercising mean arterial pressure (MAP) while preserving hindlimb skeletal muscle BF during exercise.

**METHODS:** Young male Sprague-Dawley rats (3-6 months) were randomized into control or nitrate-supplemented groups. Nitrate supplementation was administered in drinking water via 2.5 ml/day of nitrate-rich beetroot juice (0.065 mmol/ml). Either untreated (control, n=8) or nitrate supplemented (BR, n=8) tap water was available ad libitum for 3 days while daily consumption was verified. Following supplementation, BF was assessed using radiolabeled microspheres at rest and during treadmill running (20 m/min, 5% grade).

**RESULTS:** BR supplementation decreased MAP significantly by 15% at rest (control: 138 ±4; BR: 117 ±7 mmHg;  $P\leq 0.05$ ) and 10% during exercise (control: 136 ±3; BR: 123 ±6 mmHg;  $P\leq 0.05$ ). Similar BF values for 28 individual hindlimb muscles resulted in no change in total hindlimb BF at rest (control: 17 ± 2; BR: 23 ± 3 ml/min/100g;  $P>0.05$ ) or exercise (control: 114 ± 8; BR: 116 ± 10 ml/min/100g;  $P>0.05$ ).

**CONCLUSIONS:** Dietary nitrate supplementation did not change exercising hindlimb BF and, therefore, O<sub>2</sub> delivery despite a reduced arterial driving pressure; providing evidence for an improved hemodynamic response to exercise. Combined with recent results that nitrate supplementation reduces the O<sub>2</sub> cost of exercise, these data support the hypothesis that nitrate supplementation elevates O<sub>2</sub> delivery relative to O<sub>2</sub> demand, which suggest one potential mechanism by which nitrate supplementation improves metabolic control.

Support: NIH HL-108328, AHA Midwest Affiliate

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3318 Board #39 June 2 9:30 AM - 11:00 AM

**Sex Affects Autonomic Recovery Following A 45-min Bout Of Aerobic Exercise**

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(No relationships reported)

**INTRODUCTION:** Heart rate variability (HRV) reflects autonomic function and is an indicator of cardiovascular health. Previous research has shown that autonomic balance is shifted towards greater sympathetic and less parasympathetic modulation following exercise. However, sex differences in autonomic recovery following aerobic exercise are not well delineated.

**PURPOSE:** To examine sex differences in autonomic recovery following a 45-min bout of aerobic exercise in healthy individuals.

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**METHODS:** Heart rate (HR), HRV frequency-domain parameters and brachial blood pressures were obtained at rest and following exercise in 60 healthy individuals (31 males and 29 females). Low-frequency (LF) and high-frequency (HF) power, low-frequency to high-frequency ratio (LF/HF), low-frequency normalized units (nLF), and high-frequency normalized units (nHF) of HRV were evaluated in the supine position, before and at 30 and 60 minutes following 45 min of walking at 70% of heart rate reserve.

**RESULTS:** Men exhibited higher LF/HF at rest and increased LF/HF more than women after exercise ( $205.97 \pm 29.68$  to  $595.38 \pm 73.08$  to  $209.21 \pm 80.34$   $\text{ms}^2$  vs.  $159.56 \pm 32.63$  to  $355.17 \pm 38.28$  to  $167.42 \pm 42.08$   $\text{ms}^2$ ,  $p < 0.05$  for interaction). Men also exhibited higher nLF ( $0.61 \pm 0.03$  to  $0.76 \pm 0.03$  to  $0.72 \pm 0.03$   $\text{ms}^2$  vs.  $0.51 \pm 0.04$  to  $0.61 \pm 0.03$  to  $0.54 \pm 0.03$   $\text{ms}^2$  and lower nHF at baseline and following exercise ( $0.38 \pm 0.03$  to  $0.22 \pm 0.03$  to  $0.27 \pm 0.03$   $\text{ms}^2$  vs.  $0.47 \pm 0.04$  to  $0.47 \pm 0.04$  to  $0.44 \pm 0.03$   $\text{ms}^2$ ;  $p < 0.05$  for time and sex effects).

**CONCLUSION:** Women and men exhibit different HRV responses following aerobic exercise. The higher nLF and lower nHF coupled with a greater increase in the LF/HF ratio following exercise suggests men exhibit reduced vagal but increased sympathetic dominance following submaximal exercise compared to women. Future work is needed to determine if this is related to increased risk of untoward events during and following exercise in men compared to women.

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**3319 Board #40 June 2 9:30 AM - 11:00 AM**  
**Cerebral Hemodynamic Responses During Carbon Dioxide Rebreathing, Aerobic Exercise And Cognition**

Hercules Grant, Mayank Rehani, Yagesh Bhambhani. *University of Alberta, Edmonton, AB, Canada.* (Sponsor: Bob Haennel, FACSM)  
(No relationships reported)

Increases in cerebral blood volume (total Hb) and oxyhemoglobin (O<sub>2</sub>Hb) with concomitant declines in deoxyhemoglobin (HHb) measured by near infrared spectroscopy (NIRS), collectively referred to as hemodynamics, are indicative of neuronal activation.

**PURPOSE:** To determine the inter-relationship between these acute hemodynamic responses during CO<sub>2</sub> rebreathing which increases cerebral blood flow, aerobic fitness and cognition in healthy males.

**METHODS:** Informed consent was obtained from eight healthy males (20 - 58 yrs, predicted VO<sub>2max</sub> =  $35.06 \pm 8.5$  ml/kg/min) with high school to university education. NIRS was used to measure the acute changes (peak minus baseline) in hemodynamic responses over the prefrontal lobe during 5% CO<sub>2</sub> rebreathing for 90 sec, Astrand/Rhyming test to predict VO<sub>2max</sub>, and digit span testing, (a subset of Wechsler Adult Intelligence Scale IV).

**RESULTS:** Significant increases were observed in total Hb and O<sub>2</sub>Hb with concomitant declines in HHb during CO<sub>2</sub> rebreathing and cycle ergometry. Cognition elicited a trend of increasing O<sub>2</sub>Hb and decreasing HHb with digit span scores which was not significant. Changes in O<sub>2</sub>Hb and total Hb were significantly correlated with relative VO<sub>2max</sub> ( $r = 0.792$  and  $0.841$  respectively), but not with cognition. Change in PetCO<sub>2</sub> (surrogate for cerebral blood flow) was significantly correlated with relative VO<sub>2max</sub>, ( $r = 0.721$ ,  $P < 0.05$ ). Correlation between delta PetCO<sub>2</sub> and [O<sub>2</sub>Hb] during cycling was approaching significance ( $r = 0.586$ ,  $P < 0.10$ ).

**CONCLUSIONS:** Higher levels of prefrontal neuronal activation are associated with enhanced aerobic fitness. However the relationship between these increases in neuronal activation and cognition were not evident, possibly due to the heterogeneity of the small sample evaluated.

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**3320 Board #41 June 2 9:30 AM - 11:00 AM**  
**Hemodynamic Mechanism of Rate Pressure Product Increase at Voluntary Exhaustion during Maximum Incremental Test**

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(No relationships reported)

Rate pressure product (RPP) is a physiological indicator that includes the heart rate (HR) for systolic blood pressure (SBP) product. It is used to evaluate the cardiovascular stress and its increase may occur through HR's rise, SBP's rise, or both. The knowledge of responsible variable for RPP increase at voluntary exhaustion (VE) during maximum incremental test (MIT) is important for a better understanding of MIT hemodynamic.

**PURPOSE:** To determinate the responsible variable for RPP increases at VE during MIT.

**METHODS:** Took part in the study 10 active female subjects ( $25 \pm 5$  years;  $165 \pm 7$  cm;  $62 \pm 11$  kg;  $27 \pm 6\%$  body fat). MIT was done with a Bruce's non inclination adapted treadmill protocol (Centurion 300 - Micromed) with 5.5 km/h initial velocity and 1 km/h per minute increment until VE. HR and SBP were recorded at rest and at VE (FS150 Frequency Meter - Polar and BP 3AC1-1 Digital Sphygmomanometer - Microlife, respectively). A non-parametric statistics data analysis was made through Mann-Whitney test.

**RESULTS:** There were significant differences between rest RPP and VE RPP ( $8.211 \pm 994$  mmHg/bpm vs.  $16.367 \pm 2.520$  mmHg/bpm,  $p < 0.01$ ), between rest HR and VE HR ( $67 \pm 8$  bpm vs.  $150 \pm 8$  bpm,  $p < 0.01$ ), but not between rest SBP and VE SBP ( $124 \pm 6$  mmHg vs.  $128 \pm 16$  mmHg).

**CONCLUSION:** RPP increase at VE during MIT is mediated by HR's rise.

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**3321 Board #42 June 2 9:30 AM - 11:00 AM**  
**Hemodynamic Response to Active Standing in Swimmers with Orthostatic Intolerance: Prevalence of Initial Orthostatic Hypotension**

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(No relationships reported)

Orthostatic intolerance or hypotension (OH) defined as a transient decrease  $> 20$  mmHg in systolic blood pressure (SBP) and/or a transient decrease  $> 10$  mmHg in diastolic blood pressure (DBP) within 3 min of standing has been reported in endurance athletes. However the prevalence of initial orthostatic hypotension (IOH) (defined as a transient decrease in SBP;  $> 40$  mmHg and/or DBP;  $> 20$  mmHg within 15 seconds of active standing) has not been examined in endurance athletes.

**PURPOSE:** The purpose of this study was to determine the prevalence of IOH in trained male swimmers with OH and to determine the hemodynamic response to active standing.

**METHODS:** 10 male swimmers with no reported history of syncope (age:  $20.8 \pm 1.5$  yrs; ht:  $178.0 \pm 7.6$  cm; wt:  $79.9 \pm 8.5$  kg) completed an active stand orthostatic challenge test (5 min supine, 3 min standing). Subjects reported no physical activity, or caffeine or alcohol consumption within the previous 12 hours. Arterial blood pressure was measured continuously by finger photoplethysmography (Finometer Medical Systems). Mean Arterial Pressure (MAP), SBP, DBP, Heart Rate (HR), Stroke Volume (SV) and Total Peripheral Resistance (TPR) were derived from beat by beat blood pressure and averaged over 3 cardiac cycles.

**RESULTS:** 8 of 10 swimmers met both SBP and DBP, 1 met SBP and 1 met DBP OH criteria (mean decrease of  $30.6 \pm 13.3$  and  $14.7 \pm 6.5$  mmHg for SBP and DBP respectively). IOH was observed in 8 of 10 swimmers (Decrease of SBP:  $48.8 \pm 19.3$  mmHg; Decrease of DBP:  $29.6 \pm 10.0$  mmHg; Decrease of MAP:  $36.2 \pm 12.2$  mmHg) with MAP nadir occurring at  $8.7 \pm 2.8$  sec returning to baseline value at approximately  $18.2 \pm 3.4$  sec after standing. The primary hemodynamic response with decreasing MAP to nadir was increase in HR of  $37.5 \pm 13.6$  beats/min reaching a maximum at  $16.8 \pm 10.9$  sec after standing. MAP return to baseline from nadir was associated with a mean increase in TPR of 43.2%, a mean increase in SV of 15.8% and a mean increase in HR of 4.2%.

**CONCLUSION:** These results suggest that IOH is prevalent in male swimmers with OH. In response to active standing an immediate uptake in HR with a latent increase in TPR act to equilibrate MAP from nadir.

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**3322 Board #43 June 2 9:30 AM - 11:00 AM**  
**Cardiorespiratory Response to Continuous Passive Motion Exercise in People with Spinal Cord Injury**

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(No relationships reported)

Continuous passive motion exercise (CPME) is commonly implemented for people with spinal cord injury (SCI). Many individuals with paralysis use CPME for their rehabilitation programs, but the research on its cardiorespiratory effects is limited.

**PURPOSE:** To investigate the cardiorespiratory responses to CPME in individuals with SCI.

**METHODS:** Eleven individuals with SCI (6 men and 5 women, 40.7±9 yr) and 11 healthy controls (6 men and 5 women, 35.8± 5 yrs) completed performing 3 exercise modes on separate days in a randomized order. Participants were also subject to an orientation visit to determine exercise intensity. The modes of exercise included 6-minute active arm ergometer exercise at their submaximal level which was set at 60-80% of maximum heart rate in order to estimate the maximum oxygen consumption, 20-minute seated CPME (passive cycling movement) and 20-minute supine-lying CPME (passive walking movement) at a matched movement speed. A telemetric metabolic system was used to compare the cardiorespiratory variables among three exercise modes. Test sessions were separated by minimum of 24 hours to avoid any carry-over effect from the previous session.

**RESULTS:** Multivariate analysis of variance (MANOVA) revealed significant differences in the oxygen consumption in the SCI group between the pre-exercise baseline and steady state exercise during the supine-lying CPME (Multivariate Pillai's Trace = .615,  $F_{(1,20)}=11.161$ ,  $p=.012$ ) and during the seated CPME (Multivariate Pillai's Trace = .562,  $F_{(1,20)}=8.972$ ,  $p=.020$ ). The levels of oxygen consumption were 8% (seated) and 14% (supine) of the estimated maximal oxygen consumption respectively.

**CONCLUSIONS:** Our findings suggest that CPMEs elicit an increase of cardiorespiratory responses, which may lead to favorable training effects on cardiorespiratory fitness in people with SCI.

**3323** Board #44 June 2 9:30 AM - 11:00 AM

**Time-course And Reliability Of Hemodynamic Responses To An Isometric Handgrip Protocol**

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(No relationships reported)

Isometric handgrip (IHG) training leads to significant reductions in blood pressure (BP) and improves endothelial function assessed by flow mediated brachial artery dilation (FMD). Nevertheless, the acute hemodynamic responses elicited by IHG have not been fully explored.

**PURPOSE:** To describe the time-course of the acute effects of a IHG protocol on FMD, BP and muscle blood volume (Mbv)/oxygenation (Mox), and evaluate the reliability of the last three measures.

**METHODS:** 15 healthy volunteers (7 females, 26.7±6y, 75±17kg, 170.4±7.3cm) completed two visits to the laboratory. After a 10-min rest period, subjects performed four sets of 2-min bilateral IHG at 30% of their maximum voluntary contraction, intercalated by 1-min rest interval. Brachial artery diameter (BAD) was measured using high-resolution ultrasonography. BP was measured by oscillometry. Mbv and Mox range values (difference between maximum and minimum absolute values) from the flexor digitorum profundus of right forearm were monitored by dual wave near infrared spectroscopy.

**RESULTS:** Time-course analyses indicate non-significant changes in BAD (t-test  $P=0.10$ ), only discrete ranges in Mbv and Mox, and no significant changes in BP (ANOVA with repeated measures). Absolute values obtained for all variables and ICC are presented, revealing poor to excellent reliability.

| BAD (mm)  | Baseline                     | End of 1st set               | 70-s rec                     |                              |
|-----------|------------------------------|------------------------------|------------------------------|------------------------------|
|           | 4.4±0.5                      | 3.9±0.5                      | 4.4±0.7                      |                              |
|           | 1st set                      | 1-min rec 1st set            | 2nd set                      | 1-min rec 2nd set            |
| Mbv       | 0.123±0.132<br>R=.88 (P=.00) | 0.059±0.068<br>R=.53 (P=.02) | 0.094±0.086<br>R=.54 (P=.24) | 0.062±0.049<br>R=.27 (P=.17) |
| Mox       | 0.07±0.10<br>R=.47 (P=.04)   | 0.04±0.05<br>R=.76 (P=.00)   | 0.07±0.08<br>R=.85 (P=.00)   | 0.036±0.040<br>R=.74 (P=.00) |
| BP (mmHg) | Baseline                     | 2-min rec                    | 7-min rec                    | 12 min rec                   |
| SBP       | 122±14<br>R=.77 (P=.01)      | 123±13<br>R=.80 (P=.00)      | 124±11<br>R=.64 (P=.01)      | 123±13<br>R=.81 (P=.00)      |
| DBP       | 74±7<br>R=.88 (P=.00)        | 70±8<br>R=.60 (P=.01)        | 71±9<br>R=.48 (P=.04)        | 74±11<br>R=.46 (P=.09)       |
| MAP       | 91±8<br>R=.81 (P=.01)        | 88±8mmHg<br>R=.69 (P=.00)    | 89±8<br>R=.63 (P=.01)        | 91±10<br>R=.47 (P=.09)       |

Rec: recovery

**CONCLUSION:** IHG exercise has a negligible acute effect on FMD, BP and Mbv/Mox; monitoring BP by oscillometry is a reliable way of assessing BP changes, whereas Mbv and Mox ranges were moderately reliable, supporting their utilization in this type of exercise.

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**3324** Board #45 June 2 9:30 AM - 11:00 AM

**Resistance Exercise Protocols With Similar Total Work:Rest Ratio Induce Different Cardiovascular Responses**

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(No relationships reported)

A resistance exercise (RE) protocol composed of 3x15:90s (sets x reps : rest) interval is usually recommended for people with cardiovascular diseases. During RE, there is a huge increase in blood pressure (BP) which enhances the risk of an acute event, such as a stroke. We hypothesized that a RE protocol with shorter sets may attenuate BP increase during RE.

**PURPOSE:** To investigate the cardiovascular, metabolic and perception of effort responses to different RE protocols with similar total work:rest ratio (WR).

**METHODS:** Three RE protocols were tested: 3x15:88s, 9x5:22s, and 45x1:4s. All of them had a WR of 45 repetitions to 176s of rest. To test the hypothesis, 10 healthy men (26±3yrs) and 10 women (25±5yrs) performed, in random order, the three protocols using the knee extension exercise with an intensity of 50% 1RM. BP was measured before and during exercise by finger photoplethysmography. The largest increase in BP observed every 15 repetitions was analyzed. In addition, the mean BP stress throughout the RE protocols was calculated by the area under the BP curve. Blood lactate concentration and perception of effort (PE) were measured after each protocol. Data were compared by a three-way ANOVA for repeated measures and significance was set to  $P < 0.05$ .

**RESULTS:** Systolic BP (98±40 vs. 87±33 and 79±33mmHg), HR (68±21 vs. 47±16 and 45±21bpm), rate pressure-product (22451±9549 vs. 15537±8114 and 15654±8110mmHg.bpm), lactate (3±1 vs. 2.0±1 and 2.0±1mmol.L<sup>-1</sup>), and PE (9.3±0.6 vs. 8.2±1.1 and 7.7±1.4) were significantly higher in the 3x15:88s compared to the 45x1:4s and 9x5:22s protocols. Diastolic BP was higher in the 3x15:88s and 45x1:4s compared to the 9x5:22s (59±28 and 55±26 vs. 45±19mmHg). In contrast, the area under BP and HR curves were not different between the protocols. In all protocols and analyses, males showed higher changes in BP than females.

**CONCLUSIONS:** Compared to the 3x15:88s, the 9x5:22s and the 45x1:4s protocols reduced the BP and HR peaks during exercise execution without changing the total cardiovascular stress. Thus, our results suggested that RE protocols with shorter sets and rest periods with intermediate duration may attenuate BP increase during RE.

3325 Board #46 June 2 9:30 AM - 11:00 AM

**Acute Cardiovascular Response To Mud-pack Treatment In Hypertensive Subjects Under Therapy**

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(No relationships reported)

Hypertensive subjects often develop a blunted cardio-vagal baroreflex sensitivity and an imbalance between sympathetic and parasympathetic tone; this may reduce the adaptation of cardiac output and peripheral resistances to warm environments. Such reactions may be enhanced by anti-hypertensive drugs, especially those inhibiting the angiotensin II-mediated vasoconstriction. Therefore, the immersion in hot mud typical of SPA treatment may cause hypotension in these patients.

**PURPOSE:** To evaluate the acute cardiovascular effects of mud-pack treatment in pharmacologically treated hypertensive patients.

**METHODS:** 28 subjects (M/F 10/18; 67±11 yrs, m±SD) were divided in 2 groups, matched for age and anthropometric characteristics: normotensive (N) and hypertensive (H) subjects, treated with beta-blockers, ACE-inhibitors or angiotensin II receptor antagonists (no diuretics). Beat-by-beat systolic (SBP) and diastolic blood pressure (DBP)(finger pletismography), and heart rate (HR) were recorded before, in supine position (10 min), and during mud-pack treatment (mud temperature 42°C, 15 min). Cardiac output and total peripheral resistance were calculated from the computed aortic-flow waveform. HR variability spectral indexes of sympathovagal balance (HF, High Frequency; LF, Low Frequency and LF/HF ratio) were finally calculated.

**RESULTS:** Compared to basal (pre-treatment) conditions, mud treatment tended to decrease SBP (difference between mud immersion and basal condition; H: -6±16 mmHg; N: -3±5 mmHg), whereas DBP did not differ (H: -2±7 mmHg; N: 7±5 mmHg) in both groups. HR significantly increased (p<0.05) in both groups (H: 7±6 bpm; N: 8±4 bpm). Cardiac output decreased significantly (p<0.01) in H subjects only (H: -1.5±2.0 l/min; N: -0.5±1.6 l/min), whereas total peripheral resistances decreased in H and increased in N subjects (H: -160±237 l/min; N: 97±124 dyn·s/cm<sup>5</sup>)(p<0.05). LF/HF ratio slightly but not significantly increased in both groups (H: 0.1±1.5; N: 0.7±1.6), as a results of an increase in LF and a reduction of HF, the latter being significant (p<0.05) in H subjects only.

**CONCLUSIONS:** Mud-pack treatment seems to be safe in pharmacologically treated hypertensive subjects. Partially supported by FoRST (Fondazione per la Ricerca Scientifica Termale, Italy).

3326 Board #47 June 2 9:30 AM - 11:00 AM

**Progressive Handgrip Exercise: Evidence of Attenuated Nitric-oxide Dependent Vasodilation and Blood Flow Regulation with Age**

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(No relationships reported)

**PURPOSE:** The purpose of this investigation was to better understand the altered role of nitric oxide (NO) with age and the potential for exercise-induced vasodilation of the brachial artery (BA) to assess NO bioavailability.

**METHODS:** BA blood flow (Doppler ultrasound), diameter, and shear rate were measured in response to progressive handgrip exercise with and without eNOS inhibition (intra-arterial infusion of L-NMMA) in 7 older subjects (69 ± 2 yr). Handgrip exercise was performed at 15, 25, 40, and 50% of maximal voluntary contraction and comparisons were made to our published observations in young adults (Wray et al. 2011).

**RESULTS:** The relationship between the change in BA diameter and shear rate was attenuated by 4 fold in the old (r = 0.66, p < 0.01; slope = 0.00013 ± 0.00004) compared to the young (r = 0.73, p < 0.01; slope = 0.00049 ± 0.00012, p = 0.002). Unlike the young, where eNOS inhibition ablated this relationship (r = 0.1, p = 0.5; slope = 0.00005 ± 0.00006), the diameter/shear rate response remained statistically unchanged in the old (r = 0.61, p < 0.01; slope = 0.00011 ± 0.00007). However, eNOS inhibition attenuated the BA diameter increase by 50% in the old compared to the 70% reduction in the young, indicating a substantial yet reduced role of NO with age. Blood flow was unaffected by eNOS inhibition in the old which contrasts with the ~25% reduction documented in the young.

**CONCLUSION:** These findings reveal that with age both shear stress mediated BA vasodilation and BA blood flow are less NO dependent during handgrip exercise and support the use of the progressive handgrip paradigm as a valid and novel approach to the non-invasive assessment of NO bioavailability in humans across the lifespan.

3327 Board #48 June 2 9:30 AM - 11:00 AM

**LBNP Effect On Rapid Changes In Stroke Volume And Cardiac Output At Exercise Onset**

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(No relationships reported)

**PURPOSE:** The kinetics of cardiac output (CO) at the onset of exercise is characterized by two phases. The first rapid phase (phase I), which has a time constant of less than 5 s, is generally attributed to the sudden withdrawal of vagal tone. Yet the hypothesis was put forward that a mechanical effect related to sudden increase in venous return at exercise start might also play a role, especially by increasing stroke volume (SV) via the Frank-Starling mechanism. If the latter was the case, then application of increasing levels of lower body negative pressure (LBNP) would generate a progressively greater increase in phase I amplitude (A1) of SV at exercise start, which may also affect A1 for CO.

**METHODS:** To test this hypothesis, 8 healthy subjects (24.8 ± 5.0 years) repeated 3 transitions of 5 min moderate (50 W) pedaling exercise in supine position, with 0 (control), -15, -30 and -45 mmHg of LBNP. The pulse pressure waveform of a left hand's finger was continuously recorded using Portapress device, allowing calculation of CO, SV and heart rate (HR) on a beat-by-beat basis using Modellflow method (Wesseling et al., 1993). After superimposition of the 3 transitions, kinetics of CO, SV and HR were fitted using bi-exponential model, and the amplitude of phase one (A1) amongst the 4 conditions was compared using repeated ANOVA (with Tukey post-hoc test).

**RESULTS:** A1 of SV was significantly increased from 7.5 ± 3.7 and 9.5 ± 3.8 to 16.7 ± 12.4 and 21.4 ± 7.9 ml, for 0 (control), -15, -30 and -45 mmHg of LBNP respectively. By contrast, A1 of HR was reduced (p = 0.05) with increasing LBNP level. As a consequence, A1 of CO exhibited only a trend (p = 0.06) to increase from 1.93 ± 0.79 to 2.42 ± 0.72, 3.01 ± 1.47 and 3.19 ± 0.82 l.min<sup>-1</sup>, for 0 (control), -15, -30 and -45 mmHg of LBNP respectively. The time constant of phase 1 was ranged between 1.5 and 3.5 s and remained unaffected by LBNP exposure for either SV, HR or CO.

**CONCLUSIONS:** The tested hypothesis was supported by the results in so far as A1 of SV was increased. However, this change did not translate into an equivalent change in CO, because of the concomitant reduction of A1 of HR, possibly due to a weaker vagal activity during LBNP exposure before exercise started. We conclude that the amplitude of the first phase of CO kinetics is indeed under dual control: neural and mechanical.

3328 Board #49 June 2 9:30 AM - 11:00 AM

**Gender Disparity In Cardiac AMPK Activation In Response to Exhaustive Exercise**

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(No relationships reported)

A single bout of exercise activates 5'-AMP-activated protein kinase (AMPK) in a graded fashion in both heart and skeletal muscle. In humans a gender difference in exercise-induced AMPK activation (P-AMPK) in vastus lateralis m. has been reported, with males showing a ~200% increase compared to a non-significant rise in females. Whether this gender difference in P-AMPK response to exercise also applies to the heart is unknown.

**PURPOSE:** To investigate whether this sex difference in AMPK activation to exercise also occurs in the heart, we measured left ventricular (LV) AMPK response to exhaustive exercise in both sedentary (SED) and trained (TR) male and female C57BL/6 mice.

**METHODS:** TR mice ran on a motorized treadmill at progressively increasing speeds up to 22m/min, 1hr/day, 6 days/wk for 12 wks. TR and SED mice of both genders were sacrificed immediately following exercise to the point of exhaustion and compared to SED resting controls. LV was rapidly excised, freeze-clamped, homogenized and AMPK activity measured by <sup>32</sup>P-ATP radioimmunoassay with S-Adenosyl methionine (SAMS) as substrate.

**RESULTS:** Irrespective of gender, trained mice demonstrated a relative cardiac hypertrophy (HW/BW) compared to sedentary mice (males 5.28 ± 0.20 vs. 4.30 ± 0.18 mg/g; females 4.97 ± 0.15 vs. 4.45 ± 0.14 mg/g; P < 0.001 and P < 0.05 respectively). Regardless of training status, male mice (n=19) demonstrated a ~3.5-fold higher AMPK response to the same level of exhaustive exercise compared to female mice (n=18) (0.117 ± 0.009 vs. 0.034 ± 0.003 nmols/mg/min; P < 0.001). Irrespective of gender, trained mice also exhibited higher AMPK activity (P < 0.05) compared to sedentary counterparts.

**CONCLUSION:** As AMPK is recognized as a fuel regulator in the heart under stressful conditions including ischemia, the sex- and training-induced differences in cardiac AMPK response to exhaustive exercise warrant further investigation.

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**3329** Board #50 June 2 9:30 AM - 11:00 AM

**Acute Sedentary Behavior and Markers of Cardiometabolic Risk: A Systematic Review of Intervention Studies**

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(No relationships reported)

**PURPOSE:** North Americans spend half their waking hours engaging in sedentary behavior. Although several recent interventions suggest that short bouts of uninterrupted sedentary behavior may result in acute increases in cardiometabolic risk, this literature has not been reviewed systematically. The purpose of the present study was to systematically review the impact of uninterrupted sedentary behavior lasting ≤7 days on markers of cardiometabolic risk (insulin sensitivity, glucose tolerance, and lipid levels) in humans.

**METHODS:** Interventions were identified through systematic searches of Medline and Embase, and screened by 2 independent reviewers

**RESULTS:** A total of 22 interventions were identified that examined the impact of imposed sedentary behaviour on biomarkers of interest. The majority of these studies focused on healthy young men, with very little identified research on females or other age groups. We found consistent, moderate quality evidence that uninterrupted sedentary behaviour ≤7 days results in moderate and deleterious changes in insulin sensitivity and plasma triglyceride levels, respectively. In contrast, there is inconsistent, very low quality evidence linking uninterrupted sedentary behaviour with changes in glucose tolerance, HDL or LDL Cholesterol.

**CONCLUSIONS:** These findings suggest that uninterrupted bouts of sedentary behaviour should be avoided in order to prevent or attenuate transient increases in metabolic risk.

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**3330** Board #51 June 2 9:30 AM - 11:00 AM

**Measurement of Leg Blood Flow During Exercise Using Strain Gauge Plethysmography: Effect of Venous Occlusion Pressure**

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(No relationships reported)

Venous occlusion strain gauge plethysmography (VOP) is well established as a non-invasive technique for the measurement of limb blood flow. While the susceptibility of the technique to movement artefact has limited its use primarily to the assessment of resting blood flow, VOP has recently been shown to compare favourably with Doppler ultrasound for the measurement of contraction-by-contraction blood flow during lower limb exercise. Before VOP can be recommended for use during exercise, the effect of venous occlusion on muscle performance needs to be determined. Furthermore, it is plausible that exercise in the upright position, which increases venous pressure in the lower limbs, would negate or minimise the need for venous occlusion, although this has not been tested.

**PURPOSE:** To compare the effect of standard (60 mmHg), low (30 mmHg) and no (0 mmHg) venous occlusion pressure on leg blood flow and muscle fatigue during intermittent isometric plantar flexion exercise.

**METHODS:** Eighteen male participants (age: 21 ± 2 y) attended three testing sessions, 7 days apart, and performed a 5-min intermittent isometric plantar flexion exercise test at a target force of 50% MVC, with one of three venous occlusion pressures (thigh cuff at 0, 30 or 60 mmHg) in a random order. Contraction-by-contraction blood flow data were fitted to a biexponential curve to determine the mean response time and magnitude of blood flow. MVCs were performed before and after each bout of exercise to determine the magnitude of fatigue.

**RESULTS:** Muscle fatigue, relative to pre-test MVC force, increased with increases in occlusion pressure (mean ± SD: 0mmHg = 9.86 ± 6.45; 30mmHg = 13.66 ± 6.04; 60mmHg = 13.41 ± 5.30%, p<.05). Blood flow mean response time was longer (0mmHg = 20.80 ± 7.49; 60mmHg = 23.46 ± 7.53 s; p<.05) and magnitude was higher (0mmHg = 53.04 ± 14.98; 60mmHg = 56.92 ± 12.90 ml/100ml/min; p<.05) at 60 mmHg compared with 0 mmHg, but was not different to the 30 mmHg condition.

**CONCLUSION:** The use of a standard venous occlusion pressure of 60 mmHg to measure lower limb blood flow during exercise has a negative effect on muscle fatigue. This effect may be minimised, without significantly influencing blood flow, by using an occlusion pressure of 30 mmHg.

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**3331** Board #52 June 2 9:30 AM - 11:00 AM

**Chronotropic and Perceptual Responses To Deep Water Running**

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(No relationships reported)

Deep Water Running (DWR) is gaining popularity as a means to maintaining and improving cardiorespiratory endurance in people for whom weight bearing aerobic exercise is contraindicated. However there is limited knowledge about the chronotropic and perceptual responses of the body to DWR.

**PURPOSE:** To compare the Heart Rate (HR) and Rating of Perceived Exertion (RPE) responses during Treadmill Running (TMR) and DWR and to investigate the relationship between HR and RPE in these environments

**METHODS:** 10 male recreational athletes aged between 18 and 30 years performed TMR and DWR on two different days at six incremental levels of speed (6,7,8,9,10 & 11 kmph).

Participants exercised for four minutes in each level and were given eight minutes recovery between levels. DWR was performed by immersing the individual till the neck level in an upright position using a floatation device. At the end of each level, HR and RPE were measured. HR was measured using a radio telemetric tester and RPE was measured using modified Borg's scale.

**RESULTS:** Paired t-test and Wilcoxon signed rank test was used to measure the difference in HR and RPE across environments in each level. HR was significantly lower in DWR than in TMR in all levels of speed except the first two levels of speed (p=0.29 & 0.24) and RPE was significantly higher in DWR at all levels of speed. The mean HR difference in the last four stages was 20 beats/min. Pearson product moment correlation was used to measure the relationship of the dependent variables. HR and RPE had a moderate correlation in TMR and DWR (0.670 and 0.580). Regression analysis was performed and an equation was derived to predict HR during DWR from RPE.

**CONCLUSIONS:** HR was found to be consistently lower and RPE was consistently higher in DWR than in TMR for a given workload. HR in DWR can be predicted through RPE with this equation (6.29 x RPE + 110.48)

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**3332** Board #53 June 2 9:30 AM - 11:00 AM

**The Effect Of Nicotine On Cardiorespiratory Responses And Energy Expenditure During Exercise**

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(No relationships reported)

**PURPOSE:** Recently, nicotine patches or chewing gums have been often prescribed for smokers to quit smoking. To date, studies have investigated the effect of nicotine on cardiorespiratory responses and energy expenditure during exercise to reveal any possible cautions to be taken when prescribing exercise. These studies however used a fixed low exercise intensity, so that the

effect of nicotine on cardiorespiratory responses and energy expenditure during varying exercise intensities, especially exhaustion remains to be investigated.

To examine the effects of transdermal nicotine patch on cardiorespiratory responses and energy expenditure during incremental pedaling exercise.

**METHODS:** Twelve healthy males aged 21-29 year-old performed an incremental step exercise on a cycle ergometer at a cadence of 60 rpm (initially 0.5 kp, increased by 0.5 kp until 4.0 kp every 4 min) on two occasions. Subjects were administered either a placebo (control) or 7 mg transdermal nicotine patch 10 hr before the exercise using a randomized-order cross-over method. The patch was attached on the left arm until the completion of the exercise. Heart rate (HR), the volume of oxygen consumption (VO<sub>2</sub>), energy expenditure (EE), respiratory exchange ratio (RER), rate of perceived exertion (RPE), and blood lactate (La) were measured at each exercise intensity. Data were analyzed using two-way repeated measures ANOVAs.

**RESULTS:** Four out of twelve subjects exhausted and terminated exercise at 3.5 kp for both placebo and nicotine conditions. RPE for the eight subjects who could pedal at 4.0 kp ranged between 15 and 18. VO<sub>2</sub>, EE, RER and La responses during the incremental exercise were similar between placebo and nicotine. Only HR was affected by nicotine (P = 0.005), and was higher for nicotine condition for all intensities investigated compared to control (mean difference=6.3%).

**CONCLUSIONS:** A 7 mg transdermal nicotine administration resulted in slightly higher HR compared to control. Therefore, the nicotine effect should be taken into consideration when estimating physical fitness level or determining exercise intensities using HR during exercise.

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3333 Board #54 June 2 9:30 AM - 11:00 AM

**Noninvasive Optical Quantification of Absolute Blood Flow and Oxygen Consumption Rate in Exercising Skeletal Muscle**

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(No relationships reported)

Many common diseases (peripheral vascular disease, fibromyalgia) affecting skeletal muscle involve moderate to severe impairments in circulatory and metabolic functions. A hybrid optical instrument combining near-infrared spectroscopy (NIRS) and diffuse correlation spectroscopy (DCS) has been developed to noninvasively monitor multiple tissue hemodynamic parameters. Using this hybrid instrument with a few simple physiological manipulations, we demonstrate, for the first time, a noninvasive optical method for obtaining the absolute measurements of blood flow, oxygenation, and oxygen consumption rate in exercising muscle.

**PURPOSE:** To noninvasively monitor absolute blood flow, oxygenation and oxygen consumption rate in skeletal muscle.

**METHODS:** DCS monitors relative blood flow (rBF) by measuring the speckle fluctuations caused by moving red blood cells, while NIRS measures tissue absorption and scattering to determine tissue blood oxygen saturation (StO<sub>2</sub>). Relative oxygen consumption rate (rVO<sub>2</sub>) is calculated by the Fick principle using the measured StO<sub>2</sub> and rBF. Absolute baseline blood flow (BF) and VO<sub>2</sub> were characterized in the forearm of 7 healthy subjects using venous and arterial occlusions, respectively. Both parameters were manipulated by 5 minutes of rhythmic isotonic handgrip exercise, while absolute values of BF and VO<sub>2</sub> during exercise were determined by multiplying rBF and r VO<sub>2</sub> with absolute baselines. Previous problems with muscle fiber motion artifact in optical measurements during exercise were mitigated in this study by using a gating algorithm to determine the contraction status of the muscle based on the position of the handgrip device.

**RESULTS:** Baseline BF and VO<sub>2</sub> values were 1.7 ± 0.5 ml/100ml/min and 3.6 ± 0.8 μmol O<sub>2</sub>/100ml/min, respectively. During exercise, values of BF and VO<sub>2</sub> increased to 9.8 ± 4.0 ml/100ml/min and 17.5 ± 5.2 μmol O<sub>2</sub>/100ml/min. These values are comparable to those found in the literature using other techniques (strain gauge, catheter).

**CONCLUSIONS:** Our results show that DCS/NIRS can noninvasively monitor absolute BF, StO<sub>2</sub>, and VO<sub>2</sub> in exercising muscle. The information provided by such measurements can be highly valuable in assessing the functionalities of the microcirculation and metabolism in regards to skeletal muscle disease.

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3334 Board #55 June 2 9:30 AM - 11:00 AM

**Accumulating Short Bouts Of Exercise Negates The Postprandial Impairment Of Endothelial Function In Adolescent Boys**

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(No relationships reported)

An impairment in endothelial function is considered a key factor in the development and progression of atherosclerosis. The ingestion of high-fat meals impairs endothelial function in adults, and continuous exercise has been shown to attenuate this impairment. No study has investigated if high-fat meals impair endothelial function in adolescents, but the young tend to exercise in short bouts, and the benefits of such patterns of exercise have yet to be established.

**PURPOSE:** To investigate the effects of accumulating short bouts of exercise on postprandial endothelial function in adolescent boys.

**METHODS:** Seven adolescent boys (mean ± SD, age 12.7 ± 0.5 years, weight 44.9 ± 9.4 kg, BMI 20.2 ± 2.8 kg·m<sup>-2</sup>) completed two, 2-day main trials (control and exercise) in a counterbalanced cross-over design. On day 1 participants were either inactive (control trial) or completed six 10-min bouts of running, with each bout interspersed with 50 min rest, at 70% peak oxygen uptake (exercise trial). On day 2 participants consumed a high-fat breakfast (0 h) and lunch (3.5 h). Endothelial function was assessed (as flow-mediated dilation (FMD)) in the fasting state and 3 h following each meal.

**RESULTS:** There was no difference in fasting FMD between the control and exercise trial (P = 0.250). In the control trial flow-mediated dilation was lower, compared to the fasting (F) measure, following breakfast (B) and lunch (L) (F vs. B: 8.2 ± 1.7 vs. 5.4 ± 1.7 %, P = 0.006; F vs. L: 8.2 ± 1.7 vs. 5.5 ± 1.4 %, P = 0.027). This represented a reduction in FMD, compared with fasting values, of 34% and 33% respectively. In the exercise trial flow-mediated dilation was not different, compared to the fasting measure, following breakfast and lunch (F vs. B: 8.8 ± 1.5 vs. 8.7 ± 2.0%, P = 1.000; 8.8 ± 1.5 vs. 8.0 ± 1.9%, P = 0.588).

**CONCLUSION:** The ingestion of high-fat meals impaired endothelial function in the seven boys studied, suggesting that the postprandial period is a time when even healthy adolescent boys may be susceptible to atherosclerotic development and progression. However, the impairment in endothelial function was attenuated when a series of short bouts of exercise were performed in the day preceding consumption of the meals.

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3335 Board #56 June 2 9:30 AM - 11:00 AM

**Comparison of Intra-arterial vs Manual Auscultation of Blood Pressure During Exercise in Healthy Humans**

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(No relationships reported)

**PURPOSE:** Blood pressure (BP) is a key measure of cardiovascular function. As such accurate measurement is important to ensure proper clinical evaluation, diagnosis, and treatment. We compared intra-arterial (Direct) vs. cuff auscultation (Manual) measurement techniques at rest and during multiple steady-state submaximal exercise intensities.

**METHODS:** Sixty-four adults (age=29±1, 52% female, ht=174±1 cm, wt=73±2 kg, BMI=24.1±0.4 kg/m<sup>2</sup>, BSA=1.87±0.03 m<sup>2</sup>) participated in the study. Blood pressure was measured directly via radial artery catheter and manually by brachial auscultation with sphygmomanometry at rest and during two levels of submaximal steady-state exercise (9 min at 40% and 75% max watts). Cardiac output was measured via open circuit acetylene uptake. Measures were taken in triplicate (1x every 3 min).

**RESULTS:** At rest, low and moderate intensity Direct measurement demonstrated a significant elevation in systolic (SBP) and diastolic (DBP) blood pressure (Bias for SBP: 22±13, 29±19 and 27±23 mmHg and DBP: 5±10, 5±12 and 17±15 mmHg; rest, low and moderate intensity respectively, p<0.001 for all). At rest, the correlation and agreement between the two methods was modest (SBP: r=0.56, bias=+22 mmHg; DBP: r=0.53, bias=+5 mmHg, p<0.001 for both). Although there was good correlation and agreement with SBP at low and moderate intensity, we noted the Manual method demonstrated a weaker relationship for DBP (SBP: r=0.74 and 0.74; bias=+30.2 and +26.8 mmHg; DBP: r=0.39 and 0.28; bias= +7.1 and +13.4 mmHg, for low and moderate intensity respectively, p<0.001). Further, Manual measurement demonstrated a greater slope for the relationship between pulse pressure and cardiac output (13.6±0.4 vs 12.3±0.4, p=0.03). These changes resulted in a narrowing of the difference in PP between techniques during moderate intensity.

**CONCLUSIONS:** Our results suggest that as exercise intensity increases Manual DBP tends to bias low compared to Direct DBP, which when combined with parallel increases in SBP, leads to no differences in pulse pressure between methods at moderate intensity exercise. Due to the use of PP in calculation of other cardiovascular parameters (MAP, SVR), the intensity of exercise is an important consideration when determining the most appropriate technique for measurement of BP.

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3336 Board #57 June 2 9:30 AM - 11:00 AM

**Effects Of Aerobic Cycle Exercise In The Evening On The Following Nocturnal Sleep And Its Hemodynamic Response**

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(No relationships reported)

**PURPOSE:** It is not well established as to whether the nocturnal sleep would be affected by the preceding exercise in daytime. While the exercise is known to elicit acutely a reduction in blood pressure (BP) for approximately 2-3 hours (i.e. post-exercise hypotension: PEH) even in healthy subjects, it is still unclear as to whether the PEH would be lasting until the bedtime of the following night. We, therefore, determined the effect of aerobic exercise in early evening on the quality/quantity of sleep and its hemodynamic response in the following night, not in laboratory, but in subject's own bedroom.

**METHODS:** 12 healthy young male subjects (age: 18-25 yr) participated first in preliminary protocol, in order to check whether he could accustom to equip the ambulatory BP recording device for one day from the early evening to the noon of next day and the special watch for continuous HR recording for bedtime, without exercise intervention. As a result, 10 of 12 subjects had no serious disturbance to usual daily life including the bedtime. Then 10 subjects performed two main protocols either with or without the cycle ergometer exercise (60 min at 50% HR reserve) in early evening (i.e. 1st day), in random order. The ambulatory monitoring of BP/HR (Holter type) and physical activity by accelerometer (AW-16 Actiwatch) were started from the late afternoon (i.e. 30 min before exercise) to the noon of next day (i.e. 2nd day). In addition, the special watch (NEM-T1 Toshiba) for identifying the sleep stage by HRV analysis was equipped, instead of the constraint EEG monitoring, during the bedtime. To avoid any effect induced by the food intake, the standardized contents of lunch and dinner of 1st day and breakfast of the 2nd day were offered.

**RESULTS:** There were no substantial differences in the objective indices of sleep between with and without preceding exercise. Compared to control (i.e. without exercise), the mean value of BP during nocturnal sleep showed a tendency to be lowered by the preceding exercise.

**CONCLUSIONS:** The aerobic exercise in early evening has no acute effect to the sleep itself, but some residual effect to the hemodynamic response during sleep, i.e. the prolonged PEH.

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3337 Board #58 June 2 9:30 AM - 11:00 AM

**Effect Of Altitude Of Residence On The Cardiovascular Responses To Dynamic And Isometric Hand-grip Exercise At 4900 Meters**

Andrew Grant, Marta Perez, John E. Davis. *Alma College, Alma, MI.*  
(No relationships reported)

Previous studies have documented the beneficial physiological adaptations to living at high altitude. However, few studies have examined exercise responses for residents from a variety of altitudes at very high altitude.

**PURPOSE:** To examine the influence of altitude of residence on cardiovascular responses during dynamic and isometric exercise when exposed to very high altitude.

**METHODS:** Thirty subjects voluntarily participated in the study after giving informed consent and completing the Lake Louise survey for acute mountain sickness. Subjects were recruited and tested at the Mount Chimborazo refugio in Ecuador located at 4900 meters. This is an optimal location because many Ecuadorians and tourists who reside at a variety of altitudes can easily drive to the refugio. All measurements were taken immediately upon arrival at the refugio. Subjects were divided into three groups based on their altitude of residence: low altitude - LOW (0-1500 m), moderate altitude - MOD (1500-3000 m), and high altitude - HIGH (>3000 m). A maximum voluntary contraction (MVC) using a hand-grip dynamometer was performed for each subject. Each subject then performed 30 contractions on the dynamometer at 50% MVC. Following the dynamic contractions, they performed an isometric contraction at 50% of MVC until they reached 25% of MVC. Heart rate, oxygen saturation, and systolic and diastolic blood pressure were measured before the exercise and during the dynamic and isometric exercise.

**RESULTS:** Average heart rates at rest and during both dynamic and isometric exercise were significantly higher in LOW (105±8.2, 112.7±9.5, 112±12.8 bpm) when compared to MOD (84.5±16.2, 91.7±12.6, 91.3±11.8) and HIGH (78.9±17.6, 80.0±10.3, 84.3±11.9). Also, average oxygen saturation was significantly lower at rest and during dynamic exercise in LOW (72.3±15.1, 71.4±10.3%) compared to MOD (78.7±5.5, 81.1±4.1) and HIGH (82.4±3.7, 85.0±3.9). Although changes were observed in systolic and diastolic blood pressure and oxygen saturation at rest and during dynamic and isometric exercise, these values were not statistically significant between groups (p>0.05).

**CONCLUSION:** Altitude of residence had an important influence on resting cardiovascular responses at very high altitude. However, the additive effect of exercise was similar in all three groups.

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3338 Board #59 June 2 9:30 AM - 11:00 AM

**Role of Free Radicals in the Regulation of Systemic Vascular Resistance in Chronic Heart Failure**

Melissa A.H. Witman<sup>1</sup>, John McDaniel<sup>2</sup>, Stephen J. Ives<sup>1</sup>, Anette S. Fjeldstad<sup>1</sup>, Jia Zhao<sup>1</sup>, Josef Stehlik<sup>1</sup>, D. Walter Wray<sup>1</sup>, Russell S. Richardson<sup>1</sup>. <sup>1</sup>University of Utah, Salt Lake City, UT. <sup>2</sup>Kent State University, Kent, OH.  
(No relationships reported)

**PURPOSE:** To better elucidate the link between free radicals and hemodynamic control in patients with chronic heart failure (CHF), we studied 10 patients and 10 age-matched healthy controls at rest and during handgrip exercise with either an acute oral antioxidant cocktail (AOC (Vitamin C, E, and  $\alpha$  lipoic acid)) or placebo (PL) in a balanced, cross-over design.

**METHODS:** To assess central and peripheral hemodynamics, mean arterial pressure (MAP), cardiac output (CO), systemic vascular resistance, brachial artery blood flow, and peripheral (arm) vascular resistance were determined.

**RESULTS:** Compared to controls, patients with CHF exhibited greater oxidative stress, measured by thiobarbituric acid reactive substances (TBARS) (~40%), and evidence of endogenous antioxidant compensation, measured by superoxide dismutase (SOD) activity (~45%). The AOC increased plasma ascorbate (~32%) in both the CHF patients and controls. The ingestion of the AOC had significant systemic hemodynamic effects which were only evident in the patients with CHF, both at rest and throughout exercise. Specifically, the AOC reduced MAP (~5%) and SVR (~12%) but increased CO (~10%). In contrast, peripherally, brachial artery blood flow tended to be reduced, and peripheral (arm) vascular resistance was unchanged in response to AOC consumption.

**CONCLUSIONS:** Based upon the recognized link between free radicals and sympathetic nerve activity in patients with CHF, these data imply that systemic vascular resistance in this population appears, at least in part, to be free radically-mediated, however, this finding does not appear to be the direct result of muscle-specific changes in peripheral vascular resistance.

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3339 Board #60 June 2 9:30 AM - 11:00 AM

**Exercise-induced Cardioprotection Is Triggered By Cytosolic, And Not Mitochondrial Reactive Oxygen Species**

Chad R. Frasier, Hetal D. Patel, Luke M. Stewart, David A. Brown. *East Carolina University, Greenville, NC.* (Sponsor: Peter A. Farrell, FACSM)  
(C.R. Frasier: Contracted Research - Including Principle Investigator; D.A. Brown.)

Exercise provides potent and sustainable cardioprotection that is unparalleled by any other preconditioning stimuli. Although the benefits of exercise are clear, the cellular factors responsible for triggering the protection are not understood. Previous reports in the literature have indicated that production of reactive oxygen species (ROS) during exercise may initiate a protective signaling cascade, but the intracellular site(s) of ROS production remain unclear.

**PURPOSE:** To determine if bursts of ROS during exercise promote a cardioprotective phenotype, and to ascertain the intracellular locus of ROS production.

**METHODS:** Female Sprague-Dawley rats were assigned into a sedentary handling control (Sed) or an exercise trained (Ex) group. Animals in the Ex group were placed on a treadmill for ten consecutive days for 15/30/15 meters per minute for 15/30/15 minutes. Approximately 10 minutes before exercise animals received an i.p. injection of the mitochondria-targeted antioxidant MTP-131 (1.5 mg/kg), the NADPH oxidase inhibitor apocynin (5 mg/kg), or saline. Twenty-four hours after the last session hearts were placed on the cannula of a Langendorff apparatus and exposed to 25 minutes of global ischemia followed by two hours of reperfusion.



**RESULTS:** As expected, Ex decreased infarct size ( $53 \pm 3$  and  $42 \pm 2\%$  for Sed and Ex respectively;  $P < 0.05$ ). Treatment of Sed animals with MTP-131 led to a significant decrease in the size of infarction ( $41 \pm 3\%$ ;  $P < 0.05$  vs. Ex saline). Apocynin abolished the cardioprotective effects of exercise ( $53 \pm 2\%$ ;  $P < 0.05$  vs. Sed saline).

**CONCLUSIONS:** By using both a mitochondria-targeted antioxidant and an inhibitor of NADPH oxidase we were able to determine that the locus of ROS production during exercise plays a vital role in cell signaling. Our results suggest that ROS generated through NADPH oxidase, and not within the mitochondria, are potent signaling molecules involved in exercise-induced cardioprotection. Future experiments that seek to investigate the signaling mechanisms downstream of ROS production by NADPH oxidase. This study was supported by American Heart Association Predoctoral Fellowship 11PRE7590086 and Stealth Peptides, Inc.

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**3340** Board #61 June 2 9:30 AM - 11:00 AM

**Hemoglobin A1c, Glycemia, Fitness And Associated Risk Factors In Older Adults**

Raul A. Martins, Ana M. Teixeira, Manuel T. Verissimo. *University of Coimbra, Coimbra, Portugal.*

(No relationships reported)

Epidemiological evidence suggests that glycosylated hemoglobin (HbA1c) is associated with cardiovascular risk. Age is associated with several risk factors as increased body fat, deterioration of the lipid profile, decrease of the cardiorespiratory fitness, or diabetes. Sex differences have been found on some variables associated with cardiovascular risk.

**PURPOSE:** To analyze the relationships between HbA1c and other cardiovascular risk factors in older women and men.

**METHODS:** Participated 72 women ( $77.5 \pm 8.4$  yrs) and 46 men ( $75.5 \pm 6.8$  yrs). Fasting venous blood was taken to determine HbA1c, glycemia, HDL-cholesterol, LDL-cholesterol, triglycerides, and high-sensitivity C-reactive protein (hs-CRP). Body weight, waist circumference, BMI, blood pressure, resting heart rate, peak heart rate, and functional fitness variables (peak  $VO_2$ , lower and upper strength, and velocity, agility and dynamic balance) were measured. Associations between variables were assessed with bivariate correlations and partial correlations. MANOVA was used to assess differences between women and men and between age stages.

**RESULTS:** According to the IDF (2005) cut-off points for waist circumference on European people, 85% of women ( $\geq 80$  cm) and 66% of men ( $\geq 94$  cm) exhibit central obesity. Obese ( $5.6 \pm 0.9\%$ ) had higher HbA1c ( $p < 0.05$ ) than non-obese ( $5.3 \pm 0.4\%$ ) participants. Women ( $5.6 \pm 0.8\%$ ) had similar HbA1c than men ( $5.4 \pm 0.7\%$ ). Older (80+ years-old) participants ( $5.6 \pm 0.7\%$ ) had similar HbA1c than younger (65-79 years-old) participants ( $5.5 \pm 0.8\%$ ). HbA1c correlated with glycemia ( $r = 0.607$ ;  $p < 0.01$ ), triglycerides ( $r = 0.493$ ;  $p < 0.01$ ), and BMI ( $r = 0.298$ ;  $p < 0.01$ ), independently of the age, and not correlated with HDL-C, LDL-C, body weight, waist circumference, and functional fitness.

**CONCLUSIONS:** HbA1c in older adults is not influenced by sex or by age. Regional distribution of obesity as measured by the waist circumference is not related with HbA1c. However BMI is positively associated. HbA1c does not associate with functional fitness, blood pressure or heart rate.

REFERENCES: IDF, 2005. <http://www.idf.org/home/index.cfm?unode=32EF2063-B966-468F-928C-A5682A4E3910>.

Grant: This work was supported by the FCT: PTDC/DES/111620/2009

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**3341** Board #62 June 2 9:30 AM - 11:00 AM

**Exercise-induced Ischemic Preconditioning: A Systematic Review And Meta-analysis**

Francois lalonde<sup>1</sup>, Paul Poirier<sup>2</sup>, Danis Arvais<sup>1</sup>, Daniel Curmier<sup>1</sup>. <sup>1</sup>Universite De Montreal, Montreal, QC, Canada. <sup>2</sup>Universite Laval, Quebec, QC, Canada.

(No relationships reported)

**PURPOSE:** Brief intervals of ischemic insult followed by reperfusion of an organ results in the ability to withstand subsequent prolonged periods of ischemia. This phenomenon is known as ischemic preconditioning (IPC) and contributes in delaying myocardial infarction, suppressing arrhythmias and improving post-ischemic functional recovery. A non-surgical way to induced ischemic preconditioning came from the warm-up phenomenon in patients with coronary artery disease (CAD). Warm-up phenomenon occurs when angina is induced by a first exercise which is attenuated by a short rest before resuming the same first exercise at the same or greater intensity. IPC induced by exercise can be demonstrated by a significant decrease of ECG signs of myocardial ischemia on the second of two exercise tests performed within a short interval.

**METHODS:** A literature search was performed in January 2011 using PubMed, Embase, CINAHL Plus with Full Text and Web of Science. The main key words limited to human studies were: ischemic preconditioning, warm-up phenomenon and exercise. Articles were reviewed by two readers and were selected for statistical analysis. The analysed parameters on ECG were: total stress test time, time to 1 mm (ST segment depression) STD, rate-product at 1 mm STD, maximal STD, maximal rate-product and recovery time.

**RESULTS:** The systematic review on electronic database resulted in 218 articles of which 32 of them (1 033 patients) fulfilled to selection criteria. Results of statistical analysis compared the first test (as the source of IPC) versus a second or third exercise test. Time to 1 mm STD was greater in subsequent test: Standard mean deviation (SMD) 0.77 (0.56-0.98),  $p < 0.0001$ ; rate-product at 1mm STD: SMD: 0.61 (0.36-0.86)  $p < 0.0001$ ; maximal STD: SMD -0.82 (-1.08- -0.56)  $p < 0.001$ ; recovery time: SMD -1.00 (-1.53- -0.48)  $p = 0.0002$ .

**CONCLUSIONS:** This is the first meta-analysis and systematic review showing that exercise-induced IPC have positives outcomes on ECG parameters. Result summary show that CAD patient can improve their exercise performance on a second stress test after a short period of rest. Further study are needed to assess the role of exercise-induced IPC in rehabilitation programs.

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**3342** Board #63 June 2 9:30 AM - 11:00 AM

**Physical Therapy Interventions In Patients With Heart Disease And Intercostal Pains. A Randomised Controlled Trial**

Astrid T. Berg<sup>1</sup>, Inger Lise Aamot<sup>1</sup>, Aud Hiller<sup>1</sup>, Stig Slordahl<sup>2</sup>. <sup>1</sup>St. Olavs Hospital, Trondheim, Norway. <sup>2</sup>Norwegian University of science and Technology, Trondheim, Norway.

(No relationships reported)

Studies shows that patients presenting chest pain is a common problem to general practitioners and accident- and emergency departements. The symptom creates anxiety that it represents a life-threatening event and numerous investigations often follow. Musculoskeletal causes are common, but frequently overlooked with estimations showing that 20 to 25% of non-cardiac chest pain has a musculoskeletal basis. No studies concerning treatment of chest pain from the intercostal muscles were found by search in various databasis.

**PURPOSE:** To evaluate the effect of two different physical therapy interventions in patients with known heart disease and intercostal pains.

**METHODS:** The study included 29 patients (mean age  $61 \pm 9.3$  years), 6 women and 23 men. The inclusion criteria were increasing chest pain during cardiac rehabilitation classes. Patients were randomised to either deep friction massage and heat-pack (A) or heat-pack only (B) and given a maximum of 8 individual treatments. Pain was evaluated by using Visual Analogue Scale (VAS) 0 to 100, where 0 is no pain and 100 intolerable pains. VAS score was registered at inclusion, post treatment and 3 months after the last treatment session and included 3 different scores: pain here and now (1), mean pain last 14 days (2) and worst pain attack last 14 days (3). In addition all patients received oral information regarding their pain condition.

**RESULTS:** Group A scored at baseline: (1) 45.5 (20-76), (2) 50 (26-81), (3) 60 (24-96). Group A scored at post treatment: (1) 6.5 (0-47), (2) 9.5 (0-46), (3) 14 (0-47). Group A scored at 3 months: (1) 10.5 (0-28), (2) 10 (0-28), (3) 10.5 (0-35).

Group B scored at baseline: (1) 40 (3-81), (2) 50 (5-80), (3) 65 (5-96).

Group B scored at post treatment: (1) 15 (1-71), (2) 15 (2-65), (3) 22 (0-90).

Group B scored at 3 months: (1) 5 (1-77), (2) 16 (0-82), (3) 26 (0-82). Both interventions gave statistically significant pain reduction from pre to post treatment, evaluated by VAS-scale. No statistic significance between the groups was obtained at any time. No adverse effect were recorded during treatment.

**CONCLUSIONS:** Both deep friction massage and heat-pack and heat-pack only, gave significant reduced pain. These physical therapy interventions gave promising results in treating intercostal pains and the findings may have important clinical implications.

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## G-31 Free Communication/Poster - Clinical Exercise Physiology (Clinical Exercise Physiology Association)

JUNE 2, 2012 7:30 AM - 11:00 AM  
ROOM: Exhibit Hall

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**3343** Board #64 June 2 8:00 AM - 9:30 AM

### Investigation Of C-reactive Protein And Leptin As Biomarkers Of Obesity With Potential Clinical Utility

Rachel A. Friedman<sup>1</sup>, Scott Lyons<sup>2</sup>, James Navalta<sup>2</sup>, Mark Schafer<sup>2</sup>, Scott Arnett<sup>2</sup>. <sup>1</sup>Washington University, St. Louis, MO. <sup>2</sup>Western Kentucky University, Bowling Green, KY.

(No relationships reported)

Obesity is a major health problem in the United States with life-threatening associated disease states. Obesity itself is considered a problematic condition due to the chronic effects it has on the body. Intense exercise also stresses the body, putting humans in recovery from exercise in a condition that may be analogous to a disease state.

**PURPOSE:** The purpose of this study was to examine biomarkers associated with obesity (CRP and Leptin) before and after continuous and intermittent bouts of exercise in an obese sample vs. a non-obese sample.

**METHODS:** The obese group's biomarkers at rest were compared to those of the non-obese group after exercise. Eighteen male subjects performed a VO<sub>2</sub> max test and a series of three Wingate tests in a cross-over study design. Blood was taken PRE, POST, and 1-HR POST.

**RESULTS:** During the VO<sub>2</sub> max test, the non-obese group's CRP levels decreased POST and returned to baseline 1-HR POST, while the obese group's CRP levels increased immediately after and returned to baseline after 1 hour (changes not significant). Significant differences were noted between groups PRE on the VO<sub>2</sub> max testing day with the obese group's resting levels at .94±.54 mg-dl<sup>-1</sup> and the healthy group's at .49 ±.27mg-dl<sup>-1</sup> and in Leptin levels on the Wingate test day with the obese group's at 18.68±13.29ng-ml<sup>-1</sup> and the non-obese group's at 5.39±4.24 ng-ml<sup>-1</sup>. On the Wingate test day, the CRP responses were the opposite of those on the VO<sub>2</sub> max day, with a significant change in CRP from POST to 1-HR POST in the obese group (1.18±.72 to .97±.60 mg-dl<sup>-1</sup>). Serum Leptin levels for both groups increased POST after both exercise modes and returned to baseline 1-HR POST (changes not significant). Non-obese participants were examined individually. Two of them demonstrated the possibility of being at-risk for obesity based on post exercise elevations in CRP and Leptin on at least 3 of the 4 conditions (CRP-VO<sub>2</sub>, CRP- Wingate, Leptin-VO<sub>2</sub>, and Leptin-Wingate) that caused the levels of the biomarkers to approach the obese group's at rest. Three additional subjects demonstrated two elevations and reported parental obesity. Therefore, five participants could potentially be "at-risk" based on the assumptions of the present study.

**CONCLUSION:** These results suggest CRP and Leptin could possess the ability to classify individuals in a "pre-obesity state."

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**3344** Board #65 June 2 8:00 AM - 9:30 AM

### Offloading and Vascular Responses to CLEAR Cleat Cycling by Individuals at Risk of Diabetic Foot Ulceration

Ryan T. Crews, Steven R. Smith, Shannon B. Liu. *Rosalind Franklin University, North Chicago, IL.*

(No relationships reported)

Exercise has been associated with improved wound healing. While diabetic foot ulcers (DFU) are exceptionally difficult to heal, the location of the wounds prohibit most types of exercise. The wounds typically develop in part due to the forces applied to the feet during weight bearing activities, and healing requires offloading of the wounds. The CLEAR Cleat was designed to allow individuals with forefoot DFU to be able to safely participate in aerobic exercise that utilizes the lower limbs.

**PURPOSE:** This study sought to determine whether cycling with the CLEAR Cleat offloaded the forefoot of individuals at high risk for DFU in comparison to cycling with standard pedals and athletic shoes. It also investigated whether the exercise improved blood flow to the forefoot.

**METHODS:** Ten subjects with diabetic peripheral neuropathy, with or without addition DFU risk factors, were recruited to participate (aged 52±9 y; BMI 33±5). Individuals were excluded if they had an active DFU. Each subject completed two 5-minute stationary cycling sessions at the same self-selected cadence and resistance level. Standard athletic shoes and pedals were used during one session, and the CLEAR Cleat was used with their highest risk foot during the other session. Plantar pressure data was collected during the cycling sessions by in shoe pedobarography. Perfusion levels (tpu - total perfusion units) were examined at the hallux by a surface laser Doppler probe, pre and post each cycling bout.

**RESULTS:** The CLEAR Cleat significantly (p<.05) offloaded the forefoot. The peak pressure (10.9±10.6 vs. 69.0±43.5 kPa) and pressure time integral (15.4±16.0 vs. 76.4±28.8 kPa\*S) were both reduced. The cycling significantly increased microcirculation at the hallux during both cycling conditions (pre 3.15±2.9 vs. post 6.8±6.3 tpu).

**CONCLUSIONS:** These results suggest that the CLEAR Cleat will allow individuals with DFU to exercise in a manner that will not be detrimental to their wounds. The increased vascularity in these high risk subjects indicates that the cycling may improve blood flow to forefoot DFU and therefore aid healing. Based upon these promising results, additional research to determine whether the CLEAR Cleat improves healing and/or general health of individuals with DFU is planned. Partially supported by NIH grant T35DK074390.

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**3345** Board #66 June 2 8:00 AM - 9:30 AM

### No Effect Of Kinesio Taping On Jump Performance In Female Track And Field Athletes

Thorsten Schiffer<sup>1</sup>, Anne Möllinger<sup>2</sup>, Billy Sperlich<sup>1</sup>, Daniel Memmert<sup>1</sup>. <sup>1</sup>German Sport University Cologne, Cologne, Germany. <sup>2</sup>University Heidelberg, Heidelberg, Germany.

(No relationships reported)

**PURPOSE:** Previous studies have indicated that kinesio taping (KT) alters muscle activation and proprioception in patients. Since muscle activation and proprioception are known to influence the jumping performance it was the aim of the study to test the hypothesis whether the application of KT enhances the jumping performance of healthy non-injured elite female track and field athletes.

**METHODS:** A double one-legged jump test was performed before and after application of KT and immediately after removal. Eighteen German female elite track and field athletes (age: 21 ± 2 years, active time in their sport: 13 ± 4 years, posture: 172 ± 4 cm, body mass 62 ± 5 kg) participated in the study.

**RESULTS:** The results revealed no significant differences in jumping performance between the tests (p>0.05, d=0.26).

**CONCLUSIONS:** These findings demonstrate that KT applied onto the muscles had no influence on the jumping performance in healthy non-injured female elite athletes.

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**3346** Board #67 June 2 8:00 AM - 9:30 AM

### A Comparison of Proprioceptive Neuromuscular Facilitation Techniques: Partner Assisted vs. Theraband® Stretch Strap Unassisted Modalities

Meaghan Maddigan, Ashley Peach, David Behm. *Memorial University of Newfoundland, St. John's, NL, Canada.*

(No relationships reported)

**PURPOSE:** Proprioceptive neuromuscular facilitation (PNF) stretching typically requires a stretching partner therefore it is not viable for a single individual. The use of a strap may allow individuals to integrate the contract and relax segments of the PNF technique alone. However, the effectiveness and benefits of a stretch strap for PNF stretching are unknown. **The purpose of this study was to compare and investigate the effects of the Thera-Band® Stretch Strap - unassisted PNF on hip joint range of motion (ROM), reaction time (RT) and movement time (MT).**

**METHODS:** Thirteen healthy and recreationally active adults, six male and seven female ranging from 19 to 33 years in age participated in this study. Participants were subjected to 5 different stretch interventions in a random order on separate days. The five different stretch conditions which were implemented were: 1) isometric, 2) concentric and 3) eccentric contractions - all using the Thera-Band® Stretch Strap for resistance and maximum ROM - and 4) partner isometric PNF which were all compared to 5) static stretching. RT, MT, dynamic, active, and passive hip flexion ROM were measured twice before and after the intervention and dynamic angular velocity was calculated during the dynamic stretch.

**RESULTS:** There was a positive main effect for time ( $p < 0.05$ ) with all the stretching conditions, increasing by 2.6%, 2.75% and 5.37% from pre- to post-intervention with dynamic, active and passive stretches respectively. There was a negative main effect for time ( $p < 0.05$ ) with dynamic angular velocity decreasing 9.2% from pre- ( $70.54 \pm 4.03$  degrees/sec) to post-intervention ( $64.01 \pm 3.55$  degrees/sec). As well there was a negative main effect ( $p < 0.05$ ) with regards to MT, pre- ( $0.47 \pm 0.027$  sec) and post-intervention ( $0.49 \pm 0.023$  sec). However, there were no significant differences found in the participants RT pre-post stretching and there was no interaction between the stretch conditions for any of the measures.

**CONCLUSION:** Theraband® Stretch Strap may be used as an alternative to assisted PNF protocols as it can provide similar increases in ROM.

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**3347** Board #68 June 2 8:00 AM - 9:30 AM

### The Relationship Between The Toe Exercises And The Medial Longitudinal Arch

Takashi Shiroshita<sup>1</sup>, Toru Fukubayashi<sup>2</sup>. <sup>1</sup>Gumma PAZ College, Gumma, Japan. <sup>2</sup>Waseda University, Saitama, Japan.

(No relationships reported)

**PURPOSE:** The toes play an important role, yet the toe flexor strength is poorly understood. We have been researching clinical and electromyogram (EMG) studies about the toe exercises we developed. However, the relationship between the toe exercises and the medial longitudinal arch (MLA) was unclear. The purpose of this study is to examine the relationship between the toe exercises and MLA.

**METHODS:** The subjects were 35 feet of 21 participants (11 males 17 feet, 10 females 18 feet), whose mean age was  $23.1 \pm 4.5$  years old. The participants performed three toe exercises and the towel gathering exercise. The three toe exercises were isotonic contractions (10 times) of the great toe flexor, 2nd-to-5th toe flexors and 3rd-to-5th toe flexors.

All subjects randomly performed the three toe exercises and the towel gathering exercise. Before and after each exercise, we assessed MLA using the navicular drop test (NDT) Brody developed.

This study was performed with the consent of the Ethics Committee for Human Research of Waseda University and Gumma Paz College.

For statistical analysis we performed Repeated ANOVA using IBM SPSS Statistics 19. Results were considered significant at values of  $p < 0.05$ .

**RESULTS:** NDT of before the training was 4.50 mm (within the range of the normal value). NDT of the towel gathering was 5.20mm, showing significant drop in comparison with before exercise. Also, in the great toe exercise, it was 5.39mm, showing a significant drop in comparison with before ( $p < 0.05$ ). In the 2nd-to-5th toe flexors and 3rd-to-5th toe flexors exercises, these were 3.16mm, 3.28mm respectively, those exercises showed significantly no drop in comparison with before ( $p < 0.05$ ).

**CONCLUSIONS:** The towel gathering and the great toe flexor exercise significantly decreased MLA. In regard to the great toe flexor exercise, the tendency was stronger. On the other hand, the exercises of 2nd-to-5th toe flexors and 3rd-to-5th toe flexors increased MLA.

This study has limits, as it was not possible to get rid of influence of fatigue. We consider that it is necessary to study the toe exercises we developed by longitudinal method research.

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**3348** Board #69 June 2 8:00 AM - 9:30 AM

### Electromyographic Analysis of the Lower Extremity Position during Trunk Exercise in Prone Position

Tetsuji Ishida<sup>1</sup>, Masanori Takemura<sup>2</sup>, Shunsuke Fujitake<sup>3</sup>, Chihiro Dehara<sup>4</sup>, Moonhwa Park<sup>5</sup>, Yu Hashiguchi<sup>5</sup>, Junzo Tsujita<sup>2</sup>. <sup>1</sup>Shiga Medical Center for Children, Moriyama, Japan. <sup>2</sup>Hyogo College of Medicine, Nishinomiya, Japan. <sup>3</sup>Tachiiri Orthopedics, Kyoto, Japan. <sup>4</sup>Gakkentoshi Hospital, Seika, Japan. <sup>5</sup>Graduate School of Medicine, Kyoto University, Kyoto, Japan.

(No relationships reported)

**PURPOSE:** To compare the electromyographic (EMG) activity of local and global muscles in lumborum at various hip positions of lower extremity during lower trunk muscles exercises in prone position.

**METHODS:** Fifteen healthy adults (10 males and 5 females, means (SD) age; 26.7 (4.3) years) participated in this study. Each subjects performed maximal voluntary isometric contractions (MVIC) of trunk extension, then they performed three exercises for back muscles in the prone position. Those three exercises were hip extension at hip abduction of 0 degree (EXT), hip extension at hip abduction of 20 degree and hip internal rotation (similar to PNF pattern, EXT-ABD-IR), and hip extension at hip abduction of 20 degree and hip external rotation (EXT-ABD-ER). Surface EMG was recorded from the muscle belly of longissimus thoracis (LT), iliocostalis lumborum (IC), lumbar multifidus (LM) and gluteus maximus (GM) muscles, and EMG root mean square (RMS) were calculated and normalized to MVIC (%MVIC). Furthermore, the LM : contralateral IC, LM : contralateral LT, LM : ipsilateral IC, and LM : ipsilateral LT ratio were calculated as the local : global muscles activity ratio. Statistical analysis were performed a 3-way analysis of variance (ANOVA) with exercises and muscles activity ration as within-subject variable and sex as between-subject variable and a Least Significant Difference (LSD) multiple comparison test.

**RESULTS:** The activity (%MVIC) of ipsilateral LM were 48.9 (26.8) at EXT, 52.2 (29.1) at EXT-ABD-IR, and 53.8 (26.2) at EXT-ABD-ER. The muscles activity ratio at EXT, EXT-ABD-IR, and EXT-ABD-ER were 1.32 (0.67), 1.51 (0.72), 1.40 (0.74) as LM : contralateral IC, 1.53 (0.98), 1.72 (1.06), 1.49 (1.16) as LM : contralateral LT, 1.56 (0.73), 1.55 (0.65), 1.68 (0.79) as LM : ipsilateral IC, and 1.64 (1.05), 1.61 (0.81), 1.85 (1.26) as LM : ipsilateral LT, respectively. The LM : contralateral IC and TL were significantly higher EXT-ABD-IR compare to EXT and EXT-ABD-ER. Although the LM : ipsilateral IC and TL were not difference.

**CONCLUSION:** The result of this study showed that the prone back muscles exercise with hip extension at hip abduction of 20 degree and hip internal rotation (similar to PNF diagonal and spiral functional pattern) was activated selectively the lumbar multifidus muscle as local muscles.

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**3349** Board #70 June 2 8:00 AM - 9:30 AM

### Precision Of The GE Lunar iDXA Densitometer for the measurement of Total Body Composition and Fat Distribution in Severely Obese Adults

Tamara E. Carver<sup>1</sup>, Nicolas V. Christou<sup>2</sup>, Ross E. Andersen, FACSM<sup>1</sup>. <sup>1</sup>McGill University, Montreal, QC, Canada. <sup>2</sup>McGill University Health Centre, Montreal, QC, Canada.

(No relationships reported)

Bariatric surgery is the most effective treatment for severe obesity. Rapid weight loss leads to changes in lean tissue mass, fat mass, and bone mass. No study has evaluated the precision of the GE Lunar iDXA™ (GE Healthcare, USA) in measuring body composition among severely obese patients.

**PURPOSE:** To evaluate the precision of the iDXA for total body composition and fat distribution measurements.

**METHODS:** 36 severely obese participants with a mean age of  $45 \pm 10$  yrs, BMI of  $48.3 \pm 10.5$  kg/m<sup>2</sup>, and mean body mass of  $136.4 \pm 20.4$  kg took part in the study. Two consecutive iDXA scans of the total body with repositioning were conducted for each participant. The coefficient of variation (CV), the root-mean-square (RMS) averages of standard deviations of repeated measurements, and the corresponding 95% least significant change (LSC) were calculated.

**RESULTS:** Precision was excellent for all measurements particularly for total body percentage fat (%TBF), fat free mass (FFM), total fat mass (TBF), total body lean mass (TBL), and bone mineral content (BMC) (RMS 0.407%, 0.690 kg, 0.706kg, 0.693kg, 0.035kg; CV 0.79%, 0.97%, 1.00%, 1.02%, and 1.12% respectively). Precision was better for gynoid fat distribution (%FG) (RMS 0.627kg; CV 1.30%) than for android fat distribution (%AF) (RMS 1.096 kg; CV 1.86%).

**CONCLUSIONS:** The Lunar iDXA provided excellent precision for total body composition measurements and is the first study to assess reproducibility of the GE Lunar iDXA in severely obese adults.

| Precision of the GE Lunar iDXA Densitometer for the Measurement of Total Body Composition |       |        |              |        |
|---|-------|--------|--------------|--------|
|   |       |        | LSC (95% CI) |        |
|   | RMS   | CV (%) | RMS          | CV (%) |
| BMC   | 0.035 | 1.12   | 0.096        | 3.11   |
| %TBF  | 0.407 | 0.79   | 1.128        | 2.19   |
| FFM   | 0.690 | 0.97   | 1.910        | 2.68   |
| TBF   | 0.706 | 1.00   | 1.956        | 2.76   |
| TBL   | 0.693 | 1.02   | 1.921        | 2.83   |
| %AF   | 1.096 | 1.86   | 3.037        | 5.15   |
| %GF   | 0.627 | 1.30   | 1.736        | 3.59   |

**3350 Board #71 June 2 8:00 AM - 9:30 AM**

**Electromyographic Analysis of the Upper Limb Position during Trunk Exercise in Prone Position**

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(No relationships reported)

**PURPOSE:** To compare the EMG activity of local and global muscles in lumborum and thoracic at various positions of upper-limb during back muscles exercises in prone position.

**METHODS:** Fifteen healthy adult (10 males and 5 females, means (SD) age; 26.7 (4.3) years) performed back muscles exercises in prone position with the depression and retraction in the right scapulothoracic joint and raising upper-limb at three different upper-limb starting positions (0 degree, 160 degree (similar to PNF) and 180 degree of abduction). Surface EMG analysis of the muscle activity of the thoracic part of the longissimus thoracis (LT), iliocostalis lumborum (IC), lumbar multifidus (LM) and latissimus dorsi (LD) were measured. For each of the muscles root mean square (RMS) was calculated and was normalized to the amplitude in maximal voluntary contraction (%MVC). Statistical analysis was performed using ANOVA and multiple comparisons.

**RESULT:** Left LM, LT and IC were activated significantly at 180 degree compared to 0 degree of abduction and left LT and IC were activated significantly at 180 degree compared to 160 degree of abduction [%MVC (SD) of 0.160 and 180 degree of abduction: left LM; 43.4 (29.2), 44.9 (18.9), 33.1 (13.6), left LT; 28.1 (9.3), 31.0 (8.6), 36.1 (11.6), left IC; 27.3 (12.6), 29.3 (12.5) 33.1 (13.6)]. Right LD were activated significantly at 0 degree compared to 180 degree and 160 degree of abduction [%MVC (SD) of 0.160 and 180 degree of abduction: right LD; 191.0 (83.8), 136.7 (74.6), 112.5 (57.5)].

**CONCLUSION:** The present study suggested that both LM, local muscles, and LT and IC, the global muscles were activated significantly at 180 degree compared to 0 degree of abduction. It was suggested that the LM could not activate selectively by different positions of upper-limb during back muscles exercises in prone position in this study. To increase the LM activity, therapists should increase trunk extension loads of the exercise in clinical practice. Also, the increase of the LM activity was not affected by facilitative effect of the increased LD activity. It is suggested that the EMG activity in local and global muscles of lumborum and thoracic at various positions of upper-limb during back muscles exercises in prone position for LBP should be analyzed, because of previous studies showed the lower activity of LM.

**3351 Board #72 June 2 8:00 AM - 9:30 AM**

**Association Of Adiposity And Muscle Quality With Physical Function Differs In Young And Old Women**

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(No relationships reported)

Whole body adiposity (%Fat) and leg muscle quality (MQ), defined as strength per mineral free lean mass (MFLM), both have been shown to impact lower extremity physical function (LEPF) in older women. However, the muscle strength measurement (isometric, isokinetic, fatigue) may impact MQ and its subsequent relation to LEPF. Moreover, the %Fat and MQ associations with LEPF may differ in young and old women.

**PURPOSE:** The aims of this study were to investigate if age impacts: 1) the relation between %Fat, MQ and LEPF, and 2) if different muscle strength indices used to calculate MQ impact the association between MQ and LEPF.

**METHODS:** Younger (YOUNG: 20-30 yrs, n = 37) and Older (OLD: 64-80 yrs, n = 39) women were assessed for %Fat and upper leg MFLM via DXA. Strength assessments, leg extensions performed on an isokinetic dynamometer, included: a) maximal isometric (IM), b) isokinetic [at 60 deg/sec (IK60) and 180 deg/sec (IK180)] and c) a 25 repetition fatigue protocol (FTG) at 180 deg/sec. MQ-IM, MQ-IK60, MQ-IK180, and MQ-FTG were calculated as Nm/MFLM(kg). LEPF was determined by an up and go (UPGO) challenge.

**RESULTS:** As expected, YOUNG had lower %Fat, more leg MFLM, greater MQ, and faster UPGO time, compared to OLD (all p < 0.05). In YOUNG, although MFLM was associated with UPGO (r = -0.44, p = 0.007), no measures of MQ were related to UPGO (all p > 0.05). Conversely in OLD, MFLM was not related to UPGO (p > 0.05) while MQ-IK60, MQ-IK180, and MQ-FTG were negatively associated with UPGO (MQ-IK60; r = -0.36, MQ-IK180; r = -0.37, and MQ-FTG; r = -0.40 (all p < 0.05). %Fat was not related to UPGO in YOUNG; however, higher %Fat was associated with slower UPGO times in OLD (r = 0.32, p = 0.048).

**CONCLUSION:** Younger women's physical function is most dependent on the lean mass of the leg and not MQ or adiposity, whereas the physical function of older women is impacted on the quality of the muscle and adiposity, which may be in part related to muscle activation and/or fat infiltration into the muscle.

**3352 Board #73 June 2 8:00 AM - 9:30 AM**

**Exercise, Support, And Education Enable Hispanic Parents And Children To Combat The Effects Of Obesity**

Susan Shore, Kathryn Ecklund, Zachary McGill, Eles Altamirano, Jennifer Blair, Falcicy Bowman, Brigitte Dubon, Patricia Huesca, Natasha Kane, Katherine Skorupa, Giselle Kurywachak, Kerry Lane, Johanna Szin. *Azusa Pacific University, Azusa, CA.*  
(No relationships reported)

**PURPOSE:** The incidence of childhood obesity has reached unprecedented proportions, with rates in the Hispanic population being especially high. There is a link between obesity and cardiovascular disease risk factors including hyperlipidemia, diabetes, and hypertension. Exercise is known to have a moderating effect on these risk factors. The purpose of this study was to evaluate the effect of multidimensional intervention on the incidence of obesity and associated risk factors in a population of Hispanic mothers and children.

**METHODS:** Thirteen Hispanic mothers (average age 36.8 + 5.2 years) and their 14 children (average age 9.8 + 1.1 years) volunteered to participate in a twice weekly after school program of exercise, group support, and education in a Los Angeles area elementary school. At baseline and following 10 weeks of intervention, the following data was taken: resting heart rate and blood pressure, height, weight, body fat measurements (using ultrasound), blood cholesterol, sugar, and CReactive Protein (from finger stick blood draws), Behavioral Assessment Scale for Children, Personality Inventory for Youth, and the Parent Child Relationship Inventory. Parents completed a 2 day diet log, and distance was measured for both parents and children during a 12 minute walk/run. Individualized results were reported to parents and children during educational sessions.

**RESULTS:** At baseline, 84.6% of mothers and 78.6% of children were overweight or obese. After intervention, changes were as follows: Despite no significant changes in BMI, percent body fat, or psychosocial variables, mothers' total cholesterol dropped an average of 9.92 points (p<0.039), and blood glucose dropped 11.92 points (p<0.007). Systolic blood pressure decreased

from 131.08 to 117.67, ( $p < 0.001$ ). Average distance walked in 12 minutes increased by 21.97% ( $p < 0.009$ ). In children, there were no significant changes in blood work; however, systolic blood pressure dropped an average of 6.63 mm Hg ( $p < 0.039$ ). Average distance run in 12 minutes increased by 13.27% ( $p < 0.0001$ ).

**CONCLUSION:** A twice weekly program of exercise, group support, and education for Hispanic mothers and their children was associated with positive changes in some cardiovascular risk factors associated with obesity.

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**3353 Board #74 June 2 8:00 AM - 9:30 AM**  
**Comparison Of Handheld Device And Electromechanical Dynamometer For Measuring Plantarflexion Force**

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(No relationships reported)

Measurements of muscle force are a standard component of clinical examinations. Handheld devices (HH) provide quick and reliable measure of muscle force; however the amount of resistance provided by the clinician may influence the reading. Electromechanical dynamometers (ED) allow better experimental control and provide more accurate measurements of force, but are expensive and are difficult to set up.

**PURPOSE:** to assess the concurrent validity of measuring plantarflexion force (PFF) with a HH using the ED measurements as a gold standard.

**METHODS:** Five healthy subjects (2M/3F,  $25 \pm 4$  yr age,  $1.72 \pm 0.12$  m,  $68.5 \pm 12.9$  kg) were recruited for the study. PFF of the right limb was assessed with an ED and a HH by the same experienced clinician. During testing, subjects lay supine, with the ankles flexed to  $90^\circ$ . Subjects were asked to push as hard as possible; for the ED testing, the ED arm was fixed and for the HH testing, the device was held on the ball of the foot by the clinician. Lever arm was constant between conditions. For each device, three trials were collected and one minute rest was given between trials. The order of testing was randomized. The peak value from each trial was averaged and compared between devices using an interclass correlation coefficient (ICC). Pearson Product Moment correlations were calculated between conditions and between PFF from each device and body mass.

**RESULTS:** Peak PFF ICC was  $-0.191$  ( $p = .641$ ). PFF from HH and ED were not significantly correlated ( $r = -0.271$ ,  $p = .659$ ). Body mass was significantly correlated with ED force measures, but not with HH measures (Figure 1).

**CONCLUSION:** The lack of a relation between HH measurements of PFF to the gold standard or body mass suggests that HH does not provide valid and accurate measures of PFF.

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**3354 Board #75 June 2 8:00 AM - 9:30 AM**  
**Neuromuscular Responses to Acute Whole Body Vibration**

Caroline J. Ketcham, Paul C. Miller, George Wentz, Andrea Gross, Kelly Brand, Paul Riuli. *Elon University, Elon, NC.* (Sponsor: Eric E. Hall, FACSM)  
(No relationships reported)

Whole body vibration (WBV) has shown to positively impact neuromuscular activity. Studies have shown significant improvements in muscular strength and power following acute bouts of WBV in trained participants (Cochrane et al., 2009; Cochrane et al., 2008; Stewart et al., 2009). Less is understood about the exact mechanisms for these changes in strength and power.

**PURPOSE:** The purpose of this research is to explore the neuromuscular mechanisms underlying changes in contractile function following an acute bout of WBV. It was hypothesized that WBV may alter neuromuscular activation resulting in changes to anaerobic power production.

**METHODS:** Twelve non-resistance trained male and female completed this study ( $20.6 \pm 0.9$  yrs). The experimental protocol required three days of testing for each participant. Day one was a familiarization trial. On days two and three, participants were randomly assigned to either no vibration or WBV condition. Participants then completed a 6-stage cycle ergometer anaerobic power test. EMG was recorded during each stage.

**RESULTS:** There was a significant condition effect for EMG activity with lower EMG activity during the cycling task following the WBV condition ( $p < .05$ ). These were not related to differences in power production between the conditions ( $p > .05$ ).

**CONCLUSIONS:** These results support the hypothesis that WBV does impact muscle function. Specifically, lower muscle activity followed WBV while maintaining the same level of power output suggesting improved muscular efficiency.

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**3355 Board #76 June 2 8:00 AM - 9:30 AM**  
**Cardiovascular And Metabolic Responses To Exercising With The Glidetrak Compared To Running**

Aaron W. Johnson, Pat Vehrs, FACSM, James George, Gil Felingham, Jordan Perry. *Brigham Young University, Provo, UT.*  
(No relationships reported)

**PURPOSE:** To evaluate the cardiovascular and metabolic responses of treadmill exercise using the GlideTrak (GT) device as compared with unassisted treadmill (UT) exercise. Previous research indicates that the GT reduces ground reaction forces by 85%; thus, one would expect the exercise intensity to be less when using this device. Because the GT may provide a viable form of exercise for those who cannot otherwise exercise independently (due to amputation, obesity, injury, or arthritic joints) we sought to understand the exercise response of this device.

**METHODS:** Participants were 20 healthy untrained individuals (male: 11, female: 9) with an average age of  $22 \pm 2.1$  years, height of  $1.71 \pm .13$  m, and body mass of  $72.4 \pm 14$  kg. For both GT exercise and UT exercise, a submaximal exercise test protocol was completed, which included a series of 3-minute stages: walking at a natural pace, walking at a self-selected brisk walking pace, walking at a brisk pace with a 2% grade, and jogging at a self-selected speed. Following 3 minutes of jogging, the incline of the treadmill was increased by 2% each stage until the participant reached an RER of 1.0 or 90% of the age-predicted maximal HR. Steady-state VO<sub>2</sub> and HR were recorded during each stage. After a 10-15 minute rest, the participant completed a graded maximal exercise test to determine VO<sub>2</sub>max. After a 3 minute warm-up period, participants jogged at a self-selected speed. Every minute thereafter we increased the incline by 1.5% until VO<sub>2</sub>max was achieved. In the GT condition we increased the incline 2% and the speed by 1 mph until VO<sub>2</sub>max was achieved.

**RESULTS:** We examined the HR/VO<sub>2</sub> relationship in both modes of exercise. There was an overall gender effect between genders across both modes of exercise. There was a statistical difference between exercise modes ( $p < .05$ ) in VO<sub>2</sub>max (GT:  $38.1 \pm 7.0$ , UT:  $49.0 \pm 9.0$ ), HRmax (GT:  $183.5 \pm 9.0$ , UT:  $194.3 \pm 9.0$ ), RPE (GT:  $17.9 \pm 1.9$ , UT:  $19.4 \pm 0.6$ ), and in MPHmax (GT:  $6.9 \pm 2.2$ , UT:  $5.8 \pm 0.7$ ), but not in RER (GT:  $1.1 \pm 0.05$ , UT:  $1.1 \pm 0.04$ ).

**CONCLUSIONS:** The GT allows for appropriate cardiovascular training, but compared with UT exercise the VO<sub>2</sub> response is about 15-20% lower at any given exercise HR. To experience a similar cardiovascular training effect, those who use the GT device should work at a higher relative percentage of HRmax while maintaining a comparable RPE response.

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**3356 Board #77 June 2 8:00 AM - 9:30 AM**  
**Association Between Physical Activity Levels And Chronic Disease Risk In Early Postpartum.**

Melanie Bonin<sup>1</sup>, Yaiza Cordero-Rodriguez<sup>2</sup>, Stephanie-May Ruchat<sup>1</sup>, Ashley Smith<sup>1</sup>, Michelle F. Mottola, FACSM<sup>1</sup>. <sup>1</sup>Univ. of Western Ontario, London, ON, Canada. <sup>2</sup>Universidad Politecnica de Madrid, Madrid, Spain.  
(No relationships reported)

The early postpartum period is a critical time period for women to return to being physically active in order to reduce weight retention from pregnancy. Weight retention, body mass index (BMI), waist circumference and waist:hip ratios may be important predictors of future chronic disease risk.

**PURPOSE:** To examine daily physical activity levels and cardiovascular disease risk factors in women at two months postpartum (6 normal weight (NW); BMI=18.5-24.9kg/m<sup>2</sup>, 18 overweight (OW); 25-29.9kg/m<sup>2</sup> and 16 obese (OB);  $\geq 30$ kg/m<sup>2</sup>).

**METHODS:** Physical activity was assessed at 2 months postpartum using an accelerometer and a pedometer worn simultaneously fixed on a belt for an average of 5 days. The 3 BMI groups were compared for chronic disease risks and physical activity levels using ANOVA.

**RESULTS:** At 2 months postpartum, NW, OW and OB women presented similar ( $p > 0.05$ ) waist:hip ratios, all greater than 0.85, and similar weight retention, all greater than 3.0 kg. NW women had a waist circumference  $< 88$  cm, however, NW and OW women had a lower waist circumference than OB women ( $84.3 \pm 11.2$  cm,  $91.7 \pm 5.2$  cm and  $109.0 \pm 13.3$  cm, respectively,

p<0.05). NW and OW reported higher pedometer daily step counts than OB women (NW: 8784±2927 steps/day, OW: 8219±1981 steps/day, OB: 6134±1843 steps/day; p<0.05). Uploaded accelerometer daily step counts were higher in OW (9364±2299 steps/day) but not in NW (8234±3701 steps/day), compared to OB women (6572±2777 steps/day, p<0.05). Comparing pedometer (self-reported) and accelerometer step counts, the pedometer significantly underestimated daily step counts in OW women (-1145 ±2194, p=0.02).

**CONCLUSIONS:** Women at 2 months post-delivery, irrespective of their BMI, are at risk for long-term chronic disease and are not meeting the step recommendations of 10,000 steps per day. OB women presented the highest risk for chronic disease and were classified in the low active category, indicating that the promotion of an early healthy postpartum lifestyle is particularly important in OB women. The difference found in step counts obtained from a pedometer compared to an accelerometer in OW women needs to be further examined.

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**3357** Board #78 June 2 8:00 AM - 9:30 AM

**Physiological and Psychological Responses to a Longitudinal Rehabilitation Program**

Jessica M. Brown<sup>1</sup>, Trent L. Lalonde<sup>1</sup>, Kurt Dallow, FACSM<sup>2</sup>, Reid Hayward<sup>1</sup>, Carole M. Schneider, FACSM<sup>1</sup>. <sup>1</sup>Rocky Mtn Cancer Rehab, Univ Northern Colorado, Greeley, CO. <sup>2</sup>North Colorado Family Medicine, Greeley, CO.

(No relationships reported)

Physiological and psychological improvements have been well noted in cancer survivors after an exercise intervention. To date, little research has been done on the effects of a long-term exercise training program.

**PURPOSE:** To assess the physiological and psychological responses to exercise training in cancer survivors over a 21 month exercise intervention.

**METHODS:** Thirty-four cancer survivors, including 9 males and 24 females, participated in a cancer rehabilitation program consisting of 60 minute exercise training sessions, three days per week for 21 months. Each session included cardiovascular, muscular strength, muscular endurance, flexibility, and balance training. Physiological and psychological assessments which examined cardiorespiratory fitness, muscular endurance, depression, fatigue, and quality of life were conducted at the onset of the program (INTL), at three months (1ST), and every six months until four reassessments were completed (2ND, 3RD, and 4TH, respectively.)

**RESULTS:** Significant improvements were observed in all measures (p<0.05), except muscular endurance. Cardiovascular endurance improved 12.1% (p=.002) at onset (INTL to 1ST) and although additional improvement occurred, it was not significant. Likewise, total fatigue decreased -33.9% (p<.0001) from INTL to 1ST while subsequent improvements were not significant. Depression was shown to decrease -17.9% (p=.043) and -17.6% (p=.025) from INTL to 1ST and 3RD to 4TH, respectively. Although the main effects for muscular endurance yielded no significance, pairwise comparisons revealed a 32.9% improvement from INT to 1ST (p=0.011). Total quality of life did not improve at onset, but a significant 10.1% increase (p=.006) occurred from 2ND to 3RD reassessments.

**CONCLUSION:** A 21 month full-body exercise program has been shown to elicit improvements in physiological and psychological measures in cancer survivors. The greatest improvements occur during the first three months of training then plateau. This suggests that a 3-month exercise intervention is sufficient to return cancer survivors to normal functional capacity.

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**3358** Board #79 June 2 8:00 AM - 9:30 AM

**Forearm Deoxygenation Measured By Nirs During A New Handgrip Exercise Protocol In Patients With Mitochondrial Myopathy**

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(No relationships reported)

Mitochondrial myopathy (MM) is a multisystemic disorder and contains a very large spectrum of different diseases providing a large scale of symptoms. The golden standard for diagnosis remains muscle biopsy with histochemical analysis. The validity and reliability of near infrared spectroscopy (NIRS) as an appropriate technique to measure non invasively tissue oxygenation was well established on muscle tissue at rest and during exercise.

**PURPOSE:** We propose a new handgrip exercise protocol using NIRS for relative evaluation of microvascular oxygen extraction in a MM population. The reliability of this protocol has been established in a previous study.

**METHODS:** Two groups of subjects were studied: 12 patients with severe MM and 12 age- and gender matched untrained controls. The patient's and control subject's age, height and body weight were respectively (mean values ± SE) 30.42 ± 13.28 and 30.83 ± 13.06 years, 166.6 ± 11.25 cm and 177.38 ± 9.56 cm, 62.34 ± 15.74 kg and 78.24 ± 16.45 kg. The protocol started with an arterial occlusion of the forearm until a steady state in deoxy[Hb+Mb] was reached. The handgrip exercise protocol until exhaustion consisted of 2-min periods (½ Hz) at different intensities (% MVC) separated by a 60-s rest period. The changes in deoxy[Hb+Mb] during each work step (i.e., the mean of the maximum 10-s) were expressed relative to this amplitude.

**RESULTS:** Significant differences were found between patients and control subjects for every submaximal and maximal intensity. The percentual deoxy[Hb+Mb] (mean values ± SE) at 20% (p=0.019), 30% (p<0.001), 40% (p<0.001), 50% (p=0.002) and 60%MVC (p<0.001) for patients were respectively 9.45 ± 6.70%, 13.52 ± 6.70%, 12.73 ± 8.75%, 20.47 ± 12.24%, 17.94 ± 8.06% and for control subjects respectively 21.17 ± 16.29%, 34.04 ± 15.93%, 39.81 ± 19.03%, 49.65 ± 25.2% and 62.4 ± 21.14%. The percentual maximal deoxy[Hb+Mb] (p<0.001) (mean values ± SE) was respectively for patients 24.96 ± 8.47% and for controls 72.82 ± 23.56%.

**CONCLUSION:** Microvascular O<sub>2</sub>-extraction is significantly lower in a MM population during this protocol, which can be used as an evaluation tool of the muscle oxidative capacity for the MM patients.

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**3359** Board #80 June 2 8:00 AM - 9:30 AM

**Individual Training Response In Allogeneic Stem Cell Transplant Patients Depending On Baseline Fitness Level**

Joachim Wiskemann<sup>1</sup>, Dirk Jaeger<sup>1</sup>, Cornelia M. Ulrich<sup>1</sup>, Gerhard Huber<sup>2</sup>, Peter Dreger<sup>3</sup>, Rainer Schwerdtfeger<sup>4</sup>, Martin Bohus<sup>5</sup>. <sup>1</sup>National Center for Tumor Diseases, Heidelberg, Germany. <sup>2</sup>University Heidelberg, Heidelberg, Germany. <sup>3</sup>University Clinic Heidelberg, Heidelberg, Germany. <sup>4</sup>German Clinic for Diagnostic, Wiesbaden, Germany. <sup>5</sup>Central Institute of Mental Health, Mannheim, Germany.

(No relationships reported)

Before, during and after allogeneic stem cell transplantation (allo-HSCT) patients experience considerable physical, psychological and psychosocial distress. Besides GvHD and infections, particularly reduced physical performance and functioning as well as high levels of fatigue affect patient's quality of life negatively. Physical exercise therapy constitutes a potentially promising intervention to reduce treatment-related side effects of allo-HSCT and consequently enhance the rehabilitation process.

**PURPOSE:** To determine the individual training response of allo-HSCT patients depending on their baseline fitness level.

**METHODS:** In a multicenter RCT105 patients were equally randomized to an exercise (EX) and a social contact group (Control). Exercisers trained in a home-based setting prior to hospital admission, during inpatient treatment and 6-8 weeks period after discharge (partly self-administered with an intervention manual and DVD). Physical performance was assessed via 6-minute walk test (6MWT) and handheld dynamometry (HHD). In order to analyze individual training response patients in the EX were categorized as "fit" (>80% of their predicted fitness scores) or "unfit" (<80% of their predicted fitness scores).

**RESULTS:** Regarding maximal voluntary isometric strength in knee extensor muscles patients in the "unfit" group declined about 6,4% over the whole study period whereas the "fit" group loses 30,8% in average (p<0.05). Comparable results could be reported for all other measured muscle groups. Also the 6MWT distance showed a significant better development for the "unfit" vs. the "fit" group (+13,4% vs. -3,7%, p<0.05). Furthermore, a better development in physical performance was significantly associated with less treatment-related side effects (e.g. cancer-related fatigue, p<0.05).

**CONCLUSION:** The effect of exercise training on physical fitness in allo-HSCT patients is related to their performance level at baseline. Oncologists and exercise therapists should be aware of the importance of exercise in initial unfit patients during allo-HSCT and communicate/interpret a potential fitness loss in initial fit patients in the right way.

Supported by German José Carreras Leukaemia Foundation (R05/33p)

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3360 Board #81 June 2 8:00 AM - 9:30 AM

**Whole Body Vibration Compared To Biking On The Warm-up Effect Of The Lower Extremity**

Kevin Myers, Cameron Shumway, J. Brent Feland, A. Wayne Johnson, Kent Crossley, Dennis L. Eggett. *Brigham Young University, Provo, UT.* (Sponsor: J. Ty Hopkins, FACSM)  
(No relationships reported)

Use of whole body vibration training (WBV) platforms is becoming increasingly popular. With facilitation of lower extremity muscle contraction, it has been suggested that WBV can function as a good form of warm-up.

**PURPOSE:** To determine the effectiveness of WBV training on increasing intramuscular temperature (IMT) of the medial gastrocnemius (MG) and vastus lateralis (VL) compared to traditional bike warm-up.

**METHODS:** 20 male subjects (avg age  $21.4 \pm 2.3$  yrs) with less than  $\frac{1}{2}$  cm subcutaneous fat levels over the VL and MG qualified for this study. 10 subjects in each of two groups (bike, vibration). Resting baseline muscle temperatures of the VL (1.5 cm depth) and MG (.5 cm) were made using intramuscular thermistors. IMT's were measured two more times: immediately following either 5 minutes of pedaling at 70watts or oscillating WBV at 26Hz/4mm amplitude. Then immediately following another 5 minutes of biking or WBV.

**RESULTS:** Data were analyzed using a 3 factor mixed models analysis of covariance blocking on individual subjects, with baseline temperature being the covariate. A post hoc Tukey pairwise comparisons of means was used where needed. No significant differences in treatment existed ( $p=0.2247$ ) or in the muscle\*treatment interaction ( $p=0.9672$ ). Temperatures did significantly increase over time ( $p=0.0097$ ), with only vibration showing a significant increase in temperature from 2nd to 3rd temperature measurement ( $p < 0.0001$ ).

**CONCLUSIONS:** Both treatments are effective at increasing IMT. While no statistical difference was found between bike and vibration treatments, the mean changes were: MG = .50C (bike) and .97C (vibration) and VL = 1.58C (bike) and 1.95C (vibration). Thus, oscillating platform vibration appears to show a trend towards greater IMT increases, particularly after the first 5 minutes as compared to bike pedaling. This increase in temperature may also be correlated to the performance enhancements reported in the vibration training literature, although this has yet to be shown. Further investigation of temperature responses in other muscle groups and at different frequencies is needed.

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3361 Board #82 June 2 8:00 AM - 9:30 AM

**The Intra-Hemodialytic Protein And Exercise(IHOPE) Study: Rationale And Study Design**

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(No relationships reported)

**PURPOSE:** Chronic kidney disease (CKD) patients receiving hemodialysis therapy suffer from a variety of co-morbid diseases. Protein malnutrition and muscle wasting are especially common, and these lead to reduced muscle strength and function. Physical inactivity exacerbates these functional declines, and also promotes cardiovascular disease (CVD) and bone disorders. In an attempt to deter functional declines and wasting, the National Kidney Foundation has increased the protein recommendation for dialysis patients to 1.2 g/kg/day. Previous acute studies indicate that intradialytic oral protein supplementation, with or without concomitant intradialytic exercise, may help reverse the negative protein balance that occurs during dialysis. However, little is known regarding the efficacy of chronic protein supplementation and exercise training in dialysis patients. To study this question, we recently initiated a randomized, controlled clinical trial called the Intra-Hemodialytic Oral Protein and Exercise (IHOPE) study.

**METHODS:** We will recruit ~150 dialysis patients over 5 years to complete this study. At baseline, 6 and 12 months, we will measure a variety of factors related to physical function, cardiovascular disease risk, body composition, and quality of life (QOL). Following baseline testing, subjects will be randomized to 1 year of either intradialytic 1) non-protein (control) supplement, 2) whey protein supplement, or 3) whey protein supplement and endurance exercise training.

**RESULTS:** During our first year of the study, we enrolled 39 patients ( $n = 13/\text{group}$ ). Selected baseline characteristics of the current participants include the following: 1) average age =  $52.7 \pm 10.5$ ; 2) gender = 44% male; 3) BMI =  $32. \pm 8.5$ ; 4) serum albumin =  $4.0 \pm 0.4$  g/L; 5) diabetes prevalence = 58%. There are no statistically significance differences in these variables between groups.

**CONCLUSIONS:** When completed, this study will provide novel information regarding the long-term effects of oral protein supplementation and exercise training on clinical outcomes and the QOL in hemodialysis patients. Results from this study will enable clinicians to make more informed decisions regarding the extent to which these low-cost treatment strategies should be included as a component of the standard care in their clinics.

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3362 Board #83 June 2 8:00 AM - 9:30 AM

**The Influences of 4-Week Walking Training with Blood Flow Restriction on Lower Limb Strength in Elderly**

Wei-Hsiu Lin, Che-Yu Kuo. *National Chiayi University, Chiayi, Taiwan.*  
(No relationships reported)

Few researches indicated that walking with blood flow restriction (BFR) increase the lower limb strength in elderly. In previous studies, the training intensity of BFR-group was relatively higher than no BFR group (NBFR-group) since both groups were trained at the same walking speed instead of the same percentage of maximal heart rate reserve (MHR).

**PURPOSE:** To investigate the influences of 4-week BFR-walking training with the intensity at 35%~45% MHR on lower limb strength in elderly.

**METHODS:** Eleven physical active men and women ( $62 \sim 73$  yrs;  $160.2 \pm 7.2$  cm;  $66.5 \pm 8.4$  kg) participated in this study and were divided into BFR ( $n = 6$ ) and NBFR ( $n = 5$ ) groups. The individual cuff pressure of BFR-group was set at 50% of complete blood occlusion pressure. All of the subjects performed 20-minute treadmill walking at 35%~45% MHR, 5 days/wk for 4 weeks. The muscle strength of isokinetic knee extension/flexion and ankle dorsi/plantar flexion were evaluated using Biodex System 4 and the testing angular velocities were set at 60°/s and 180°/s for knee; 60°/s and 120°/s for ankle. Two-way mixed design ANOVA was performed to compare all the variables.

**RESULTS:** After 4-week walking training, the dorsiflexion peak torque and total work in BFR-group improved 6.9%~9.1% and 1.8%~14.3% respectively; plantar flexion peak torque and total work in BFR-group improved 26.6%~28.3% and 35.9%~41.1% respectively (plantar flexion total work at 120°/s increased significantly after training,  $p < .01$ ).

**CONCLUSIONS:** BFR-walking training at 35%~45% MHR enhance the calf strength but the thigh strength. Low training intensity and wide cuffs might limit the training effect on thigh muscles.

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3363 Board #84 June 2 8:00 AM - 9:30 AM

**Increasing Strength And Muscle Mass In Hiv+ Men Recovering From Substance Abuse**

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(No relationships reported)

The combination of substance (drug and/or alcohol) abuse and infection with human immunodeficiency virus (HIV) can result in the development of several co-morbidities, including muscle wasting. Resistance training could, therefore, be an important tool in the treatment of substance addiction/abuse and HIV.

**PURPOSE:** The purpose of this study was to examine the effect of resistance training on measures of muscle mass and strength in the context of co-occurring substance abuse and HIV.

**METHODS:** Seventeen untrained men (Mean  $\pm$  SD:  $42 \pm 11$  years,  $89.7 \pm 16.0$  kg,  $179.7 \pm 9.1$  cm,  $18.9 \pm 5.5$  %fat) who are infected with HIV and enrolled in an in-patient substance addiction/abuse treatment program completed six weeks of either resistance training (RT) (three sessions per week) or no-exercise prescription (Control). Before (Pre) and after (Post) the 6-week period, anthropometric (e.g., body mass, skinfolds, and circumferences), strength (bench press and isometric squat), and power (vertical jumps) measurements were obtained.

**RESULTS:** Predicted bench press 1-repetition maximum (1-RM) increased significantly ( $p < 0.05$ ) for RT (Pre:  $73.4 \pm 23.4$  kg; Post:  $85.0 \pm 30.4$  kg) but not for Control (Pre:  $54.9 \pm 24.6$  kg; Post:  $57.3 \pm 27.0$  kg). Peak isometric squat force increased significantly for RT (Pre:  $2627 \pm 1071$  N; Post:  $2892 \pm 1171$  N) but not for Control (Pre:  $2411 \pm 675$  N; Post:  $2394 \pm 592$  N). Peak vertical jump power also increased significantly for RT (Pre:  $35.9 \pm 3.5$  W·kg<sup>-1</sup>; Post:  $36.2 \pm 5.0$  W·kg<sup>-1</sup>) but not for Control (Pre:  $33.9 \pm 3.9$  W·kg<sup>-1</sup>; Post:  $35.7 \pm 4$  W·kg<sup>-1</sup>). Muscle mass

increased significantly for RT (Pre: 46.4 ± 8.2 kg; Post: to 50.5 ± 8.1 kg) but not for Control (Pre: 46.9 ± 13.0 kg; Post: 47.8 ± 12.4 kg). Upper arm and forearm circumference increased only for RT. No adverse effects of the resistance training program were observed.

**CONCLUSION:** Resistance training for six weeks increases muscle strength and power, and induces muscle hypertrophy, in men who are infected with HIV and recovering from substance abuse. These findings support the efficacy for including resistance training in the standard of care for men with HIV undergoing in-patient treatment for substance **addiction/abuse**.

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**3364** Board #85 June 2 8:00 AM - 9:30 AM

**Do Parameters Of Exercise Capacity Predict Mortality In Adolescent With Cystic Fibrosis?**

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(No relationships reported)

**PURPOSE:** Several determinants, such as lung function, nutritional status and exercise capacity ( $VO_{2max/kg}$ ), are known to be associated with mortality in patients with Cystic Fibrosis (CF). The aim of the current study was to develop a model to predict survival from parameters derived from a cardiopulmonary exercise test (CPET), in addition to resting lung function.

**METHODS:** Data of 127 adolescents with CF (57 girls and 70 boys, mean age 12.7 ± 0.9 years, mean forced expired volume in 1 sec ( $FEV_1$ ) = 77.7%<sub>predicted</sub> ± 15.6%) were available for analysis. Cox regression analysis was performed to determine which (combination) of parameters was best in predicting mortality and/or lung transplantation.  $FEV_1$ ,  $VO_{2max/kg}$ , peak minute ventilation ( $VE_{max}$ ),  $VE_{max}/VO_{2max}$ ,  $VE_{max}/VCO_{2max}$  and breathing reserve ( $1 - (VE_{max}/MVV)$ ) were included in one model. A backward selection procedure was used. All predictors were also dichotomized; ROC curves were used to determine the criterion value, and combined into one model.

**RESULTS:** Mean duration of follow-up was 7.5 ± 2.7 years, 9 patients died and 6 underwent lung transplantation. The best model to predict survival in this population included  $FEV_1$  expressed as percentage of predicted and  $VE_{max}/VO_{2max}$ . This was both the case when variables were used continuously ( $FEV_1$ %pred. ( $HR=918$ ,  $p<.001$ ) and  $VE_{max}/VO_{2max}$  ( $HR=1.088$ ,  $p=.02$ ) or dichotomized ( $FEV_1$ %pred. ( $HR=19.368$ ,  $p<.001$ ) and  $VE_{max}/VO_{2max}$  ( $HR=5.179$ ,  $p=.03$ ).

**CONCLUSIONS:** This findings show the relevance of performing a CPET in adolescents with CF because  $VE_{max}/VO_{2max}$  combined with  $FEV_1$ %<sub>predicted</sub> is a significant predictor of survival. In clinical practice this can be used to distinguish patients with a lower risk and patients at risk and to offer the patients at risk additional therapy and/or a more intensive follow-up.

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**3365** Board #86 June 2 8:00 AM - 9:30 AM

**Therapeutic Effects Of Whole Body Vibration On Chronic Knee Osteoarthritis**

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(No relationships reported)

**PURPOSE:** To investigate the effect on pain reduction and strengthening of whole body vibration in chronic knee osteoarthritis

**METHODS:** Thirty six female patients were randomly divided to study group and control group. Study group patients performed whole body vibration (20 minutes, 3 times) with home based exercise and control group only home based exercise for 8 weeks. 11 patients in each group completed study. We measured pain intensity with Numeric Rating Scale, functional scales with Korean Western Ontario McMaster score. We also measured strength with isokinetic and isometric torque and dynamic balance with a kind of balance board before training and at 1 and 2 month after training.

**RESULTS:** Pain intensity was significantly decreased in each group and change of pain intensity was significantly larger in study group (1.5±1.7 vs 0.6±2.9,  $p=0.04$ ) at 2 months after training. Functional scales improved in both groups but no significant differences of changes between groups (8.5±11.7 vs 2.1±9.2). Isokinetic strength of right quadriceps and isometric strengths of both quadriceps improved in both groups but no significant differences of changes between groups (isokinetic, right: 15.65±10.91 vs 10.30±8.2, isometric (right/left): 13.98±16.91/13.06±14.54 vs 16.33±19.19/19.13±15.75). Isokinetic strength of left quadriceps did not improve in both groups (change: 8.70±11.88 vs 2.84±19.03). Dynamic balance improved in both groups but no significant differences of changes between groups (anterior-posterior: 0.96±1.16 vs 1.28±2.12, medial-lateral: 1.75±2.05 vs 0.73±1.00).

**CONCLUSIONS:** In chronic knee osteoarthritis patients, whole body vibration and home based exercise reduced pain intensity and increased strength of right quadriceps and dynamic balance. When compared with home based exercise, whole body vibration had additional effect only in pain reduction.

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**3366** Board #87 June 2 8:00 AM - 9:30 AM

**The Effect of Preconditioning on Initial Physiological and Psychological Assessments Following Treatment**

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(No relationships reported)

Exercise has been associated with the improvement of various physiological and psychological variables in cancer survivors post cancer treatment. However, little information exists on the role prior physical activity may have on functional capacity.

**PURPOSE:** To assess the differences between prior physical activity and the initial physiological and psychological assessments in cancer survivors following treatment.

**METHODS:** A total of 412 cancer survivors that had undergone radiation and/or chemotherapy were eligible for this study. Participants completed comprehensive physical assessments and Piper fatigue and Beck depression inventories. Functional capacity was determined during an initial assessment including  $VO_{2peak}$  (multistage treadmill protocol). Prior physical activity (PA) was defined as being none (1), low (2), and moderate (3) based on frequency, intensity, and duration according to the ACSM guidelines. A multivariate analysis of variance (MANOVA) determined the group variance differences.

**RESULTS:** There was a significant ( $p<.05$ ) main effect for prior PA. Post hoc pairwise comparisons determined that there were significant ( $p<.05$ ) differences between groups 1 and 3 for  $VO_{2peak}$  (21.23 ± 6.70 vs. 23.46 ± 7.02 mL·kg<sup>-1</sup>·min<sup>-1</sup>, respectively), groups 1 and 3, and groups 2 and 3 for fatigue (5.09 ± 2.23 vs. 4.28 ± 2.19 and 5.07 ± 2.03 vs. 4.28 ± 2.19, respectively) and groups 1 and 3 for depression (12.03 ± 7.74 vs. 9.90 ± 6.19, respectively). Moderately active individuals showed greater initial assessment values for functional capacity ( $VO_{2peak}$ ). Additionally, greater decreases were observed in fatigue and depression in the moderate activity group.

**CONCLUSION:** Cancer treatment-related side-effects lengthen the recovery process post treatment for cancer survivors. The results of this study demonstrate the importance of moderate prior physical activity for the attenuation of treatment-related reductions in functional capacity, fatigue and depression.

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**3367** Board #88 June 2 8:00 AM - 9:30 AM

**Evidence Of Functional Aerobic Impairment Among Adults Living With HIV**

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(No relationships reported)

**PURPOSE:** Published results from our lab show that males living with HIV exhibit functional aerobic impairment (FAI) as indicated by a 25% lower age predicted  $VO_2$  max. It is well established that a lower aerobic capacity increases the risk of chronic disease and all-cause mortality among healthy populations. Currently no investigation has assessed aerobic capacity in a sample of HIV+ females. The purpose of this study was to examine aerobic capacity, as measured by peak  $VO_2$ , in a sample of HIV+ adults.

**METHODS:** Preliminary data was used from an ongoing exercise intervention that included a total of 10 males and 15 females. All participants underwent a maximal exercise treadmill test at baseline prior to randomization in which  $VO_2$ , heart rate, and blood pressure were assessed. FAI was determined if the participant exhibited a peak  $VO_2 \leq 25\%$  of their age-predicted  $VO_2$ .



**RESULTS:** Both males and females exhibited FAI (males: FAI = 37%; females: FAI = 47%) according to their age-predicted VO<sub>2</sub> max. When separated by gender males had a peak VO<sub>2</sub> of 24.16 ± 2.52, whereas females had a significantly lower peak VO<sub>2</sub> of 15.37 ± 0.97 (p = 0.001). Both genders had a peak heart rate significantly less than their age predicted max (males: 138 ± 8 bpm; females: 136 ± 5 bpm).

**CONCLUSIONS:** These results agree with previously published data that show males living with HIV often present FAI, possibly due to a sedentary lifestyle and/or disease related fatigue. The current data indicate that females living with HIV have greater FAI compared with males. Caution should be taken when prescribing aerobic exercise with this population and should be initiated at a light intensity less than the current recommendations for the general population.

This project is supported by the NIH/NINR and Thera-Band®

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**3368 Board #89 June 2 8:00 AM - 9:30 AM**

**Knee Osteoarthritis And The Efficacy Of Home-based Kinesthesia, Balance & Agility Exercise Training**

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(No relationships reported)

Knee osteoarthritis (OA) is one of the most frequent causes of physical disability and pain among older persons. Evidence suggests incorporating kinesthesia, balance and agility (KBA) exercise with resistance training (RT) results in greater improvements than RT alone. However, the efficacy of KBA alone is unknown.

**PURPOSE:** To determine the efficacy of a home-based KBA knee OA exercise program to improve symptoms and quality of life.

**METHODS:** Fifty-four persons age ≥ 50y with knee OA were randomly assigned to 8-weeks KBA, RT, KBA + RT, or Sham. Participants trained 3 times per week for 40 minutes. KBA utilized exercises such as cross-over walking, side-stepping, and backward stepping, plus single-leg static and dynamic balancing. RT used elastic resistance bands for open chain lower extremity exercises. KBA + RT performed selected exercises from each technique to ensure the total exercise exposure remained equal. Sham applied inert lotion daily in a manner that avoided self-massage. Outcomes included the OA specific WOMAC Index of Pain, Stiffness, & Physical Function (PF), community activity level, exercise self-efficacy, and self-report knee stability.

**RESULTS:** Thirty-three participants completed the trial. Analysis of Variance comparing baseline, mid-point, and follow-up measures revealed significant (p < 0.05) improvements in WOMAC Pain, Stiffness, PF, and Total scores among KBA (n = 8), RT (n = 8), KBA + RT (n = 9), and Sham (n = 8), with no differences between groups. There were no significant changes in community activity level. Only Sham improved exercise self-efficacy. Knee stability was significantly improved in the RT and Sham conditions.

**CONCLUSION:** The three exercise conditions appeared relatively equal for reducing the symptoms of knee OA. Sham results indicate a strong placebo effect. However, Sham WOMAC improvements peaked at 4-week mid-point, whereas improvement in the exercise conditions continued at 8-weeks. In conclusion, our results indicate that KBA, RT, or a combination of the two administered as home exercise programs are effective in improving symptoms and quality of life among persons with knee OA. Patient preferences, costs, and convenience should be considered when choosing an exercise rehabilitation approach for knee OA.

Supported by Thera-Band Academy product grant.

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**3369 Board #90 June 2 8:00 AM - 9:30 AM**

**Effects of Atorvastatin on Resting and Peak Exercise Blood Pressure**

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(No relationships reported)

Statins reduce low density lipoprotein cholesterol and decrease cardiovascular events. They are also reported to lower resting blood pressure (BP), but this is controversial.

**PURPOSE:** To determine if 80mg of atorvastatin reduces resting BP and peak systolic BP (SBP) on a graded exercise test.

**METHODS:** Subjects were double-blinded and randomized to 80mg·d<sup>-1</sup> of atorvastatin (n=202) or placebo (n=217) for 6 months. Resting BP and peak SBP were measured by auscultation at baseline and 6 months. Repeated measures ANCOVA tested differences in resting BP and peak SBP over 6 months by drug treatment group and gender with age and body mass index (BMI) as covariates.

**RESULTS:** Subjects were 44.1 ± 0.8 yr (mean ± SEM) with resting BP of 118.9 ± 0.6/75.3 ± 0.5 mmHg and BMI of 26.4 ± 0.2 kg·m<sup>-2</sup>. Men (n=203) had higher resting BP (121.6 ± 0.9/76.5 ± 0.7 vs. 116.2 ± 0.9/74.1 ± 0.7 mmHg) and peak SBP (177.5 ± 1.9 vs. 161.3 ± 1.7 mmHg) than women (n=216) (p=0.000). Subjects reduced resting SBP (atorvastatin, -4.0 ± 0.8; placebo -3.0 ± 0.7 mmHg) (p=0.000), but not diastolic BP (p=0.86) or mean arterial pressure (p=0.76) over 6 months, regardless of atorvastatin or placebo. However, women on atorvastatin (n=103) tended to reduce resting SBP 3.0 ± 1.5 mmHg more than women on placebo (n=113) (p=0.06). There was no difference in resting SBP between atorvastatin and placebo among men (p=0.66). In the total sample, peak SBP was not different between atorvastatin and placebo over 6 months (p=0.99). However, women on atorvastatin reduced peak SBP 6.4 ± 3.3 mmHg more than women on placebo over 6 months (p=0.02). There was no difference in peak SBP between atorvastatin and placebo among men (p=0.13).

**CONCLUSION:** Participation in a clinical trial reduced resting SBP, independent of assignment to atorvastatin or placebo. Moreover, in women but not men, atorvastatin reduced resting SBP and peak SBP more than placebo, and atorvastatin did not influence resting and peak SBP among men. The mixed findings regarding the antihypertensive effects of statins may be attributable to not accounting for trial and drug placebo effects and gender differences. Supported by NHLBI/NIH grant RO1 HL081893A2.

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**3370 Board #91 June 2 8:00 AM - 9:30 AM**

**Heart Rate Recovery in Juvenile Idiopathic Arthritis: Relationship with Aerobic Fitness, Disease Subtype and Severity**

Joyce Obeid<sup>1</sup>, Marco van Brussel<sup>2</sup>, Brian W. Timmons<sup>1</sup>, Tim Takken<sup>2</sup>. <sup>1</sup>McMaster University, Hamilton, ON, Canada. <sup>2</sup>University Medical Center Utrecht, Utrecht, Netherlands. (Sponsor: Boguslaw Wilk, FACSM)

(No relationships reported)

Youth with JIA may be at an increased risk of developing cardiovascular (CV) disease, with early signs of atherosclerosis manifesting as young as 4 years of age. Heart rate recovery (HRR) following maximal exercise is a strong predictor of CV health and all-cause mortality in adults. The relationship between HRR and health outcomes in JIA is of considerable interest as HRR may represent a simple clinical tool to facilitate early detection of CV impairment in this population.

**PURPOSE:** To compare HRR in JIA and healthy controls and to examine potential associations between HRR, fitness- and disease-related variables in JIA.

**METHODS:** Sixty-two children with polyarticular, oligoarticular and systemic JIA as well as 50 healthy controls performed a graded, maximum-effort cycling test to assess aerobic fitness (VO<sub>2peak</sub>). The highest achieved power output and oxygen uptake were taken as the peak work rate (W<sub>peak</sub>) and VO<sub>2peak</sub>, respectively. Heart rate (HR) was measured at rest, continuously throughout and after exercise by ECG. HRR was calculated as the difference between peak HR (HR<sub>peak</sub>), and HR at 1-min post-exercise. Disease duration and number of swollen joints were also assessed in JIA. Independent sample t-tests were used to examine differences between JIA and healthy controls. Multiple regression analysis was used to determine significant predictors of HRR in JIA.

**RESULTS:** HRR at 1-min post-exercise was similar between youth with JIA and healthy controls (50 ± 14 vs. 53 ± 14 bpm, p>0.25), as was HRR expressed as a percentage of heart rate reserve (61.5 ± 18.5 vs. 59.4 ± 15.8%, p=0.51). The strongest significant predictors of HRR in JIA included JIA subtype (systemic vs. others), age at testing, W<sub>peak</sub>, and HR<sub>peak</sub> in the following model:  $HRR (bpm) = 114.804 - 11.041 \times JIA (0=oligo-, poly-JIA; 1=systemic) - 2.338 \times \text{age at testing} + 9.395 \times W_{peak} - 0.373 \times HR_{peak}$  (R<sup>2</sup> = 0.33; SEE = 12.2). Inclusion of BMI, VO<sub>2peak</sub>, disease duration and/or joint count did not improve HRR prediction.

**CONCLUSIONS:** While HRR is similar between JIA and healthy controls, it appears that the type of JIA (systemic) may play an important role in modulating HRR. Future work should focus on linking HRR in youth with systemic JIA to more direct markers of CV damage.

Joyce Obeid was supported by a CIHR Michael Smith Foreign Study Supplement.

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**3371 Board #92 June 2 8:00 AM - 9:30 AM**  
**Steps/min and Mets During Incremental Exercise In Hispanic Adults Living With and Without Hiv Infection**

Celina Corteguera, Farah A. Ramirez-Marrero, FACSM. *Univ. of Puerto Rico, San Juan, Puerto Rico.*  
(No relationships reported)

A walking cadence of 100 steps/min or more is used to demark moderate intensity level activity (at least 3 METs). However, because resting  $\text{VO}_2$  is higher among people living with HIV, such cadence might represent a different MET value.

**PURPOSE:** We tested the hypothesis that MET values would be lower in adults living with HIV infection compared to non-HIV adults exercising at the same intensity level.

**METHODS:** A group of 88 Hispanic adults (58 HIV and 30 non-HIV) completed a resting  $\text{VO}_2$  test, and a graded exercise test ( $\text{VO}_2\text{max}$ ) using the modified Bruce protocol while wearing an accelerometer. METs, heart rate (HR), and steps/min were measured in each stage of the protocol and compared between groups using ANOVAs and linear regressions.

**RESULTS:** The HIV group had lower MET values compared with the non-HIV group in all stages of the protocol except the first (1.7 mph, zero inclination) where MET values were not different between groups. HR response during all stages was not different between groups, and step cadence in the HIV group was higher compared to the non-HIV group only in the first stage of the protocol. A 100 steps/min cadence was equivalent to 5.8 METs in the HIV group and 7.8 METs in the non-HIV group.

**CONCLUSION:** The use of MET values to identify exercise intensity, functional capacity and/or energy expenditure must be population specific to prevent errors, particularly among Hispanic adults living with HIV infection. Funded by NIH/CTSA KL2-RR024151

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**3372 Board #93 June 2 8:00 AM - 9:30 AM**  
**Factors Influencing The Effect Of Exercise On Bone Mass Density In Women With Postmenopausal Osteoporosis**

Antonio Sgadari, Marianna Broccatelli, Simona De Bellonia, Alessia Rabini, Roberto Bernabei. *Catholic University of Sacred Heart, Rome, Italy.*  
(No relationships reported)

Osteoporosis is a condition resulting in an increased risk of skeletal fractures due to a reduction in the density of bone tissue. Interventional studies based on physical exercise programs have demonstrated modest increases in bone mineral density (BMD) in older postmenopausal women. It has been argued that in this population the capacity of the skeleton to adapt to mechanical stress of exercise is impaired due to a series of factors such as inadequate intake of specific nutrients, altered hormonal status, low level of physical activity (PA), and medications or comorbidities which may facilitate osteoporosis.

**PURPOSE:** To investigate if subject's characteristics, lifestyle habits, medications, comorbidities, dietary intake of nutrients, calcium and Vit.D, level of PA in everyday life, influenced the effect of an exercise program on BMD in 155 women with postmenopausal osteoporosis.

**METHODS:** Forty-seven women with lumbar or femoral osteoporosis, regularly exercising at the University Hospital Fitness Facility for >1 year, were recruited (EXE group); 108 sedentary women attending the Outpatient Clinic and matched by gender, age, duration of the observation period, and BMD values, were allocated to the control group (SED group). Main outcome was percent change in BMD. Concurrent diseases, medications, risk factors for osteoporosis, level of PA (Paffenbarger scale), dietary intake of macronutrients as well as of Ca, K, and P were recorded.

**RESULTS:** The mean ( $\pm$ s.d.) follow-up time was 37.7 $\pm$ 15.4 months in the EXE and 36.0 $\pm$ 17.3 in the SED group. The age was 66.2 $\pm$ 6.3 years, with no differences between the two groups. During the follow up time the BMD increased from 0.688 $\pm$ 0.087 to 0.710 $\pm$ 0.100  $\text{g}\cdot\text{cm}^{-2}$  ( $p=0.008$ ) in the EXE group and decreased from 0.697 $\pm$ 0.099 to 0.688 $\pm$ 0.107  $\text{g}\cdot\text{cm}^{-2}$  in the SED group ( $p=0.038$ ); the difference between the two groups was significant ( $p<0.001$ ). Neither the pharmacological treatment nor the dietary intake of calories, macro- and micro-nutrients significantly affected the change in BMD. Also, the change in BMD among subjects in the higher tertile of PA was not different from that of those in the lower tertile (3.4 $\pm$ 1.2 vs. 2.1 $\pm$ 0.9%,  $p=0.09$ ).

**CONCLUSIONS:** A physical exercise program was effective in improving BMD in postmenopausal women; this effect was not influenced by several modifiable factors.

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**G-32 Free Communication/Poster - Ergogenics and Clothing**

JUNE 2, 2012 7:30 AM - 11:00 AM  
ROOM: Exhibit Hall

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**3373 Board #94 June 2 9:30 AM - 11:00 AM**  
**Influence of Protective Clothing on Endurance Capacity, Thermoregulation and Fluid Balance in Fencers**

Mario Weichenberger, Yuefei Liu, Martina Velders, Jürgen M. Steinacker, FACSM. *University of Ulm, Ulm, Germany.*  
(No relationships reported)

Fencers wear special protective clothing to prevent injuries during fencing bouts consisting of jacket, breeches, glove and mask. This equipment may affect thermoregulatory processes and could therefore impact on the athlete's performance.

**PURPOSE:** To analyze the influence of protective clothing on endurance capacity, thermoregulation and fluid balance in fencers.

**METHODS:** 9 German junior top-level fencers (16.9  $\pm$  1.2 yrs) underwent two Fencing-specific Endurance Tests (FET) in a cross-over study in random order with protective clothing (PC) or normal sportswear, respectively. FET was conducted with a weapon and fencing-specific footwork forwards and backwards on a fencing ground (planche). Subjects started at 3 km/h and speed was increased by 1 km/h every 3 minutes up to exhaustion ( $v_{\text{max}}$ ). Heart rates [HR] and blood lactate [LAC] were determined during FET; hematocrit [HC], body weight [BW] and body temperature [TEMP] were measured before and after the tests.

**RESULTS:** Due to PC athletes lost more BW ( $\Delta$  0.62  $\pm$  0.12kg vs. 0.42  $\pm$  0.08kg,  $p<.01$ ) as a result of higher loss of water, had a greater increase of HC ( $\Delta$  4.9  $\pm$  1.5% vs. 2.9  $\pm$  1.1%,  $p<.01$ ) and a greater rise of TEMP ( $\Delta$  0.7  $\pm$  0.1°C vs. 0.4  $\pm$  0.1°C,  $p<.01$ ). Wearing PC resulted in lower  $v_{\text{max}}$  (7.4  $\pm$  0.7 km/h vs. 8.1  $\pm$  0.4 km/h,  $p<.05$ ) and lower performances at blood lactate concentrations of 2 mmol/l (5.2  $\pm$  0.5 km/h vs. 5.7  $\pm$  0.5 km/h,  $p<.05$ ) and 4 mmol/l (6.2  $\pm$  0.5 km/h vs. 6.8  $\pm$  0.6 km/h,  $p<.01$ ). HR were higher in athletes with PC during and 5 minutes after FET ( $p<.05$ ). Athletes with PC had a higher LAC concentration for movement speed higher than 6 km/h (3.7  $\pm$  1.2 mmol/l vs. 2.8  $\pm$  1.0 mmol/l,  $p<.05$ ).

**CONCLUSIONS:** Wearing protective clothing increases perspiration and body temperature and lowers endurance performance in fencers. These negative effects due to the protective clothing should be taken into consideration during a fencing tournament, where athletes have to perform 10 to 15 bouts. Whether the ingestion of cold beverages to regulate fluid balance and body temperature has a significant effect on counteracting performance decrements has to be verified in further studies.

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**3374 Board #95 June 2 9:30 AM - 11:00 AM**  
**Examination Of The Impact Of A Cooling Product On Cycling Performance In The Heat**

Walter R. Bixby, FACSM, Amanda B. Mischo, Paul C. Miller, Stephen P. Bailey, Eric E. Hall, FACSM. *Elon University, Elon, NC.*  
(W.R. Bixby: Contracted Research - Including Principle Investigator; Daniale LLC.)

Exercising in the heat has adverse consequences for physical performance. Little evidence exists examining the impact of a cooling strategy during the event.

**PURPOSE:** To examine if a cooling strategy during an event in the heat can reduce the negative effects commonly seen and thus positively impact performance and perception.

**METHODS:** 7 experienced male cyclists performed a graded exercise test and two time trials (TT) on 3 separate days on a Velotron. Days two and three were identical with the exception of the treatment condition and were performed in an environmentally controlled chamber set to 30 degrees Celsius with 60% humidity. Participants were given 10 minutes to warm-up. Following

the warm-up, heart rate and affect were recorded. Participants then completed a 30K TT as fast as they could. Heart rate and affect were recorded at ¼, ½, ¾ of the way through, at the end and 15 minutes after the TT. On one day participants wore a cooling product and the order of presentation was counterbalanced.

**RESULTS:** One way Repeated Measures ANOVAs were calculated for Average Watts, MPH, and Time across the two TT conditions. No significant results were found: Watts cooling 247.99 (51.99) and non-cooling 244.49 (53.47); MPH cooling 24.43 (2.01) and non-cooling 24.21 (2.06); and Time cooling 46:20 (3:48) and non-cooling 46:32 (4:03). A two way (2 Condition x 2 Time) RM ANOVA was calculated for lactate and a significant Time main effect was found,  $F(1, 6) = 13.83, p < .05$ , pre 3.56 (.94) post 11.50 (1.61). Two way (2 condition x 6 Time) RM ANOVAs were calculated for HR and Affect. A significant time main effect was found for HR,  $F(5, 30) = 113.74, p < .01$ . Heart rate increased from baseline throughout the time trial and began to return to baseline levels 15 min into recovery. A significant time main effect was found for Affect,  $F(5, 30) = 10.08, p < .05$ . Participants felt progressively worse throughout the time trial and then rebounded to near baseline levels 15 minutes after the time trial.

**CONCLUSIONS:** The cooling product did not have a statistically significant impact on performance or affect during and following a time trial in the heat. Participants performed 13 seconds faster while wearing the cooling product which could have significant real world impact.

Supported by a grant from Daniale LLC.

**3375 Board #96 June 2 9:30 AM - 11:00 AM**

**Effects of Wearing Arm Progressive Compression Sleeves on Upper-body Muscular Performance in Trained Men**

Maria Claudia C. Pereira<sup>1</sup>, Diego Jesus<sup>1</sup>, Saulo R. Soares<sup>1</sup>, Rogerio A. Guedes<sup>1</sup>, Carlos A. Vieira<sup>2</sup>, João B. Ferreira-Junior<sup>1</sup>, Lee E. Brown, FACSM<sup>3</sup>, Martim Bottaro<sup>1</sup>.  
<sup>1</sup>University of Brasília, Brasília, Brazil. <sup>2</sup>Federal University of Goiania, Goiania, Brazil. <sup>3</sup>California State University Fullerton, Fullerton, CA.  
 (No relationships reported)

Investigations have demonstrated that progressive lower-body compression garments (shorts and stockings) can enhance repetitive jump power and running economy. Recently, the use of upper-body compression garments, such as arm progressive compression sleeves, has become popular in sports that require muscular strength, endurance, and power (e.g., basketball, volleyball, tennis, standup paddle, etc.). However, the benefits of these garments on muscular performance still need to be investigated.

**PURPOSE:** To investigate the effects of wearing compression sleeves (CS) on force production and muscle fatigue of the elbow flexor in trained men.

**METHODS:** Eight healthy resistance trained young men (20.4 ± 3.1 yrs; 71.7 ± 6.0 kg) volunteered to take part in this study. Testing was conducted using a balanced and randomized treatment design with two experimental conditions consisting of: 1) compression sleeves (CS), and 2) placebo sleeve (PS) with no compression. Peak torque (PT) and total work (TW) testing consisted of four sets of 10 maximal isokinetic elbow flexion repetitions at 60°.s<sup>-1</sup> on a Biodex System 3 dynamometer.

**RESULTS:** PT and TW are presented in Table 1. No significant differences were found between the CS and PS conditions. However, PT and TW decreased significantly ( $p < 0.05$ ) between sets (1<sup>st</sup> > 2<sup>nd</sup> > 3<sup>rd</sup> > 4<sup>th</sup>) from both conditions.

Table 1.

|    | Peak Torque (N.m) |            |           |          | Total Work (Joules) |              |             |            |
|----|-------------------|------------|-----------|----------|---------------------|--------------|-------------|------------|
|    | 1st set           | 2nd set    | 3rd set   | 4th set  | 1st set             | 2nd set      | 3rd set     | 4th set    |
| CS | 62.4±7.4*         | 52.3±6.9†  | 49.2±5.5‡ | 47.5±7.4 | 921.6±95.1*         | 734.8±64.9†  | 611.8±38.0‡ | 539.6±31.8 |
| PS | 65.1±13.1*        | 56.9±11.4† | 53.4±9.4‡ | 50.6±8.3 | 969.4±153.4*        | 763.4±108.8† | 626.8±55.2‡ | 571.3±52.2 |

\* Higher than 2nd, 3rd, and 4th ( $p < 0.05$ ); † higher than 3rd, and 4th ( $p < 0.05$ ); ‡ higher than 4th ( $p < 0.05$ )

**CONCLUSION:** These results indicate that compression sleeves commonly worn by athletes and fitness enthusiasts during training and competition do not contribute to improved elbow flexion muscle strength or work capacity during repetitive high-intensity resistance exercise tasks.

**3376 Board #97 June 2 9:30 AM - 11:00 AM**

**Effects of Nanobionic Textile T-shirt on Maximal Anaerobic Power**

Evangelos Roussopoulos, Giorgos Paradisis, Elias Zacharogiannis, Nikolaos Dimitriadis. *Track and Field Sector, University of Athens, Athens, Greece.*  
 (No relationships reported)

Nanobionic is a textile, made of bio-ceramic materials, that reflects back to human body the far-infrared rays that body emits. Although there are research data regarding the use of far infrared rays to improve performance and to speed up recovery from exercise, reports on their effect on maximal anaerobic power are scarce.

**PURPOSE:** The aim of this study was to investigate the effects of a Nanobionic t-shirt on maximal anaerobic power during exercise.

**METHODS:** Twelve (7 men, 5 women) healthy active subjects (age 28.2 ± 5.7 years, body mass 71.2 ± 16.1 kg, height 173.9 ± 9.5 cm) agreed to participate in the study. A double blind cross over design was used with subjects visited the lab twice for the placebo (PT) and experiment test (ET). Maximal anaerobic power parameters were determined through the wingate anaerobic test (WAnT) which was performed on a cycle ergometer (Monark 894E, Sweden) against a resistance of 0.075 kg kg body mass<sup>-1</sup>. Peak power (PP) determined as the highest value over the first 5-s period of testing, mean Power (MP) as the average Power for the whole period of 30 s, % of Power Drop (%PD) as the difference of the PP minus the minimum power divided by the PP (PP-MP/PP).

**RESULTS:** All anaerobic power parameters showed significant improvements ( $P < 0.05$ ) in the ET condition compared to PT condition (Table).

**CONCLUSIONS:** Nanobionic t-shirt improves anaerobic power parameters; however the triggering mechanisms that produce these changes should be subject of future research which could explain the physiological basis behind the outcome of the present study.

Mean ± SD and % difference of all anaerobic power parameters for the ET and PT conditions

|       | Peak power (watt/kg) | % drop power | RPM max (rev/min) | Mean power (watt/kg) | Post WAnT lactate (mmol/l) |
|-------|----------------------|--------------|-------------------|----------------------|----------------------------|
| ET    | 10.23±2.10           | 55.08±9.76   | 193.17±23.10      | 7.05±1.24            | 16.05±3.14                 |
| PT    | 10.64±2.00           | 57.96±8.36   | 199.08±23.25      | 7.28±1.17            | 14.97±2.87                 |
| %diff | 4.0                  | 5.2          | 3.1               | 3.3                  | -6.8                       |

**3377 Board #98 June 2 9:30 AM - 11:00 AM**

**Nanobionic Textile T-shirt: Its Effect On The Parameters Of Cardiorespiratory Function**

Nikos Dimitriadis, Evangelos Roussopoulos, Georgios Paradisis, Elias Zacharogiannis. *Athens University, Athens, Greece.*  
 (No relationships reported)

Nanobionic is a high quality technological textile, made of bio-ceramic materials, that reflects back to our body the far infrared rays our body emits. The exposure of living organisms to far infrared radiation has been documented to induce an increase in temperature of the body tissues, dilate cutaneous blood vessels as well as arterioles and venules promoting blood circulation and thus promoting metabolic rate. Although there are published research data regarding the use of far infrared rays to speed up recovery from exercise, reports on their effect on the cardiorespiratory parameters are scarce.

**PURPOSE:** The aim of this study was to investigate the effects of a Nanobionic t-shirt on the parameters of cardiorespiratory function during exercise.

**METHODS:** Twenty two (11 men, 11 women) healthy active subjects (age  $27.7 \pm 4.4$  years, body mass  $68.3 \pm 13.6$  kg, body height  $173.2 \pm 8.7$  cm) agreed to participate in the study. A double blind cross over design was used. Cardiorespiratory parameters were determined by continuous exhaustive incremental testing with an open circuit spirometry. This protocol had steps of 2 min and increments of 1km.h<sup>-1</sup>. After the first evaluation with active t-shirt (ET) or with identical inactive t-shirt (PT) the subjects 7-14 days performed the second exhaustive trial.

**RESULTS:** Mean values for the ET or PT of VO<sub>2</sub>max ( $51.76 \pm 6.5$  v  $49.62 \pm 6.87$  ml.kg<sup>-1</sup>.min<sup>-1</sup>) velocity at VO<sub>2</sub>max ( $14.61 \pm 1.73$  v  $13.77 \pm 1.72$  km.h<sup>-1</sup>), the velocity at the ventilatory threshold ( $11 \pm 1.48$  v  $10.2 \pm 1.79$  km.h<sup>-1</sup>), total treadmill time (789.5 k, maximal heart rate and maximal blood lactate concentration ( $12.19 \pm 1.9$  v  $10.75 \pm 1.75$  mmol.l<sup>-1</sup>) and maximal heart rate ( $191.5 \pm 7.9$  v  $188.9 \pm 8.4$  b.p.m) were significantly different ( $p < 0.01$ )

**CONCLUSIONS:** Nanobionic t-shirt improves cardiorespiratory parameters and endurance performance. The triggering of metabolism through its reflective properties on far infrared rays should be subject of future research and may explain the physiological basis behind the outcome of the present study.

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**3378 Board #99 June 2 9:30 AM - 11:00 AM**  
**The Effect of EnergyCare™ Bands on Selected Physical Performance Tests**

Andy O'Neill, Anthony Caterisano, FACSM. *Furman University, Greenville, SC.*  
(No relationships reported)

**BACKGROUND:** In today's world athletes attempt to find a product that will improve their health and athletic performance. EnergyCare™ bands, claim to improve athletic performance in a variety of areas such as strength, power, flexibility, speed and balance. Although no previous studies on EnergyCare™ bands have been done, other studies on similar products have produced mixed results.

**PURPOSE:** To determine the effectiveness of EnergyCare™ bands on flexibility, strength, power, speed, and balance.

**METHODS:** College-age males (N=13) were tested in a double-blind format in the areas mentioned above. Students performed five tests: strength (isometric bench press), flexibility (sit and reach), balance (one foot balance test), power (vertical jump), and speed (10 yard dash). Each test was performed five times with five different conditions: those being two active bands (2AB), two placebos (PB), one active leg and one placebo arm (AL), one active arm and one placebo leg (AA), and no bands (NB). Students were randomly assigned condition order and performed all 5 tests in the same order each time. A MANOVA with a Tukey post hoc test was used to analyze the data.

**RESULTS:** There was no significant difference among power, speed, flexibility, and strength across the five experimental conditions. A significant difference exists in the balance tests measured in seconds was as follows: 2AB =  $8.52 \pm 2.26$  ( $p=.003$ ), PB =  $3.47 \pm 0.39$ , AL =  $3.59 \pm 0.31$ , AR =  $3.70 \pm 0.56$ , NB =  $2.86 \pm 0.54$ .

**CONCLUSIONS:** It appears that EnergyCare™ bands do not have an ergogenic effect on strength, power, speed or flexibility. However, the data suggests that balance may be positively affected when using both the active ankle and wrist bands, which may benefit athletes who compete in sports that emphasize balance.

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**3379 Board #100 June 2 9:30 AM - 11:00 AM**  
**The Efficacy of a Lower Limb Compression Garment in Accelerating Recovery from a Marathon Run**

Jessica Hill<sup>1</sup>, Glyn Howatson, FACSM<sup>2</sup>, Ken van Someren<sup>3</sup>, Ian Walshe<sup>2</sup>, Charles Pedlar<sup>1</sup>. <sup>1</sup>*St Mary's University College, Twickenham, United Kingdom.*  
<sup>2</sup>*Northumbria University, Newcastle, United Kingdom.* <sup>3</sup>*English Institute of Sport, Marlow, United Kingdom.*  
(No relationships reported)

Strenuous physical activity can result in exercise induced muscle damage (EIMD) particularly if the exercise is unaccustomed or of a long duration. The EIMD is characterised by a number of symptoms including muscle soreness, inflammation and reduced muscle function. Numerous interventions have been used to reduce the symptoms associated with EIMD, however few have examined the efficacy of compression garments following sports specific paradigms.

**PURPOSE:** To investigate the efficacy of a lower limb compression garment in accelerating recovery from indices of muscle damage following a Marathon run.

**METHODS:** Twenty four subjects (n= 7 female, n= 17 male, mean  $\pm$  SD age  $42 \pm 10$  yrs, height  $176 \pm 8.6$ cm and body mass  $77.4 \pm 11.0$  kg) completed a Marathon run before being assigned to a treatment or placebo group. The treatment group wore lower limb compression tights for 72 hours following the Marathon run, the placebo group received a single treatment of 15 min sham ultrasound following the Marathon run. Perceived muscle soreness, maximal isometric voluntary contraction (MIVC) and serum markers of creatine kinase (CK) and c-reactive protein (C-RP) were assessed before the Marathon, immediately after, and at 24, 48 and 72 hours post Marathon.

**RESULTS:** All subjects completed the Marathon run (mean  $\pm$  SD finish time 03:46:45  $\pm$  00:22:00 in the compression group and 03:39:27  $\pm$  00:33:10 in the placebo group). Muscle soreness, assessed using a visual analogue scale, was significantly lower ( $p < 0.05$ ) in the compression group at 24 h post Marathon when compared to the placebo group ( $13.9 \pm 13.0$ mm and  $36.4 \pm 11.6$ mm respectively). There were no significant group effects for MVIC, CK and C-RP ( $p > 0.05$ ).

**CONCLUSIONS:** There is some evidence to suggest that compression garments result in improved perceptions of recovery. However, the use of a lower limb compression garment does not attenuate markers of muscle damage or inflammation, nor does it accelerate the recovery of muscle function following a Marathon run.

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**3380 Board #101 June 2 9:30 AM - 11:00 AM**  
**Whole Body Compression Garment Promotes Muscular Strength Recovery After Strenuous Resistance Exercise**

Kazushige Goto, Takuma Morishima. *Ritsumeikan University, Kusatsu, Japan.* (Sponsor: Robert Kraemer, FACSM)  
(No relationships reported)

A recent study demonstrated that the use of whole body compression garment (CG) during 24 h after exercise enhances muscular strength the following day. However, detailed time-course changes in muscular strength from wearing CG remains unclear.

**PURPOSE:** We determined time-course changes in muscular strength, anabolic hormones and inflammatory responses after resistance exercise throughout 24 h recovery period with CG.

**METHODS:** Nine trained athletes conducted strenuous resistance exercise (3-5 sets, 9 exercises) in two different conditions, either wearing (CG trial) or not wearing (NCG control trial) the CG during a 24 h recovery period. Muscular strength, hormonal concentrations and inflammatory responses were evaluated continuously.

**RESULTS:** In both trials, one-repetition maximum (1RM) for chest press (upper limb) was significantly decreased after resistance exercise ( $P < 0.05$ ). However, the CG trial showed significantly faster recovery during 3-8 h after the exercise than the NCG trial ( $P < 0.05$ ). Similarly, recovery of maximal isometric strength for knee extension (lower limb) was significantly faster in the CG trial at 24 h after the exercise ( $P < 0.05$ ). The CG trial showed significantly lower muscle soreness and fatigue at rest on next morning compared with NCG trial ( $P < 0.05$ ). No significant difference was observed in the responses of blood lactate, creatine kinase (CK), myoglobin, free testosterone, insulin like growth factor(IGF)-1, interleukin (IL)-6, and IL-1 receptor antagonist throughout the 24h recovery period between trials.

**CONCLUSION:** These results indicate that the use of compression garment during post-exercise facilitates muscular strength recovery after strenuous exercise. For an upper body, promotion of strength recovery appears to be found within 24 h (3-8h) after the exercise.

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## G-33 Free Communication/Poster - Exercise and Aging II

JUNE 2, 2012 7:30 AM - 11:00 AM  
ROOM: Exhibit Hall

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**3381** Board #102 June 2 8:00 AM - 9:30 AM

### Improving Measures of Stride Length Using a High Velocity Resistance Training Program

Timothy J. Leszczak, Lisa E. Henning, Samantha M. Hart, Tristan G. Trotter. *Austin Peay State University, Clarksville, TN.*  
(No relationships reported)

Research has indicated that improving strength and functional performance in older adults can be accomplished through various training programs. However, few have looked at the use of a high velocity training program on improving measures of stride length.

**PURPOSE:** The purpose of this study was to see if a high velocity training program can improve stride length in community dwelling older adults.

**METHODS:** Eight older adults (5 F, 3 M) over the age of 65 completed the 12 week exercise intervention, and had an average ( $\pm$  SD) age at  $82.25 \pm 9.45$  years. All participants completed an informed consent and received medical clearance from their physician. They were tested three times during the 12-week exercise intervention (pre-intervention, mid-intervention, and post-intervention) on stride length, gait velocity, 8-foot up-and-go, chair stand, and arm curl. The training program consisted of three days per week for 12 weeks, and all exercises were progressed using weighted vest, medicine balls, and ankle weights. The exercises performed were standing hip flexion, standing hip extension, standing heel raises, chair stand, medicine ball slams, medicine ball bounces, and lifting a medicine ball from ground to standing position.

**RESULTS:** A paired samples t-test ( $\alpha = .05$ ) was used to analyze the data to see if within group differences existed between pre-and post-intervention on the aforementioned variables. Results indicated that significant differences existed for gait velocity,  $t(8) = -2.77, p = .03$ ; chair stand,  $t(8) = 3.35, p = .01$ ; and arm curl,  $t(8) = 2.58, p = .04$ .

**CONCLUSION:** Although significant differences were not observed in the stride length variable, gait velocity did improve suggesting that strength may have affected walking ability. This group may have increased their walking frequency enabling them to improve their walking time.

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**3382** Board #103 June 2 8:00 AM - 9:30 AM

### Comparison Of High- And Low-velocity Training In Older Adults: Regional Body Composition Measures

Melissa Powers<sup>1</sup>, Michelle Gray<sup>2</sup>, Kayla Garver<sup>1</sup>, Simon Smith<sup>1</sup>. <sup>1</sup>*University of Central Oklahoma, Edmond, OK.* <sup>2</sup>*University of Arkansas, Fayetteville, AR.*  
(No relationships reported)

Recently, studies have been conducted examining the impact of high-velocity resistance training on functionality among elders. However, it remains unclear if high-velocity training improves body composition especially when compared to training at a lower velocity.

**PURPOSE:** The purpose of this study was to compare regional body composition changes following high-velocity resistance training to those experienced following low-velocity training. The researchers hypothesized that no regional body composition differences would be seen between the two training methods, but that both protocols would improve body composition.

**METHODS:** Seventeen adults over the age of 75 years completed one year of training. Participants were randomly assigned to either high-velocity, low-intensity (HV) or low-velocity, high-intensity (LV) training. HV participants completed 24 weeks of LV before transitioning to HV. Regional body composition was assessed using an iDXA total body scan which measured fat mass (FM) and lean tissue mass (LTM) of the gynoid and android regions. Appendicular FM and LTM as well as the ratio of appendicular LTM to appendicular FM were calculated. Assessments were taken at baseline, 24 weeks, and after one year of training. ANOVA with repeated measures was used to analyze interaction and main effects for each outcome ( $\alpha = .007$ ).

**RESULTS:** No significant interaction effects were observed. A time effect was seen for gynoid LTM,  $F = 7.72, p = .002$ . Post hoc tests reveal a significant loss of LTM from baseline to 24 weeks. Interesting, univariate effect sizes indicate differing effect of training on gynoid LTM from 24 weeks through one year. In the gynoid region, the HV group lost LTM ( $d = 0.138$ ), while the LV group experienced maintenance of LTM ( $d = 0.034$ ).

**CONCLUSION:** Although not statistically significant, we observed a slight decrease in LTM following HV training, while the LV group experienced no change in LTM. This difference may be due to the intensity of training which was not consistent in this study. The HV group trained at a low intensity (50% of 1-repetition maximum), while the LV group trained at a high-intensity (80% of 1-repetition maximum). These results indicate the need for further study. It is recommended that this study be repeated with intensity held constant between the two training protocols.

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**3383** Board #104 June 2 8:00 AM - 9:30 AM

### Leg Strength Declines with Advancing Age Despite Chronic Endurance Exercise in Active Older Adults

Taylor J. Marcell<sup>1</sup>, Petra Martins<sup>1</sup>, Steven A. Hawkins, FACSM<sup>2</sup>, Robert A. Wiswell, FACSM<sup>3</sup>. <sup>1</sup>*California State University Stanislaus, Turlock, CA.* <sup>2</sup>*California Lutheran University, Thousand Oaks, CA.* <sup>3</sup>*University of Southern California, Los Angeles, CA.*  
(No relationships reported)

**PURPOSE:** Recent physical activity guidelines for older adults have included recommendations for resistance training and intensity, whereas earlier versions focused solely on low intensity walking activities. We have previously collected longitudinal data on highly active seniors who have exclusively participated in running as a form of exercise to evaluate whether running alone was sufficient to prevent age-associated sarcopenia.

**METHODS:** Ninety-five very active older men ( $n = 59$ ) and women ( $n = 36$ ) were selected from a population of 237 master athletes participating in a longitudinal study at the University of Southern California. Subjects attend biannual comprehensive physiologic testing between May 1987 and December 2001. Isokinetic knee extension and isometric knee extension and flexion strengths were assessed using a Kin Com dynamometer (500H). Subjects self-reported training and performance data including 5 kilometer, 10 kilometer, and marathon distances.

**RESULTS:** Data were evaluated combined and by age tertiles (50-54 yr, 55-64 yr, & 65-80 yr). Average time between tests was  $4.8 \pm 2.0$  yrs. VO<sub>2</sub> max declined significantly in men ( $48.4 \pm 9.9$  to  $44.8 \pm 9.8$  ml/kg/min;  $p = 0.001$ ) and women ( $43.5 \pm 8.0$  to  $40.6 \pm 9.3$  ml/kg/min;  $p = 0.009$ ). Isometric flexion and extension strengths declined in both men and women at all angles measured (e.g., knee-extension at 60°:  $251.2 \pm 55.3$  N to  $199.8 \pm 56.7$  N;  $p = 0.001$  men &  $158.8 \pm 34.0$  N to  $126.2 \pm 32.5$  N;  $p = 0.001$  women), whereas isokinetic concentric and eccentric strength changes did not reach statistical significance due to large variability in our measures.

**CONCLUSION(S):** Older adults who use aerobic activity as their sole means of exercise demonstrate small losses in aerobic fitness but larger losses in muscle strength. Thus, running alone will not prevent sarcopenia. The largest declines in fitness and strength were associated with those adults who decreased their running volume.

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**3384** Board #105 June 2 8:00 AM - 9:30 AM

### Changes in Self-Reported Fatigue in Postmenopausal Women Induced by Diet or Exercise Behavior Change

Christie L. Ward<sup>1</sup>, Bhibha M. Das<sup>1</sup>, Dolores D. Guest<sup>2</sup>, Ellen M. Evans, FACSM<sup>1</sup>. <sup>1</sup>*University of Georgia, Athens, GA.* <sup>2</sup>*University of Southern Illinois, Springfield, IL.*  
(No relationships reported)

Fatigue is a common clinical complaint among older women. In older adults, poorer body composition, specifically increased adiposity (%Fat) and decreased mineral free lean mass (MFLM), have been linked to increases in self-reported fatigue. The relation between changes in body composition, mediated by behavior modification involving weight loss or exercise, and fatigue in postmenopausal women is not well established.

**PURPOSE:** The aim of this study was to assess the impact of a weight loss diet (WL-D) or resistance training exercise (EX) on self-reported fatigue.

**METHODS:** Sedentary obese (BMI  $\geq$  30-35 kg/m<sup>2</sup>) age matched-women (n=31, 65.0 $\pm$ 5.4 yr, range=59-80 yr) were randomized to a WL-D (n=17) or EX (n=14) intervention for 16 weeks. Weight status and body composition were determined from measures of height, weight and DXA. Fatigue was assessed using the Multidimensional Fatigue Inventory, in which higher scores indicate greater fatigue in the dimension of interest [general (GEN), physical (PHY), mental (MEN), reduced activity (R-ACT), reduced motivation (R-MOT)].

**RESULTS:** Complete data were collected on 22 participants (WL-D n=10, EX n= 12). No differences in %Fat, MFLM, physical activity level or any dimensions of fatigue were found between groups at baseline (all p>0.05). As expected, WL-D decreased body mass (3.6 $\pm$ 4.3 kg, p=0.03), %Fat (1.04 $\pm$ 1.6%, p=0.07) and MFLM (1.3 $\pm$ 1.8 kg, p=0.04), while EX reduced %Fat (1.1 $\pm$ 1.2%, p=0.01) with a concomitant increase in MFLM (0.75 $\pm$ 0.82 kg, p=0.01). WL-D decreased PHY (p=0.045) and R-ACT (p=0.01), while EX reduced R-ACT only (p=0.02). Median splits of each group based on GEN were analyzed to determine if changes in fatigue responses were differentially affected by initial levels of fatigue. In WL-D with lower initial GEN, R-MOT decreased (p=0.02), while WL-D with higher levels of initial GEN reduced both PHY (p=0.03) and R-ACT (p=0.01) over the course of the intervention. When evaluated by initial fatigue level, EX groups demonstrated no significant changes in any dimension of fatigue.

**CONCLUSION:** Weight loss and exercise in obese sedentary older women may differentially attenuate perceptions of fatigue with the effects being impacted by initial level of fatigue. Behavioral interventions to reduce fatigue are warranted.

Support: NIH-HL090455

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**3385 Board #106 June 2 8:00 AM - 9:30 AM**  
**Effects Of Resistive Training On Strength, Self Efficacy, And Physical Activity In An Elderly Population**

Elizabeth K. Bailey, Elizabeth Cooper. *Elon University, Elon, NC.* (Sponsor: Stephen P. Bailey, FACSM)  
(No relationships reported)

Sarcopenia can affect a range of quality of life issues and exacerbate a loss in self efficacy with aging. Resistive training is shown to result in increased strength across the lifespan, and to have positive effects on measures of quality of life and self-efficacy in older adults. These positive outcomes could result in increased physical activity in the elderly, mediating further sarcopenia.

**PURPOSE:** The purpose of this study is to investigate the effect of resistive training on measures of strength, balance, self efficacy and physical activity in an elderly independent living population.

**METHODS:** Participants were recruited via the newsletter of a local retirement community. All interested participants were enrolled in the study once they were cleared for resistive exercise training (N=15, Age=81.3 + 2.3yrs). Prior to the start of the program and upon its conclusion, participants completed the Self Efficacy Scale (SES), and the Physical Activity Scale for the Elderly (PASE). Upper and lower body strength was evaluated via a timed bicep curl test and hand grip dynamometer, and up and go and sit to stand timed trials respectively. Balance was evaluated using the tandem walk test. Biweekly resistive training sessions over 8 weeks consisted of the 8 exercises described in the Strong Women Stay Young program (SWSY). Level of resistance was determined individually using a questionnaire developed for the SWSY program that estimates current level of strength.

**RESULTS:** An improvement in lower body strength (Sit to Stand: Pre=12.2 + 0.62 repetitions in 30 sec, Post=14.15 + 0.74 repetitions in 30 sec, p<0.01; Up and Go: Pre = 6.99 + 0.28 sec, Post = 6.2 sec + 0.26 sec, p<0.01) was observed and increased physical activity reported on the PASE (Pre=94.46 +15.04, Post=120.53 + 14.26; p=0.02). No other significant changes were noted. The relative improvement in PASE was correlated with a reduction in the time to complete the Up and Go test (r=-0.54; p=0.05).

**CONCLUSION:** The results support the efficacy of offering resistive training in this population, and suggest a need for further evaluation in a larger group to determine other potential positive outcomes.

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**3386 Board #107 June 2 8:00 AM - 9:30 AM**  
**Effects of Resistive Training upon Functional Tests in Community Dwelling Older Females**

Anntionette N. Roquemore, Thomas S. Marzilli, Joyce E. Ballard, FACSM. *University of Texas at Tyler, Tyler, TX.*  
(No relationships reported)

**PURPOSE:** was to test the effects of 8-weeks of resistive training upon functional tests related to independent living.

**METHODS:** Study was approved by the University's Institutional Review Board (IRB). Thirty females (60-81 years of age), recruited from the community, were screened by their physicians, and signed informed consents. Volunteers were randomly assigned to exercise class or a control group. Age, body weight, standing height, and pre-exercise blood pressures were obtained on all clients. Exercise group was tested pre and post training with 1-Repetition Max, (1-RM) on 10 machines: 5-Upper Body stations/5-Lower Body Stations. Functional tests, assessed pre and post in both groups, were: 2-minute stepping in place, 30-sec chair-stand, 30-sec 5-lb arm curl, 8 ft up and go, back-scratch, chair sit & reach and 6-min walk (done only by exercise group). The exercise class was conducted 2 days/wk for 65 min/session. Exercise logs were compiled for activity (primarily walking) performed outside of class. Kinesiology students acted as personal-one-on-one trainers for the exercise participants. Statistical procedures were: means  $\pm$  SDs, t-tests, and 2X2 ANOVAs (2 groups by pre/post tests). Significance was determined at p  $\leq$  0.05.

**RESULTS:** "t" tests on pretests values between exercise and control groups were not significant for age (yrs), body weight (lbs), standing height (ins), systolic BP (mmHg), or diastolic BP (mmHg). For the exercise group, pre-post paired sample "t"-tests on 1-RM were significant (p<.001) reported as % change at all 10 machines: [Upper Body: (Chest Press (39.3%), Biceps Curl (56.3%), Low Mountain Row (51.3%), Lat Pull (40%), Back Extension (52.9%)] and [Lower Body (Seated Leg Extension (60%), Seated Leg Curl (39.9%), Double Leg Press (99.5%), Leg Abductors (43.1%), & Leg Adductors (55.8%)]. ANOVAs on functional tests revealed significant training effects for groups by tests interactions: 2-minute stepping in place, 30-sec chair stand, 8 ft up and go, 30-sec arm curl and non-significant results for, back scratch and chair sit. Paired "t" test for 6-minute walk in exercise group was also significant.

**CONCLUSION:** An 8-week exercise program showed improvement in strength at 10 sites. Older adult women should be encouraged to increase their strength in order to improve their quality of life.

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**3387 Board #108 June 2 8:00 AM - 9:30 AM**  
**Effects of Resistive Exercise on Brain-Derived Neurotrophic Factor**

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(No relationships reported)

**INTRODUCTION:** Brain-derived neurotrophic factor (BDNF) is a member of the growth factor family that has been shown to regulate neuronal plasticity and health. An acute bout of endurance exercise elevates serum levels of BDNF in both animal and human models. The effects of resistive exercise on serum BDNF levels in humans are lacking and conflicted.

**PURPOSE:** To determine the effects of an acute resistive exercise bout on serum BDNF concentrations in humans.

**METHODS:** Subjects included 13 males (25.1  $\pm$  3.9 yr; 69.7  $\pm$  1.8 in; 89.4  $\pm$  11.4 kg; mean  $\pm$  SD) that were recreationally active but not engaged in competitive sports. The 1 repetition maximum (1RM) was assessed on each subject for six exercises (bench press, squat, lat pulls, tricep extension, shoulder press, hamstring curl). After 48-72 hrs of rest, the subjects completed a bout of resistive exercise at 75% 1RM for each exercise that included 3 sets of 10 repetitions with 2-3 min of rest between each set. Blood samples for serum BDNF and lactate were obtained pre and ~ 5 min after the resistive exercise bout.

**RESULTS:** A small but significant increase (p < 0.05; 14%) in serum BDNF was detected following the resistive exercise bout (.57  $\pm$  .04 ng/ml) when compared to pre-exercise values (.50  $\pm$  .06 ng/ml). As expected, a significant increase (p < 0.05) in lactate occurred following the resistive exercise bout (11.93  $\pm$  2.71mmol/L) when compared to pre-exercise values (1.61  $\pm$  0.66 mmol/L) however, the increase in lactate was not correlated (p > 0.05; r = .21) with the increase in serum BDNF.

**CONCLUSIONS:** An acute bout of resistive exercise upregulates serum BDNF concentrations but the increase does not appear to be associated with high levels of lactate. Resistive training may be an effective mode of exercise to improve neuronal health.

3388 Board #109 June 2 8:00 AM - 9:30 AM

**Resistance Training Prevents Age-related Decline in Exercise Tolerance but not in VO<sub>2</sub>MAX of Older Runners: Preliminary Results of the Sao Silvestre Older Runners Cohort Study**

Emmanuel Gomes Ciolac, Leonardo Kenji Hirao, Júlia Maria D'Andréa Greve, Luiz Eugênio Garcez-Leme. *Institute of Orthopedics and Traumatology, School of Medicine, University of São Paulo, Sao Paulo, Brazil.*

(No relationships reported)

**PURPOSE:** The purpose of present study was to investigate the effects of resistance training on maximal and submaximal parameters of cardiorespiratory fitness (CRF) of older runners.

**METHODS:** Twenty-four elderly male runners (age 69±0.9 years; time of training 21±7.2 years; training frequency 4.5±0.6 days·wk<sup>-1</sup>; training volume 57.5±10.9 km·wk<sup>-1</sup>) performed a graded exercise test before (T1) and after (T2) 8.9±0.2 years of follow-up. The subjects were divided into two different groups: resistance trained older runners (REG, subjects that continued endurance training and initiated a resistance training program 3.1±0.6 years before T2; n=11) and control older runners (CG, subjects that continued endurance training but did not performed resistance training; n=13). Submaximal and maximal parameters of CRF were compared between the two groups.

**RESULTS:** Data are displayed in Table 1. Both groups reduced similarly maximal oxygen consumption (VO<sub>2</sub>MAX) after follow-up (REG = 17.7±2.6%; CG = 23.1±4.9%), but the reduction of VO<sub>2</sub> at respiratory compensation point (VO<sub>2</sub>RCP) was lower in REG than CG (13.8±3.4% vs. 22.1±5.1%; p<0.05). Tolerance time to reach respiratory compensation point (TT<sub>RCP</sub>) and TT<sub>MAX</sub> were reduced in CG after follow-up, but did not change significantly in REG. Maximal heart rate (HR) reduced similar in both groups, but lower reduction of HR<sub>RCP</sub> was observed in REG than CG (4.4±2.6% vs 10.9±1.4%, p=0.03).

**CONCLUSION:** Lower reductions of VO<sub>2</sub>RCP, TT<sub>RCP</sub>, TT<sub>MAX</sub> and HR<sub>RCP</sub> (but not VO<sub>2</sub>MAX and HR<sub>MAX</sub>) were found in REG than CR. These results suggest that regular resistance training may have important implications for reducing age-related decline in CRF of older runners.

Table 1. Graded exercise test parameters

| Variable  | Resistance Trained Runners |            | Control Runners |            |
|---|----------------------------|------------|-----------------|------------|
|   | Before                     | After      | Before          | After      |
| HRRCP (bpm)   | 151.9±5.9                  | 144.0±3.5* | 156.0±4.2       | 139.0±4.1* |
| HRMAX (bpm)   | 170.7±3.9                  | 163.7±3.2* | 172.5±5.4       | 161.8±3.4* |
| TTRCP (min)   | 10.9±0.9                   | 10.1±0.5   | 9.5±0.5         | 7.5±0.5*†  |
| TT2MAX (min)  | 15.5±0.8                   | 14.9±0.6   | 13.8±0.7†       | 12.2±0.5*† |
| VO <sub>2</sub> RCP (ml·kg <sup>-1</sup> ·min <sup>-1</sup> ) | 38.1±1.4                   | 32.8±1.7*  | 35.3±1.3        | 26.5±1.5*† |
| VO <sub>2</sub> MAX (ml·kg <sup>-1</sup> ·min <sup>-1</sup> ) | 45.6±1.5                   | 37.4±1.4*  | 42.8±1.4        | 32.4±1.5*† |
| RER   | 1.15±0.02                  | 1.17±0.02  | 1.13±0.01       | 1.17±0.02  |

\* Different from before follow-up at same group (p<0.05). † Different from resistance trained runners at same period (p<0.05). HR, heart rate; TT, tolerance time; VO<sub>2</sub>, oxygen uptake; RCP, respiratory compensation point; MAX, maximal.

3389 Board #110 June 2 8:00 AM - 9:30 AM

**Resistance Training Induces Positive Effects On Risk Of Falls, Muscle Strength, And Dual Task Performance In Oldest Old Institutionalized Frail Patients**

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(No relationships reported)

The syndrome of frailty describes older people at a higher risk for adverse health outcomes. It is a condition with a complex etiology and pathophysiology. Exercise multicomponent programs and specially resistance training are currently the most relevant interventions to slow down disability and other adverse outcomes. Limited information is available about its effects on balance, gait and falls in the oldest old frail population.

**PURPOSE:** To examine the effects of 12 weeks resistance program on muscle strength, balance, gait and decrease in number and risk of falls in oldest old frail institutionalized patients.

**METHODS:** Participants were included in the study using Fried Criteria. Measurements of upper and lower limb muscle strength (hand grip, flexor hip and knee extensor strength), gait speed (5 m walking test), dual task paradigm (verbal and arithmetic) balance performance (FICSIT-4 Tests of Static Balance: parallel, semi-tandem, tandem, and one-legged stance tests) as well as Time up and Go and rise from a chair tests were conducted before and after intervention. Before starting the program all participants received Individual medical evaluation and were assigned to a twice-weekly 12 weeks progressive resistance program (8-10 reps of 40-60% of 1RM) combined with balance retraining exercises progressing in difficulty.

**RESULTS:** Strength training significantly increased hip flexor (25% P<0.01), knee extensor strength (22%; P<0.01) and rise from a chair test (70%; P<0.01). Strength training-induced gains were also observed in gait velocity and dual task performance (8% and 17%; P<0.10 and P=0.09, respectively). Significant increases in semi-tandem static balance test (P<0.01) were also observed. Significant decrease of incidence (p<0.001) and risk of falls (P<0.01) were observed.

**CONCLUSION:** 12-weeks progressive resistance program combined with balance exercises have positive effects on incidence and risk of falls, muscle strength, dual task performance, gait velocity and balance performance in very elderly institutionalized frail patients. Supported in part by grants of Spanish Ministry of Health, Institute Carlos III, Department of Health of the Government of Navarra and Government of Spain (CSD) RD06/013/1003 and 87/2010 and 008/EPB10/11.

3390 Board #111 June 2 8:00 AM - 9:30 AM

**Periodized Resistance Training and Supplementation: Effects on Body Composition and Muscular Performance in Older Men**

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(No relationships reported)

Investigations examining the effects of non-linearly periodized resistance training (RT) programs designed to promote concurrent increases in lean mass, muscular strength, and functional performance in older men are limited.

**PURPOSE:** To examine the effects of a 12-week RT program with and without creatine and protein supplementation on changes in lean mass, muscular strength, and physical function in older men.

**METHODS:** 22 men, 68.1±6.1 years, 176.8±7.7 cm, 82.7±11.1 kg (mean±SD), were randomized to one of three groups: control (C; n=8); RT only (RT; n=7); and RT combined with supplementation (RTS; n=7). A progressive, total-body RT program was performed 3 days/week for 12 weeks, with supervision. Creatine supplementation (pill form): RTS participants consumed 0.3 g/kg body weight/day for 5 days and then 0.07 g/kg body weight/day until completion of the 12-week program. RTS participants also consumed a ready-to-drink whey protein supplement (35g) immediately post-training and on non-training days. Exercise testing occurred pre- and post-RT intervention to determine changes in body composition (dual-energy x-ray absorptiometry), 1-RM machine chest press (CP) and leg press (LP) strength, and dynamic power (Margaria power stair climb; DP).

**RESULTS:** ANOVA revealed no differences in baseline characteristics among the three treatment groups ( $p>0.05$ ). Independent sample t-tests (C vs. mean of RT and RTS) revealed: RT and RTS groups experienced significantly greater increases in 1-RM CP ( $25\pm 7$  kg and  $20\pm 8$  kg) and 1-RM LP ( $172\pm 46$  kg and  $198\pm 110$  kg) ( $p<0.0001$ ), notable increases in lean mass ( $0.78\pm 1.83$  kg and  $1.33\pm 1.67$  kg;  $p=0.07$ ), and notable decreases in fat mass ( $-1.36\pm 1.93$  kg and  $-0.95\pm 1.78$  kg;  $p=0.17$ ) and percentage body fat ( $-1.36\pm 2.11\%$  and  $-1.63\pm 1.49\%$ ;  $p=0.06$ ); changes in DP were not significant ( $p>0.05$ ). However, additional analyses revealed near significant differences in DP between the RT and RTS groups ( $+58\pm 309$  watts vs.  $+371\pm 361$  watts;  $p=0.06$ ).

**CONCLUSIONS:** 12 weeks of periodized RT increased muscular strength in older men but did not significantly improve body composition or dynamic power performance. Furthermore, the addition of creatine and protein supplementation with RT provided no additional enhancements in body composition, muscular strength, or dynamic power performance.

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**3391** Board #112 June 2 8:00 AM - 9:30 AM

**Resistance Training with or without Protein and Creatine Induces Comparable Aerobic Benefits in Older Men**

Lindsey Jayne Anderson, Matthew Villanueva, E. Todd Schroeder, FACSM. *University of Southern California, Los Angeles, CA.*

(No relationships reported)

**PURPOSE:** To examine the effects of a 12-week resistance training (RT) intervention alone or with creatine and whey protein supplementation (S) on bone mass and aerobic function in older men.

**METHODS:** 22 men  $68\pm 6$  yrs,  $176.8\pm 7.7$  cm,  $82.7\pm 11.1$  kg (mean $\pm$ SD) were randomized into control (CON; N=9), RT (N=6), or RT with S (RTS; N=7). After 12 weeks, some CON participants were further randomized into RT (N=3) or RTS (N=4) for 12 weeks of exercise. Bone mineral density (BMD) and content (BMC) were measured by dual energy x-ray absorptiometry and cardiorespiratory fitness assessed with a 4-minute walk test (estimated VO<sub>2</sub>max) and 400-meter walk time. Creatine dose: 0.3g/kg BW/day (days 1-5) then 0.07g/kg BW/day (day 6+). 35g whey protein drink was consumed daily; immediately after exercise or at home on non-training days. Periodized RT was performed 3 days/week. Some RT/RTS participants served as their own control (CON crossovers) resulting in two distinct statistical analyses. CON vs. RT or RTS (3-group) compared the 1st randomization (N=9 vs. 6 or 7). RT vs. RTS (2-group) compared the 2nd randomization (N=9 vs. 11). Between-group baseline (BL) and 12-week change differences were determined by ANOVA with Bonferroni post-hoc (3-group) or independent t-tests (2-group). Within-group 12-week changes were determined by paired-sample t-tests (2 and 3-group).

**RESULTS:** BL characteristics were not different between groups (2 or 3-group;  $P>0.05$ ). In the 3-group analysis, RT (N=6) significantly increased VO<sub>2</sub>max by  $2.5\pm 1.8$  ml/kgXmin<sup>-1</sup> ( $7.1\pm 5.2\%$ ;  $P=0.02$ ); however, 12-week changes were not different between groups at the adjusted  $\alpha$ -level (0.017). In the 2-group analysis, VO<sub>2</sub>max significantly increased by  $2.2\pm 1.6$  ml/kgXmin<sup>-1</sup> ( $6.3\pm 4.7\%$ ;  $P=0.004$ ) for RT (N=9) and  $1.3\pm 1.8$  ml/kgXmin<sup>-1</sup> ( $3.6\pm 5.0\%$ ;  $P=0.04$ ) for RTS (N=11). Both training groups significantly decreased mean 400-meter walk time by  $24.4\pm 21.1$  seconds ( $11.6\pm 9.4\%$ ) for RT (N=9;  $P=0.008$ ) and  $16.1\pm 16.8$  seconds ( $9.3\pm 10.5\%$ ) for RTS (N=11;  $P=0.01$ ); between-group changes were not different (2-group;  $P>0.05$ ). BMD and BMC did not significantly change (2 or 3-group;  $P>0.05$ ).

**CONCLUSIONS:** 12 weeks of progressive total body RT did not affect bone mass but did improve cardiorespiratory fitness; however, RT with creatine and whey protein supplementation did not provide additive effects.

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**3392** Board #113 June 2 8:00 AM - 9:30 AM

**Effects of a Comprehensive Exercise Program on Functional Capacity of Older Adults**

Trinh D. Nguyen, Peggy A. Plato. *San Jose State University, San Jose, CA.* (Sponsor: Craig Cisar, FACSM)

(No relationships reported)

Although lifespan is increasing, many older adults experience functional impairments and a loss of independence in their later years. An effective intervention for older adults should incorporate activities to enhance functional capacity, as well as being enjoyable to enhance compliance. There is limited research examining functional capacity in older adults following an exercise program that uses body weight as resistance.

**PURPOSE:** To compare the effects of a whole body exercise program (EXER) and a walking program (WALK) on functional capacity of older adults.

**METHODS:** Participants were randomly assigned to a 2 day per week EXER program, incorporating warm-up and stretching activities; upper and lower body, abdominal, and balance exercises; and perceptual-motor games (16 F, 6 M,  $75.5\pm 1.6$  years) or WALK program, walking for 30-45 min at a self-selected pace (3 F, 1 M,  $65.8\pm 1.1$  years). Upper body power (30 s arm curl test), lower body power (30 s sit-to-stand test), static balance (balancing on one foot with eyes open), and dynamic balance and agility (8-foot up-and-go test) were measured before and after the 8 week programs. Statistical significance was adjusted to  $p<0.005$ .

**RESULTS:** The EXER program enhanced functional capacity by increasing upper ( $15.2\pm 1.4$  arm curls pre vs.  $19.3\pm 1.6$  post,  $p<0.001$ ) and lower body power ( $12.8\pm 0.9$  sit-to-stand reps pre vs.  $15.4\pm 1.2$  post,  $p=0.001$ ), and improving agility and dynamic balance ( $7.55\pm 0.34$  s for 8-foot up-and-go pre vs.  $6.43\pm 0.27$  s post,  $p<0.001$ ). There were no significant differences in static balance as a result of the EXER program. In contrast, the WALK group significantly improved static balance in the right leg ( $15.87\pm 4.52$  s pre vs.  $27.90\pm 5.12$  s post,  $p=0.004$ ) and approached significance in the left leg ( $16.30\pm 5.30$  s pre vs.  $28.23\pm 6.61$  s post,  $p=0.018$ ). Although participants in the walking group improved other measured components of functional capacity, there were no significant differences due to low statistical power.

**CONCLUSION:** Older adults can improve components of functional capacity by exercising 2 days a week for 8 weeks using either a whole body exercise program or a self-paced walk. Participants reported that the EXER program, performed in a group setting without external weight, was enjoyable, as well as being physically and mentally stimulating.

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**3393** Board #114 June 2 8:00 AM - 9:30 AM

**Strength Prior To Endurance Intra-session Exercise Sequence Optimizes Neuromuscular And Cardiovascular Gains In Elderly Men**

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(No relationships reported)

**PURPOSE:** To investigate the cardiorespiratory and neuromuscular adaptations to different intra-session exercise sequences during concurrent training in elderly.

**METHODS:** Twenty-six healthy elderly men ( $64.7\pm 4.1$  years), were randomly placed into two concurrent training groups: strength prior to (SE, n=13) or after (ES, n=13) endurance training. Subjects trained strength and endurance training 3 times per week performing both exercise types in the same training session. The peak oxygen uptake (VO<sub>2</sub>peak), maximum aerobic workload (W<sub>max</sub>), absolute (VT1 and VT2) and relative (VT1% and VT2%) ventilatory thresholds, as well workloads at VT1 and VT2 (WVT1 and WVT2) was evaluated during a maximal incremental test on a cycle ergometer before and after the training. In addition, force per unit of active muscle mass (i.e. muscle quality - MQ) was evaluated by the quotient between maximal dynamic strength (one repetition maximum test) of the knee extensors and the quadriceps femoris muscle thickness (sum of the muscle thickness of the four muscles) determined by ultrasonography. The training-related effects were assessed using a two-way Analysis of Variance with repeated measures (group x time).

**RESULTS:** There were no modifications after training in the VT1, VT2, VT1%, VT2%. There was significant increases on WVT1 only in SE ( $61.5\pm 13.0$  watts vs.  $75.0\pm 10.2$ ,  $P<0.05$ ), as well significant increases on WVT2 in both groups (SE:  $94.2\pm 15.0$  vs.  $111.5\pm 16.5$  watts; ES:  $104.2\pm 27.9$  vs.  $122.9\pm 24.9$  watts,  $P<0.001$ ). There was significant increase on the VO<sub>2</sub>peak, with both groups showing increases (SE:  $27.4\pm 6.1$  vs.  $29.5\pm 6.6$  ml\*kg\*min<sup>-1</sup>; ES:  $26.6\pm 6.9$  vs.  $28.8\pm 6.6$  ml\*kg\*min<sup>-1</sup>,  $P<0.001$ ), without difference between groups; as well significant increase on the W<sub>max</sub> (SE:  $121.0\pm 13.4$  vs.  $143.9\pm 19.8$  watts; ES:  $125.2\pm 40.8$  vs.  $155.3\pm 44.0$  watts,  $P<0.001$ ) without difference between SE and ES. The quadriceps femoris force per unit of muscle mass increased in both groups (SE:  $1.95\pm 0.32$  vs.  $2.47\pm 0.32$  kg\*mm<sup>-0.67</sup>; ES:  $2.03\pm 0.26$  vs.  $2.33\pm 0.32$  kg\*mm<sup>-0.67</sup>,  $P<0.001$ ), but the increase was significant higher in SE compared to ES ( $27.5\pm 12.7$  vs.  $15.2\pm 10.3\%$ ,  $P<0.02$ ).

**CONCLUSION:** The intra-session exercise sequence had no influence in the maximal endurance power to concurrent training, but had influence in the magnitude of the muscle quality enhancements.



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3394 Board #115 June 2 8:00 AM - 9:30 AM

**Effects Of A Core Instability Training On Trunk Strength/Mobility And Balance Performance In Seniors**

Urs Granacher<sup>1</sup>, Thomas Muehlbauer<sup>1</sup>, Andre Lacroix<sup>2</sup>, Katrin Roetger<sup>2</sup>, Albert Gollhofer<sup>2</sup>. <sup>1</sup>Friedrich-Schiller-University Jena, Jena, Germany. <sup>2</sup>Albert-Ludwigs-University Freiburg, Freiburg, Germany.  
(No relationships reported)

Deficits in balance and muscle strength/power have frequently been associated with an increased risk of falling in older adults. Traditionally, balance and/or resistance training were applied to counteract these intrinsic fall risk factors. Core instability training involves exercises that are challenging for both, trunk muscles and postural control and may thus have the potential to induce benefits on trunk strength/mobility and balance performance.

**PURPOSE:** The objective of this study was to investigate the effects of a core instability training on measures of core strength, trunk mobility, and dynamic postural control in healthy seniors.

**METHODS:** Thirty-two older adults were randomly assigned to an intervention group (INT; n = 16; age 70.8 ± 5.3 years; 8 females, 8 males) that conducted a 9 week progressive core instability training program (3 times/week) or a control group (CON; n = 16; age 70.2 ± 4.7 years; 9 females, 7 males). Maximal isometric strength (MIS) of the trunk flexors/extensors as well as trunk mobility in the sagittal (SAP) and the frontal (FRP) plane were measured before and after the intervention program. Dynamic postural control was tested while walking 10 m on an opto-electric walkway.

**RESULTS:** Program compliance was excellent with participants of the INT group completing 92.4% of the training sessions. Significant Group x Test interactions were found for MIS of the trunk flexors (34%, p < 0.001) and trunk extensors (21%, p < 0.001), for trunk mobility in SAP (11%, p < 0.001) and FRP (11%, p = 0.06) directions, and for stride velocity (9%, p = 0.018), stride time (5%, p = 0.01), and stride length (3%, p = 0.05) in favor of the INT group.

**CONCLUSION:** Core instability training proved to be a safe and feasible exercise program for older adults accompanied with a high adherence rate. Age-related deficits in measures of core strength, trunk mobility, and walking performance can be mitigated by core instability training in older adults. Thus, this training regimen could be used as an alternative to traditional balance and/or resistance training.

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3395 Board #116 June 2 8:00 AM - 9:30 AM

**Response of Blood Lipids and Adipocytokines to 32-week Exercise Training Without Dietary Intervention**

Joana Carvalho<sup>1</sup>, Elisa A. Marques<sup>1</sup>, Diana Tuna<sup>2</sup>, Tiago Guimarães<sup>3</sup>, Jorge Mota<sup>1</sup>. <sup>1</sup>University of Porto- Faculty of Sport, CIAFEL, Porto, Portugal. <sup>2</sup>Hospital of S. João, Porto, Portugal. <sup>3</sup>University of Porto- Faculty of Medicine, Porto, Portugal.  
(No relationships reported)

Regular exercise training is strongly recommended because of its therapeutic and protective effects against several risk factors for the development of cardiovascular diseases, including obesity and dyslipidemia. Recent studies have implicated adipocytokines in the regulation of atherosclerosis and insulin resistance, however the existing evidence has focused on weight-loss interventions and concomitant fat mass reduction, thus the independent effects of exercise training without weight loss need to be further investigated.

**PURPOSE:** To determine the effects of 32-week exercise training on blood lipid profile and adipocytokines in older adults.

**METHODS:** Forty-seven healthy older adults (61-84 years) participated in an exercise training intervention that included resistance exercise training (2 days/week) plus a multicomponent weight-bearing impact exercise training (1 day/week) for 32 weeks. Outcome measures included body fat and lean mass, total cholesterol (TC), triglycerides (TG), high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), glucose, adiponectin (ADT) and resistin (RST) before and after intervention. A two-way (group and time) factorial ANOVA, with repeated measures on one factor (time), was performed for differences in main effects and time by group interactions for each dependent variable.

**RESULTS:** After 32 weeks, both men and women significantly decreased TC (3.6±15.9%), TG (2.9±33.4%), and ADT (4.8±21.7%), while LDL-C, glucose, and TC/HDL-C ratio remained unchanged. In addition, RST significantly increased by 38.9% (p<0.001). No significant body weight, fat mass and lean mass alterations were observed after exercise training, and changes in body composition variables were not correlated with change in ADT and RST concentrations after 32 weeks.

**CONCLUSIONS:** Exercise training without weight loss is associated with a significant decrease in ADT and an increase in RST levels in older adults. Results further support the beneficial role of long-term exercise training on improving lipid risk factors.

Supported by Foundation for Science and Technology (FCT) Grant PTDC/DES/108780/2008 - FCOMP-01-0124-FEDER-009606, and individual grant SFRH/BD/36319/2007.

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3396 Board #117 June 2 8:00 AM - 9:30 AM

**Low-Intensity Resistance Training Using an Elastic Band Improves Muscle Mass and Function in Older People**

Kenji Matsutani, Koji Sato, Motoyuki Iemitsu, Toshiyuki Kurihara, Tetsuya Kimura, Tadao Isaka, Takafumi Hamaoka, FACSM, Satoshi Fujita. *Ritsumeikan University, Kusatsu, Japan.* (Sponsor: Takafumi Hamaoka, FACSM)  
(No relationships reported)

Age associated decrease in skeletal muscle and function (sarcopenia) leads to an increased risk of fall, fracture, and bedridden. Resistance exercise is a useful intervention to increase skeletal muscle mass and strength in older adults. Previous study has shown exercise intensity is a critical factor in muscle hypertrophy and strength gain associated with resistance exercise; however, another recent study has also suggested that even 30% 1-RM with high exercise volume stimulates muscle anabolism.

**PURPOSE:** To investigate whether the low-intensity resistance training using an elastic band improves muscle mass and function in older men and women.

**METHODS:** We performed a 3-month randomized controlled trial: 28 healthy older men and women (age: 67.9±6.7 yr) were assigned to either training (men: n=5, women: n=9) or control group (men: n=5, women: n=9). Exercise intensity of elastic band (Thera-Band) was measured by loadcell. Subject performed the elastic band resistance training two times per week for 12 weeks (13 lower and upper body exercises including 3 leg exercises, one set of 10 reps, RPE: 13-15). Quadriceps muscle cross sectional area (CSA) was measured by MRI and free fat mass was assessed by DXA. Knee extension and flexion strength were measured by BIODEX, and measurements of functional strength were also assessed.

**RESULTS:** Exercise intensities of band exercises were 43.2±14.2% and 40.2±9.7% MVC in knee extension and elbow flexion, respectively. Changes in quadriceps muscle CSA and free fat mass were significantly higher in training group (CSA: 4.1%, FFM: 3.3%) compared to control group (CSA: -1.3 %, FFM: -0.6%) (P<0.05). Change in knee extension strength was significantly higher in training group (11.5%) compared to control group (-2.1%) (P<0.05). However, no significant difference was observed in knee flexion strength in either group. Scores of 8-ft Up & Go and 30-second Chair stand improved significantly after resistance training (P<0.05). However, no significant change in grip strength or flexibility was observed.

**CONCLUSION:** Although exercise intensity of elastic band was approximately 40% MVC, muscle mass and function were improved significantly after 12 weeks of resistance training in older men and women.

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3397 Board #118 June 2 8:00 AM - 9:30 AM

**Effects Of A University-based Exercise Program Intervention As Compared To Community-dwelling Seniors**

B. Sue Graves, Anita D'Angelo, HFS. *Florida Atlantic University, Boca Raton, FL.*  
(No relationships reported)

**PURPOSE:** This study compared balance (postural control) and fitness levels of seniors, who attended a structured twelve-week university-based exercise program, to other community-dwelling individuals.

**METHODS:** Twenty seniors (P) participated in three supervised exercises sessions per week, performing both walking and resistance exercise (70.6±7.3 yrs, 171.4±7.6 cm, 82.4±3.8 kgs). Another group (C) of fourteen seniors (64.3±8.0 yrs, 166.6±8.4 cm, 75.7±1.5 kgs), who exercised on their own, were compared to the first group. Each group was tested at the beginning and end of twelve weeks. Both groups were evaluated using the Senior Fitness Test for measures of functional strength, aerobic endurance, dynamic balance and agility, and flexibility, plus the Sensory Organization Test.

**RESULTS:** Following the twelve-week training period, there were no significant improvements in either group for the Senior Fitness Test (Chair Stand (sec), P, 13.4+3.87, C 14.57+2.44, p=0.32; Arm Curls (n), P, 16.3+3.55, C 15.64+3.17, p=0.58; Sit and Reach (in), P, 2.84+3.55, C 1.07+2.48, p=0.21; Back Scratch (in), P, -2.51+4.21, C -2.25+4.81, p=0.87; Eight-foot Up and Go (sec), P, 5.41+0.91, C 5.41+1.20, p=0.98; Six Minute Walk (sec), P, 609.8+67.27, C 647.5+104.9, p=0.25). The Sensory Organization Test was not significant for between the groups (P, 83.2+2.87, C 82.21+4.02, p=0.46). C was also significantly younger (p<0.02) and were more recreationally active.

**CONCLUSIONS:** The results of this university-based exercise program indicate the need to include additional training for flexibility, dynamic balance, and agility in the structured exercise program, since no differences were seen between groups in the performance measures.

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**3398** Board #119 June 2 8:00 AM - 9:30 AM

**Effect of Body Mass-Based Squat Training on Knee Extensor Strength in Frail Elderly**

Eiji Fujita, Yasuhide Yoshitake, Yohei Takai, Hiroaki Kanehisa. *National Institute of Fitness and Sports in Kanoya, Kagoshima, Japan.*

(No relationships reported)

For the elderly individuals with lower force-generation capacity, training program which mainly consisted of body mass-based exercises can be a measure to improve knee extensor torque (KET). However, the magnitude of the exercise-induced gain in KET has a large inter-individual variation. Considering that the muscular activity of the quadriceps femoris muscles (QF) during the squat exercise is associated to KET relative to body mass (KET/BM), the strength improvement by the training will depend on the association between KET/BM and the activity level of QF during the squat exercise before intervention.

**PURPOSE:** This study aimed to examine 1) the effect of body mass-based squat training on KET in frail elderly, and 2) how the extent of the gain in KET can be associated with the muscular activity level of QF during the exercise before intervention affects.

**METHODS:** Eleven frail elderly individuals aged 74 to 88 yrs who used the long-term care insurance system voluntarily participated in a training program consisted of body mass-based squat using a standard chair (34 reps/day, 3days/week, 12weeks). Before and after the intervention, KET during maximal isometric voluntary contraction (MVC) and electromyogram (EMG) activities of the rectus femoris (RF) and vastus lateralis (VL) muscle during MVC and the squat tasks were determined. The rectified EMG signals during the squat task were averaged and normalized as the relative value (%EMGmax) to that during MVC. The %EMGmax values for RF and VL were averaged and used an index of QF activity levels during the squat task (QF %EMGmax).

**RESULTS:** The squat training increased KET/BM by 22.8%, and decreased QF %EMGmax by -35.4% compared to before intervention. The relative change in KET/BM were correlated to the QF %EMGmax before the intervention ( $r = -0.68, P < 0.05$ ).

**CONCLUSIONS:** While body mass-based squat training is effective to improve KET/BM in frail elderly, the magnitude of the strength improvement depends on the association between KET/BM and the activity level of QF during the squat exercise before intervention.

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**3399** Board #120 June 2 8:00 AM - 9:30 AM

**Short-term Changes in Resistance Training Exercise Confidence in Young and Older Adults**

Sandor Dorgo<sup>1</sup>, Rebecca J. Reed-Jones<sup>1</sup>, Chandrasekhar Bulusu<sup>1</sup>, Chantal A. Vella<sup>2</sup>. <sup>1</sup>University of Texas at El Paso, El Paso, TX. <sup>2</sup>University of Idaho, Moscow, ID.

(No relationships reported)

Improving exercise confidence is essential for untrained individuals to promote long-term exercise adherence. However, it is unclear what training intensity is needed to improve one's exercise confidence.

**PURPOSE:** To compare changes in resistance training exercise confidence using traditional resistance (TR) and minimal resistance (MR) intensities between untrained groups of older adults (OA) and younger adults (YA) over a three-week period.

**METHODS:** 39 untrained OA (mean±SD age: 67.5±5.9 y) and 28 YA (mean±SD age: 23.3±3.9 y) with no experience in resistance training were randomly assigned to either TR or MR group. Two exercises were used: the bench press representing a multi-joint exercise, and the triceps pressdown as a single-joint exercise. Subjects performed three sets of 10 repetitions on two days/week for three weeks. Subjects in the TR group trained at 75% of 1RM intensity, while subjects in the MR group used minimal (< 10% of 1RM) intensity. Subjects rated their level of confidence on executing the two exercises using a 100-point visual analog scale with anchors, at the end of each week. Data were compared between OA and YA, as well as between the TR and MR groups using a general linear mixed model with alpha level set at p<0.05.

**RESULTS:** There were no baseline differences in the bench press confidence between OA (32.6±31.7) and YA (27.7±28.5) and between TR (33.6±30.8) and MR (26.7±29.4) (p≥0.203), or in the triceps pressdown confidence between OA (33.3±29.1) and YA (32.5±29.4) and between TR (33.7±28.9) and MR (32.1±29.6) (p≥0.426) groups. There was a significant time effect for all groups for both exercises (p<0.001) as confidence scores increased by 52% to 111%. Non-significant group (TR vs. MR) by time (p≥0.479) and group (TR vs. MR) by age (OA vs. YA) by time (p≥0.478) interactions were observed. However, the age (OA vs. YA) by time interaction was significant for both the bench press (p=0.039) and the triceps pressdown (p=0.023).

**CONCLUSION:** Our data showed that untrained OA and YA initially indicated similarly low levels of exercise confidence for the two resistance training exercises. Exercise confidence improved significantly in both OA and YA regardless of the exercise intensity. Our findings also suggest that exercise confidence of YA increased at a greater rate compared to OA within the three-week period.

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**G-34** Free Communication/Poster - Exercise: Energy Expenditure

JUNE 2, 2012 7:30 AM - 11:00 AM

ROOM: Exhibit Hall

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**3400** Board #121 June 2 9:30 AM - 11:00 AM

**How Mode of Exercise Affects Accuracy of BodyBugg and PolarHR Monitor Estimates of Caloric Expenditure**

Austin W. Bills, Julie E. Taylor. *Southern Utah University, Cedar City, UT.*

(No relationships reported)

**INTRODUCTION:** Various methods for estimating energy expenditure have become available to aid individuals in monitoring their caloric expenditure and managing caloric intake accordingly. Two popular devices for estimating caloric expenditure were tested in this research; the BodyBugg (Bodymedia, Pittsburg, PA) and the RS400 Heart Rate Monitor (Polar Electro Inc. Lake Success, NY).

**PURPOSE:** Determine the validity of these devices compared to direct measures of VO<sub>2</sub>. A secondary purpose was to determine if two different modes of exercise would affect the accuracy of these two devices: treadmill and rowing exercise.

**METHODS:** Twelve men and twelve women ages 18-60 years were recruited. This study was approved by the IRB of Southern Utah University. Participants completed informed consents and health histories to ensure they were apparently healthy. Prior to exercise, participants were fitted with a BodyBugg, a HR monitor and a face mask to collect expired gases. All participants performed 24 minutes of submaximal (60%-70% max HR) treadmill exercise. Twelve participants on a separate day also performed 24 minutes of submaximal rowing exercise (n=6 men, 6 women). Following the exercise bout, caloric expenditure from both devices was recorded and compared to caloric expenditure measured via indirect calorimetry using oxygen consumption and RER (VCO<sub>2</sub>/VO<sub>2</sub>) levels. Paired t-tests were used to compare caloric estimates from each device relative to VO<sub>2</sub> measures. Statistical significance was set at p< 0.05.

**RESULTS:** BodyBugg overestimated caloric expenditure during treadmill exercise by 1.4 kCals/min ( $\pm 1.6$ ) for men and 0.6 kCals/min ( $\pm 0.8$ ) for women ( $p < 0.05$ ). Polar HR monitor overestimated during rowing exercise on average by 2.0 kCals/min ( $\pm 1.2$ ) for men only ( $p < 0.05$ ).

**CONCLUSION:** The BodyBugg may be more accurate for exercises requiring upper body emphasis while the Polar HR monitor may be more accurate for lower body exercises (especially for men). Consumers should consider their most common mode of exercise prior to purchasing either device.

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**3401** Board #122 June 2 9:30 AM - 11:00 AM

**The Benefits of Electrical Muscle Stimulation on Resting Metabolism**

Craig Broeder, FACSM<sup>1</sup>, Dimitria Vandarakis<sup>1</sup>, Amanda J. Salacinski<sup>2</sup>, Steven M. Mauk<sup>3</sup>, Laurie A. Schubert<sup>1</sup>, Richard Hickey, III<sup>2</sup>. <sup>1</sup>Exercising Nutritionally, LLC, Naperville, IL. <sup>2</sup>Northern Illinois University, DeKalb, IL. <sup>3</sup>Adrian College, Adrian, MI.  
(No relationships reported)

**PURPOSE:** Electrical muscle stimulation (EMS) use has shown improvements in muscle strength and endurance. Thus, EMS may have a positive effect on energy expenditure during EMS muscles activation. This study determined the effects of a FDA approved medical grade electrical muscle stimulator system on enhancing energy expenditure at rest in healthy, active adults.

**METHODS:** Thirty-eight subjects (males =19; females =19) participated. Each subject performed the following items: a Block short-form food frequency questionnaire, body composition assessment (Inbody 520), a free-living physical activity assessment (BodyMedia Armband), a maximal aerobic capacity treadmill test (VO2 max), practice resting metabolic rate (RMR) and EMS accommodation training, and two standardized RMR trials with and without Contour MX9 EMS activation. The resting trials with and without EMS were performed in duplicate. The EMS level was set to the strength setting at level 3 (Contraction Phase = 6-sec at 85Hz; Rest Phase = 4-sec at 10hz).

**RESULTS:** Subject characteristics were age ( $27.9 \pm 6.9$  yrs), Wt ( $168.1 \pm 37.4$  lbs), BodyFat ( $21.2 \pm 8.7\%$ ), VO2 max ( $44.0 \pm 8.3$  ml/kg/min), 24-hr energy expenditure ( $2,881 \pm 637$  kcal), Daily Steps ( $10,630 \pm 4,687$ ). Test-retest data showed that both the non-EMS (Delta: 1.2%; r-value: 0.93; SEE: 15 kcal; p-value 0.0001) and EMS trials (Delta: 0.8%; r-value: 0.94; SEE: 27 kcal; p-value 0.0001) were highly reliable. In men, EMS activation increased RMR 22% ( $p=0.001$ ) and HR 13% ( $p=0.01$ ). In women RMR and HR increased 16% ( $p = 0.0005$ ) and 14% ( $p=0.03$ ), respectively. Interestingly, when subjects were divided into low vs high EMS tolerance levels (% of max EMS unit activation output), both groups showed similar increases in RMR (Low = 19% and High = 20%, NS). Abdominal lean muscle mass showed the highest independent correlation to the EMS activation effect for all subjects (r-value: 0.89,  $p = 0.0001$ ). Compared to predicted RMR values, 47% of the subjects had non-EMS RMR values > predicted. In contrast, RMR with EMS, 76% of the subjects exceeded the predicted norm (Chi Square = 9.40,  $p=0.002$ ).

**CONCLUSIONS:** These results indicate the Contour MX9 EMS system acutely increases a person's RMR. Future studies need to determine the chronic effects of EMS on muscle metabolism including insulin sensitivity and glucose tolerance.

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**3402** Board #123 June 2 9:30 AM - 11:00 AM

**Effects Of Using Active Video Game On Body Weight And Fat Mass In Adults: A Randomized Intervention Trial**

Motohiko Miyachi<sup>1</sup>, Haruka Murakami<sup>1</sup>, Ryoko Kawakami<sup>1</sup>, Yuko Gando<sup>2</sup>, Azusa Sasaki<sup>1</sup>, Satoshi Hanawa<sup>1</sup>, Aiko Hirotsako<sup>1</sup>, Tatsuya Nishikata<sup>3</sup>. <sup>1</sup>National Institute of Health and Nutrition, Tokyo, Japan. <sup>2</sup>Waseda University, Tokorozawa, Japan. <sup>3</sup>NKS data, Tokyo, Japan.  
(No relationships reported)

**BACKGROUND:** Active video game systems controlled through arm gestures and motions and force plate-controlled video games (Wii Fit Plus) are becoming increasingly popular. We previously revealed that time spent playing one-third of activities supplied by Wii Fit Plus can count toward the daily amount of exercise required according to the guidelines provided by the ACSM and AHA which focus on 30 minutes of moderate-intensity daily physical activity five days a week.

**PURPOSE:** To examine the effects of home-based intervention using Wii Fit Plus on body weight and composition.

**METHODS:** Randomized controlled trial conducted in 2010. A total of 40 adult men ( $n=6$ ) and women ( $n=34$ ) aged 21 to 50 yrs participated. Participants were randomly assigned to an intervention group ( $n=20$ ) or a control group ( $n=20$ ) after baseline measurements. The intervention group have played favorite games for 200 min per every week for one month. At baseline and after one month, height, weight, waist circumference, %fat, and lean body mass were measured.

**RESULTS:** One-month data were available for 39 men and women. The intervention group showed significant differences from controls in baseline to one-month changes in body weight (-2.0 kg,  $P < 0.001$ ), waist circumference (-1.8 cm,  $P < 0.001$ ), and body fat mass (-0.9 kg,  $P < 0.01$ ). There was no such between-group difference in %fat (-0.4%, NS) and lean body mass (-0.6 kg, NS).

**CONCLUSIONS:** The daily use of active video game systems controlled through arm gestures and motions and force plate-controlled video games (Wii Fit Plus) is efficacious for body weight and fat mass reductions in adults.

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**3403** Board #124 June 2 9:30 AM - 11:00 AM

**Comparing The Energy Cost Of Two Body Shaper Undergarments During Walking**

Claire Brady, Corey A. Rynders, Frank I. Katch, FACSM, Arthur Weltman, FACSM. University of Virginia, Charlottesville, VA.  
(No relationships reported)

**PURPOSE:** We previously reported that wearing a body shaper undergarment with built in resistance bands increased the energy cost of walking by 3-5% compared to wearing usual undergarments. The present study compared the energy cost of wearing the resistance band body shaper undergarment (ShaToBu, Mayfair Tech Montreal Canada) to a commercially available shaper undergarment without resistance bands.

**METHODS:** Fifteen women completed testing (mean $\pm$ SD; age= $41.3 \pm 14.0$  yr; BMI= $28.4 \pm 3.4$  kg/m<sup>2</sup>). Subjects completed two continuous 10-min treadmill walking tests separated by 15-min of seated rest. Treadmill percent grade was 5% over the first 5-min and increased to 10% over the last 5-min. The ShaToBu body shaper undergarment was worn during one of the walking tests and a commercially available shaper was worn during the other with order randomized. Indirect calorimetry assessed energy expenditure (EE) throughout the walk (Oxycon Mobile, Cardinal Health, Yorba Linda, CA).

**RESULTS:** Wearing the undergarment with resistance bands resulted in a 4.6% higher EE at 5% grade,  $5.9 \pm 1.3$  kcal vs.  $5.6 \pm 1.2$  kcal ( $p=0.01$ ).

**CONCLUSIONS:** The body shaper with resistance bands increased the energy cost of walking uphill at 5% grade (typical of an activity of daily living) by 4.6%. This difference in EE is virtually identical to the differences reported previously with usual undergarments and suggests that the resistance bands, rather than the compressive nature of the garment, accounts for the increased EE. Wearing a body shaper during activities of daily living that increases EE may help to offset the small energy gap (~30 to 50 kcal daily) commonly associated with yearly weight gain.

Supported by an unrestricted gift to the University of Virginia from Mayfair Tech, Inc. F.I. Katch, and A. Weltman serve as scientific advisors to Mayfair Tech, Inc.

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**3404** Board #125 June 2 9:30 AM - 11:00 AM

**Energy Cost of Active and Sedentary Music Video Games: Drum and Handheld Gaming versus Walking**

Scott Mazzetti, Michael T. Kolankowski, Vincent Gutierrez, Brittany S. Wilkerson, Matthew Overstreet, Edwin R. Miranda, Ryan Sapp, Christina Orcino. Salisbury University, Salisbury, MD.  
(No relationships reported)

**PURPOSE:** The purpose of this study was to compare energy expenditure during and after active and handheld video game drumming compared to walking on a treadmill.

**METHODS:** Eleven experienced college-aged men performed four protocols, one per week, after an overnight fast. Expired air was collected during (30min) and after (30min) active drumming on a drum pad (DRUM), virtual drumming on a handheld gaming device (HANDHELD), walking on a treadmill at 35% of VO<sub>2</sub>max (WALK), and no-exercise seated control (CTRL). DRUM and HANDHELD song lists were identical.

**RESULTS:** Significant differences ( $p \leq 0.05$ ) among the average rates of energy expenditure (kcal.min<sup>-1</sup>) included WALK > DRUM > HANDHELD (see Table). There were no significant differences in the rates of energy expenditure among groups during recovery. Total energy expenditure was significantly greater ( $p \leq 0.05$ ) during WALK ( $231 \pm 80.0$  kcal) compared to DRUM ( $177 \pm 31.0$  kcal) and HANDHELD ( $112 \pm 24.9$  kcal), and greater during DRUM compared to HANDHELD.

**CONCLUSIONS:** Active video game drumming significantly increased energy expenditure compared to handheld, but energy expenditure was greatest during walking. Thus, traditional aerobic exercise remains important for achieving the minimum amount and intensity of physical activity for health. Energy expenditure with handheld video game drumming was nearly identical to no-exercise control, demonstrating that handheld video game devices provide essentially no stimulus for increased metabolism.

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**3405** Board #126 June 2 9:30 AM - 11:00 AM

**Multi-sensor Armband Quantification Of Energy Expenditure During Loaded Vs Unloaded Uphill Walking**

Amine N. Issa, Nicole M. Herman, Micah W. Johnson, John W. Kelsey, Andrew D. Miller, Thomas P. Olson, Bruce D. Johnson. *Mayo Clinic, Rochester, MN.*  
(No relationships reported)

**PURPOSE:** The BodyMedia© Sensewear armband measures movement (biaxial accelerometry), heat flux and galvanic skin response (GSR) to derive energy expenditure (EE) using customized algorithms. This EE estimation has compared favorably to doubly labeled water techniques, and thus, has been used in a growing number of clinical and non-clinical studies. However, quantifying EE during loaded vs. unloaded treadmill exercise is difficult due to the high reliance of algorithms on motion data. The purpose of the present study was to determine the ability of standard device algorithms for tracking EE during uphill walking with and without a backpack, and if inadequate, to determine how closely the measured physiological metrics tracked EE.

**METHODS:** Eight healthy males, (age=34±3 yrs, ht=180±8 cm, wt=78±4 kg) were recruited and performed 2 separate walking tests on a motor driven treadmill. The first included walking for 15 min at 2 mph followed by 15 min at 2 mph with 10, 17.5, and 25% grades. Subjects rested, re-hydrated and subsequently repeated the study with a 15% body weight backpack. Measures of metabolic rate were determined with the Sensewear device and compared with indirect calorimetry using a cardiopulmonary gas exchange system (Medical Graphics©)

**RESULTS:** The average metabolic rates (VO<sub>2</sub>) for walking with no backpack were 7.3, 18.7, 24.9 and 30.4 ml/kg/min at 0, 10, 17.5 and 25% grade, respectively. These values increased progressively using a backpack (8.4, 21.9, 30.8, 40.0 ml/kg/min,  $p < 0.05$ ). The EE estimation by the armband showed a poor but significant correlation with indirect calorimetry with or without the pack ( $r = 0.49$ , and  $0.45$ ,  $p < 0.0001$ , respectively), but significantly underestimated EE under all conditions ( $p < 0.0001$ ). No single metric was found to accurately track energy expenditure. Heat flux ( $r = 0.52$ ,  $p = 0.0005$ ) and GSR ( $r = 0.49$ ,  $p = 0.0041$ ) were the best predictors of energy expenditure in the no pack trial, and GSR was the only variable with a significant correlation ( $r = 0.62$ ,  $p = 0.0008$ ) in the with-pack trial. Using a multiple linear regression model, GSR, heat flux, and biaxial acceleration could only account for 78% of the change in EE.

**CONCLUSION:** For uphill walking on a treadmill, improved algorithms and additional sensors, such as heart rate, may be necessary to adequately quantify metabolic rate.

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**3406** Board #127 June 2 9:30 AM - 11:00 AM

**A Single-Bout of 30-Min Aerobic Exercise Increases Resting Metabolism and Fat Oxidation in Young Women**

Lidia G. De Leon<sup>1</sup>, Belen Feriche<sup>2</sup>, Claudia E. Carrasco-Legleu<sup>1</sup>, Ofelia Urita<sup>1</sup>, Diana Espino<sup>1</sup>. <sup>1</sup>University of Chihuahua, Chihuahua, Chih., Mexico. <sup>2</sup>University of Granada, Granada, Spain.  
(No relationships reported)

Physical activity has demonstrated a consistent contribution to weight loss in men and women, but intensity and duration of exercise have different impact on the magnitude of changes in resting metabolism, so results can be very heterogeneous. Describing changes on resting energy expenditure and respiratory quotient is essential to understand their relationship with body weight and clarify the influence of physical activity on weight control.

**PURPOSE:** To determine the effect of a single-bout of 30-min aerobic exercise at 50% of maximal oxygen uptake on resting energy expenditure and respiratory quotient in sedentary young women with normal weight or overweight.

**METHODS:** Twenty six sedentary healthy women, 18 to 35 years of age, 19 with normal weight (NW) and 7 overweight or obese (OW) were measured by height, weight and body mass index (BMI). Maximal oxygen uptake (VO<sub>2</sub>max) was obtained by an exercise stress testing before to perform a single-bout of 30-min-treadmill walking at 50% of VO<sub>2</sub>max. Resting energy expenditure (REE) and respiratory quotient (RQ) were measured by indirect calorimetry before and after the workload. Descriptive statistics and paired t test at a  $p < 0.05$  significance level were used.

**RESULTS:** Age, height and VO<sub>2</sub>max were similar in both groups. Body weight was 37% higher in OW than in NW ( $77.8 \pm 10.3$  and  $56.7 \pm 5.6$  kg respectively,  $p < 0.001$ ). OW had greater BMI than NW ( $29.4 \pm 2.6$  vs  $22.1 \pm 1.9$  kg/m<sup>2</sup>,  $p < 0.001$ ). Absolute REE was higher in OW than in NW, before the exercise ( $1502 \pm 236$  vs  $1260 \pm 178$  Kcal/day,  $p = 0.009$ ) but this relationship was inverted when adjusted by body weight ( $19.4 \pm 2.9$  vs  $22.2 \pm 2.5$  Kcal/day/kg respectively,  $p = 0.049$ ). NW increased REE/kg after 30-min workload from  $22.2 \pm 2.5$  to  $23.6 \pm 2.7$  Kcal/day/kg,  $p = 0.050$ , while OW group had a wide-ranging response (from  $19.4 \pm 2.9$  to  $21.4 \pm 4.8$  Kcal/day/kg respectively,  $p = 0.118$ ). RQ showed a significant decrease after 30-min workload in NW from  $0.74 \pm 0.09$  to  $0.70 \pm 0.07$ ,  $p = 0.006$ .

**CONCLUSIONS:** REE and RQ showed a reciprocal response to a short session of moderate-intensity exercise in NW, but, this level of physical activity was not able to produce effects in OW. It is possible that evident lower fat oxidation rate in OW group, may suppose important repercussions in body weight control.

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**3407** Board #128 June 2 9:30 AM - 11:00 AM

**The Reliability and Validity of the COSMED Fitmate Canopy System for Assessing Resting Metabolic Rate**

Dimitria Vandarakis<sup>1</sup>, Amanda J. Salacinski<sup>2</sup>, Craig E. Broeder, FACSM<sup>1</sup>. <sup>1</sup>Exercising Nutritionally, Naperville, IL. <sup>2</sup>Northern Illinois University, DeKalb, IL, IL.  
(No relationships reported)

**PURPOSE:** This study's purpose was to determine the reliability and validity of measuring resting metabolic rate (RMR) with COSMED's FitMate™ metabolic system using a canopy dilution set-up compared to a previously validated research grade RMR system (COSMED Quark CPET) in 30 healthy adults (Age:  $28.4 \pm 7.0$  yrs, Weight:  $79.9 \pm 20.2$  lbs, Percent Body Fat:  $22.5 \pm 8.6$  %).

**METHODS:** Subjects were randomly assigned to start RMR testing on either the FitMate™ or Quark CPET for four 10-minute measurements (Equalled 20-mins per system tested). Prior to testing, subjects were required to fast 4-hours from food, caffeine, and nicotine. Subjects were not allowed to exercise intensely 12-hrs prior RMR testing. Immediately before the RMR measurements, subjects rested in the supine position for 20-mins in a semi-dark room. Then the ventilatory hood was placed over the subject's head and they rested an additional 15 mins accommodating to the hood set-up while both systems were calibrated. Ambient room temperature was kept at  $22 \pm 1^\circ\text{C}$ .

**RESULTS:** Test-retest intra-class correlations were excellent for all parameters tested (r-value Range: 0.95-0.99,  $p \leq 0.0001$ ). There were no significant differences in Ve (Fitmate:  $33.0 \pm 8.7$  liters/min; CPET:  $32.8 \pm 8.5$  liters/min,  $P = 0.48$ ) RMR (Fitmate:  $1771 \pm 473$  kcal/day; CPET:  $1787 \pm 402$  kcal/day,  $P = 0.55$ ), VO<sub>2</sub> (Fitmate:  $255 \pm 68$  mls; CPET:  $260 \pm 60$  mls,  $P = 0.17$ ), and heart rate (Fitmate:  $62 \pm 15$  bpm; CPET:  $61 \pm 14$  bpm,  $P = 0.32$ ) between the two systems.

**CONCLUSIONS:** These results suggest the FitMate™ can be used with canopy dilution for RMR measurements with the same outcome as more expensive laboratory grade equipment. This will aid wellness and health club facilities in offering this type of measurement, which normally could not occur because the cost was prohibitive.

3408 Board #129 June 2 9:30 AM - 11:00 AM

**The Relationship Between Resting Metabolic Rate, Cardiorespiratory Fitness, And Body Composition**

Robin P. Shook, E. Patrick Crowley, John C. Sieverdes, Kelly Kavanaugh, Madison Demello, Vivek Prasad, Jason Jagers, Gregory A. Hand, FACSM, Steven N. Blair, FACSM. *University of South Carolina, COLUMBIA, SC.* (Sponsor: Steven N. Blair, FACSM)  
(No relationships reported)

**PURPOSE:** Recent research has shown considerable variability of resting metabolic rate (RMR) across various populations, both in absolute values and those adjusted for body weight. The purpose of this study was to examine the relationships between RMR, cardiorespiratory fitness (CRF), body mass index (BMI), and body fat (BF).

**METHODS:** RMR was measured in healthy adults using a ventilated hood system. Participants arrived fasted for at least 12 hrs and having refrained from alcohol or exercise for at least 24 hrs. Participants rested in a supine position under a ventilated hood for 30 minutes, followed by a 30 minute RMR gas collection period. Height and weight were measured and BMI was calculated as body weight (kgs)/height (meters)<sup>2</sup>. CRF was measured via a metabolic cart during a modified Bruce treadmill protocol. BF was calculated as the percentage of total weight identified as fat tissue by dual x-ray absorptiometry.

**RESULTS:** Of the original sample of 55 healthy adults, 48 (22 males and 26 females; mean age 27±3 years) met the criteria for a successful exercise treadmill test (one of the following: plateau of VO<sub>2</sub>, plateau of heart rate, respiratory exchange ratio ≥1.15, or rating of perceived exertion ≥17). The mean±standard deviation BMI for the sample was 26.7±4.5 (men: 27.0±4.2; women: 26.4±4.7) with a mean percent BF of 30.2 (men: 24.7±7.3; women: 34.8±7.6). RMR ranged from 0.17 to 0.32 L/min (men: 0.25±0.037; women: 0.21±0.03) resulting in a mean relative RMR 2.97±0.34 ml/kg/min (men: 2.99±0.33; women: 2.94±0.35). Mean CRF was 37.6 ± 9.2 ml/kg/min (men: 42.1±7.9; women: 33.8±8.5). A statistically significant relationship was detected between CRF and RMR (r=0.61, p<0.0001) in an unadjusted analysis. After adjusting for BMI, a statistically significant relationship remained between RMR and CRF (p=0.0054). However, after replacing BMI with BF the association between RMR and CRF was no longer significant (p=0.0817).

**CONCLUSIONS:** The results of this study indicate that after controlling for BF percent, RMR was not associated with CRF in a sample of normal to obese young adults. These findings demonstrate the role of metabolically active fat free mass in RMR, which may be overlooked if BMI is the only indicator of body fatness examined.

This study was supported by the Coca Cola Corporation.

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**G-35 Free Communication/Poster - Exercise Immunology and Disease**

JUNE 2, 2012 7:30 AM - 11:00 AM  
ROOM: Exhibit Hall

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3409 Board #130 June 2 8:00 AM - 9:30 AM

**The Effect Of Combined Training On Immune Functioning, Metabolic Variables, And Qol In Hiv-infected Individuals**

Eduard Tiozzo<sup>1</sup>, John E. Lewis<sup>1</sup>, Arlette Perry, FACSM<sup>2</sup>, Allan Rodriguez<sup>1</sup>, Dushyantha Jayaweera<sup>1</sup>, Janet Konefal<sup>1</sup>, Angelica Melillo<sup>1</sup>, Larry Chen<sup>1</sup>, Evan Long<sup>1</sup>. <sup>1</sup>University of Miami Miller School of Medicine, Miami, FL. <sup>2</sup>University of Miami, Coral Gables, FL  
(No relationships reported)

Highly-active antiretroviral therapy (HAART) has improved the prognosis of HIV-infected individuals. Unfortunately it has also been associated with impaired functional capacity and development of metabolic perturbations which increases health risk.

**PURPOSE:** This study tested the hypothesis that a combined cardiorespiratory and resistance exercise training (CARET) intervention may result in significant health benefits in HIV-infected individuals receiving HAART.

**METHODS:** Thirty-seven HIV-infected men and women, predominantly of lower socioeconomic status (SES), were recruited and randomly assigned to: 1) a group of moderate-intensity CARET for three months or 2) a control group receiving no exercise intervention for three months. At baseline and following the intervention, physical characteristics (body weight, body mass index, waist circumference, and blood pressure), physical fitness variables (estimated VO<sub>2max</sub> and one repetition maximum for upper and lower body), metabolic variables (fasting glucose and serum lipids), immune functioning (CD4+ T Cell count, CD4/CD8 ratio, and HIV RNA viral load), and quality of life (SF-36 Health Survey) were measured.

**RESULTS:** Exercise participants evidenced increases in estimated VO<sub>2max</sub> (21%, p < 0.01), upper body strength (15%, p < 0.05), and lower body strength (22%, p < 0.05), while showing reductions in waist circumference (-2%, p < 0.05), and fasting glucose (-16%, p < 0.05). While the control group showed a significant decrease in CD4+ T cell count (-16%, p < 0.05) from baseline, the exercise group maintained a more stable count following training (-3%, p = 0.39). Finally, the exercise participants showed self-reported improvements in physical (11%, p < 0.03) and mental (10%, p < 0.02) quality of life.

**CONCLUSIONS:** Our study demonstrated that a three-month, supervised, and moderate intensity CARET program performed three times a week, can result in significant improvements in physical characteristics, physical fitness, metabolic variables, and physical and mental quality of life. Furthermore, the same intervention resulted in more favorable immunological responses following training in HIV-infected individuals of lower SES.

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3410 Board #131 June 2 8:00 AM - 9:30 AM

**The Effect of Exercise Intensity on Chemotherapy Completion Rate in Early-Stage Breast Cancer Patients**

Lianne B. Dolan<sup>1</sup>, Karen Gelmon<sup>2</sup>, Donald C. McKenzie<sup>1</sup>. <sup>1</sup>University of British Columbia, Vancouver, BC, Canada. <sup>2</sup>British Columbia Cancer Agency, Vancouver, BC, Canada.  
(No relationships reported)

The association between survival and the maintenance of chemotherapy dose intensity has been established in early-stage breast cancer (EBC) patients. However, the influence of exercise on the planned chemotherapy dose, (RDI), has been poorly documented.

**PURPOSE:** The purpose of this study is to investigate the effect of exercise intensity during a supervised exercise program on chemotherapy completion rate in women undergoing treatment for early-stage breast cancer.

**METHODS:** Women with EBC receiving adjuvant chemotherapy who participated in a personalized, thrice weekly, supervised exercise program (E), were matched with similar patients undergoing usual care (UC). Subjects were matched based on treatment (6 cycles of FEC-D between 2008-2010), age and body surface area (BSA). Relative dose intensity (RDI), and variables that may influence a reduction in chemotherapy dose (hospitalization days, neutrophil counts, and hemoglobin concentration) were compared between groups.

**RESULTS:** Baseline characteristics between each group of 30 women were similar (age; E= 49.1± 8.4 years, UC= 49.0± 8.6 years, P= 0.916, BSA; E= 1.75 ± 0.27 m<sup>2</sup>, UC= 1.75 ± 0.25 m<sup>2</sup>, P= 0.925). RDI for patients who chose to incorporate short bouts of high intensity exercise (80-90% VO<sub>2peak</sub>) into their program received 91.9± 8.7% of their planned dose. RDI for UC was similar at 90.1± 9%, (P =0.42). Exercise did not have a negative impact on the myelosuppressive effects of chemotherapy (# of episodes where neutrophil counts dropped below 1.0g/L, P= 0.53, decline in hemoglobin concentration, P=0.285), nor did it cause increased risk of hospitalization (P=0.67).

**CONCLUSION:** Women undergoing FEC-D treatment for EBC can incorporate bouts of higher intensity exercise without negatively impacting their treatment.

Supported by the Canadian Institute of Health Research

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3411 Board #132 June 2 8:00 AM - 9:30 AM

**Voluntary Exercise Decreases Tumorigenesis in the C3(1)SV40Tag Mouse Model of Breast Cancer**

E. Angela Murphy<sup>1</sup>, Jennifer L. Steiner<sup>2</sup>, J. Mark Davis, FACSM<sup>2</sup>, Jamie L. McClellan<sup>2</sup>, Martin D. Carmichael<sup>2</sup>. <sup>1</sup>*School of Medicine, University of South Carolina, Columbia, SC.* <sup>2</sup>*University of South Carolina, Columbia, SC.*  
(No relationships reported)

Many observational epidemiologic studies suggest an association between exercise and breast cancer risk. However, the lack of controlled experimental studies that examine this relationship and the mechanisms involved weaken the basis for inferring a causal relationship. Further, the optimal mode, intensity and duration of exercise have yet to be determined.

**PURPOSE:** To examine the relationship between voluntary wheel running activity and breast cancer progression in C3(1)SV40Tag mice.

**METHODS:** Female C3(1)SV40Tag mice were assigned to either exercise (Ex) or sedentary (Sed) treatment (n=9/group). Beginning at 4wks of age C3(1)SV40Tag mice were either placed in a cage with a running wheel (Ex) or in a cage with a locked running wheel (Sed). Mice were examined weekly and at sacrifice (24 wks) for palpable tumors, and tumor number and volume was recorded. At 24wks of age mice were sacrificed and all visible tumors were counted, and measured. Heart weight was also recorded as an indicator of training status.

**RESULTS:** Voluntary wheel running significantly reduced average tumor volume by ~40% at sacrifice (24 wks) (P<0.05) but not tumor number. When Ex mice were grouped by average wheel running distance, a dose dependent effect of exercise on tumorigenesis was observed; mice running  $\geq 3,000\text{m/d}$  had a ~70% reduction in tumor volume at sacrifice. Heart weight expressed as a percentage of total body weight was increased following Ex (P<0.05), indicating that this mode of physical activity provides a sufficient training stimulus.

**CONCLUSIONS:** These data provide strong support for a beneficial effect of voluntary wheel running on tumor progression in the C3(1)SV40Tag mouse model of breast cancer as well as preliminary evidence of a dose-dependent effect of this type of exercise on mammary tumorigenesis. However, further research is necessary to fully understand this relationship and the mechanisms involved.

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3412 Board #133 June 2 8:00 AM - 9:30 AM

**Voluntary Exercise Decreases Tumor Grade in a Mouse Model of Metastatic Breast Cancer**

Jorming Goh<sup>1</sup>, Shu Xian Lee<sup>1</sup>, Emma Endicott<sup>1</sup>, David McDonald<sup>2</sup>, Julio Vasquez<sup>2</sup>, Warren Ladiges<sup>1</sup>. <sup>1</sup>*University of Washington, Seattle, WA.* <sup>2</sup>*Fred Hutchinson Cancer Research Center, Seattle, WA.*  
(No relationships reported)

Although studies report a protective effect of exercise against breast cancer, the biological mechanisms are unclear.

**PURPOSE:** To investigate mechanisms of protective effects of exercise in a mouse model of breast cancer.

**METHODS:** 6-week old Polyoma Middle T Oncoprotein (PyMT) mice were housed singly with access to freely rotating wheels (voluntary exercise) or locked wheels (sedentary) for one month. Mice were monitored weekly for tumor growth. Quantitative Magnetic Resonance was used to assess body composition. Mammary tumors were quantified for tumor burden, formalin-fixed, paraffin-embedded, and stained with Hematoxylin and Eosin (H&E). H&E stained tumors were histologically scored (grade1-4); higher scores reflecting increased tumor invasion and poorer prognosis. Tumors were immunostained and digitally quantitated for CD34 and Ki-67. Outcomes were compared using Student's t-test. Correlational analyses were assessed using Pearson's correlation.

**RESULTS:** Mice ran a median distance of 17.49km daily. Running distance was not correlated with lean body mass (Pearson  $r=0.59$ ,  $p=0.075$ ), fat mass (Pearson  $r=0.28$ ,  $p=0.46$ ), heart weights (Pearson  $r=-0.24$ ,  $p=0.54$ ) or tumor burden (Pearson  $r=-0.28$ ,  $p=0.47$ ). Normalized lean body mass and fat mass were similar between exercised and sedentary mice (80.08 $\pm$ 0.463 vs. 80.87 $\pm$ 0.4794%,  $p=0.25$ ; 9.22 $\pm$ 0.3213 vs. 9.63 $\pm$ 0.4317%,  $p=0.44$ ). Tumor grades were lower in the exercise group compared with the sedentary group (grade 2.0 $\pm$ 0.2236 vs. 3.056 $\pm$ 0.294;  $p=0.01$ ). Tumor burden was not different between groups (1.016 $\pm$ 0.2082g/cm vs. 1.198 $\pm$ 0.2102g/cm;  $p=0.55$ ). Tumors both groups showed comparable CD34 and Ki-67 labeling (CD34: 0.729 $\pm$ 0.4639% vs. 1.39 $\pm$ 0.3439%,  $p=0.37$ ; Ki-67: 24.46 $\pm$ 4.726 vs 20.88 $\pm$ 5.745,  $p=0.68$ ).

**CONCLUSION:** Voluntary exercise is associated with reduced tumor grade, suggesting that exercise attenuates tumor invasion and improves prognosis. The absence of exercise effects on tumor burden, proliferation and vascularization may be due to the short duration of exercise training.

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3413 Board #134 June 2 8:00 AM - 9:30 AM

**Immuno-modulatory Effects Of Aerobic Exercise Training In Dss - Induced Ulcerative Colitis**

Marc D. Cook, Steve Martin, Jeffrey Woods. *University of Illinois Urbana-Champaign, Urbana, IL.*  
(No relationships reported)

Inflammatory bowel diseases, such as ulcerative colitis, significantly reduce physical functioning and decrease the quality of life in afflicted patients. Preliminary studies have shown that there is a positive correlation between physical activity, reduced inflammatory biomarkers and inflammatory-related disease activity indices.

**PURPOSE:** The purpose of this study was to determine whether 6 weeks of moderate exercise training reduces inflammation and sickness behavior associated with colitis in a mouse model.

**METHODS:** Colitis was induced by dextran sodium sulfate (DSS)

treatment in treadmill exercised (Ex/DSS, 8-12 m/min for 6 weeks- 5x/week) or sedentary (Sed/DSS) C57Bl/6 male mice while control mice received water (Ex/H2O, Sed/H2O) (n=13/group). DSS (2%) was given in drinking water over 5 days. Sickness outcomes were assessed by changes in food and fluid intake, body weight (BW), and locomotor activity (LMA). Mice were euthanized and brains and colons were harvested at 3 days post cessation of DSS administration (Day 8) for analysis of inflammatory gene expression.

**RESULTS:** Proinflammatory gene expression (2 $\Delta\Delta\text{CT}$ ) in the colon were as follows: IL-6 (Sed+H2O: 1.63 $\pm$ 1.1; Sed+DSS: 16.44 $\pm$ 34.3; Ex+DSS: 390.7 $\pm$ 515.6; Ex+H2O:1.34 $\pm$ 1.2); IL- $\beta$  (Sed+H2O: 1.55 $\pm$ 1.3; Sed+DSS: 7.54 $\pm$ 13.6; Ex+DSS: 115.22 $\pm$ 154.3; Ex+H2O: 1.13 $\pm$ 1.2); TNF- $\alpha$  (Sed+H2O: 2.85 $\pm$ 3.7; Sed+DSS: 3.6 $\pm$ 4.0; Ex+DSS: 15.56 $\pm$ 19.8; Ex+H2O: 1.59 $\pm$ 2.1). Statistical analysis showed a significant intervention\*treatment (Ex+DSS) effect for IL-6 ( $F_{1,52} = 6.83$ ;  $p=0.012$ ), IL- $\beta$  ( $F_{1,52}=6.33$ ;  $p=0.015$ ) & TNF $\alpha$  ( $F_{1,52} = 5.323$ ;  $p=0.025$ ). Sickness outcomes and brain cytokines were not different between groups.

**CONCLUSIONS:** Six weeks of exercise training caused intensified local colon inflammation in mice treated with DSS. While DSS-treated mice exhibited reductions in food and fluid intake, BW, LMA when compared to the water-only groups, prior exercise training did not exacerbate these symptoms associated with colitis. These data demonstrate that exercise can modulate local inflammation in response to DSS-induced acute ulcerative colitis. Further investigation is essential to characterize these effects and elucidate the mechanism that drives this exacerbated immune response in the colon.

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3414 Board #135 June 2 8:00 AM - 9:30 AM

**Exercise Training Enhances Recipient Survival With No Benefit to Long-term Engraftment Following Bone Marrow Transplantation**

Michael De Lisio, Gianni Parise. *McMaster University, Hamilton, ON, Canada.*  
(No relationships reported)

Exercise training has profound systemic effects which ultimately induce positive adaptations in numerous body tissues. Recently, we have demonstrated increased bone marrow cell survival and proliferation in response to exercise training which may be attributable to increased quality of the niche.

**PURPOSE:** The present study determined the extent to which exercise-induced alterations in the bone marrow microenvironment can increase success of bone marrow transplantation (BMT).

**METHODS.** In our BMT assay, recipient C57Bl/6 mice remained sedentary (SED) or were exercise trained on a treadmill (EX; 3d/wk, 8 wks). Both groups of mice had their native marrow ablated prior to receiving GFP-labeled donor marrow. Successful BMT was established by recipient survival, and both donor-derived blood reconstitution, and total (donor- and recipient-derived) blood reconstitution measured by flow cytometry. One and 4 days post-BMT, donor cell homing, as well as apoptosis, determined by activated caspase-3/-7 activity, were determined in the bone marrow cavity by flow cytometry.

**RESULTS.** Whereas only 25% of SED survived, 82% of EX recipients survived the BMT. Homing of donor-derived marrow cells to the recipients' marrow cavity acutely post-BMT was not altered in EX, but EX mice displayed decreased levels (10%,  $p < 0.05$ ) of activated caspase-3/7 1 day following BMT. The acute inhibition of marrow cell apoptosis in EX resulted in increased total blood cell reconstitution at 3.5 months post-BMT in EX (37%,  $p < 0.05$ ), but did not improve donor-derived reconstitution.

**CONCLUSION.** Exercise training increases recipient survival post-BMT with increased total blood cell reconstitution. Donor-derived reconstitution was not improved, possibly due to enhanced competition for niche availability created by the inhibition of apoptosis with exercise.

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**3415** Board #136 June 2 8:00 AM - 9:30 AM

**Effects of Tai Chi Exercise on T-lymphocytes Subgroups of Non-small Cell Lung Cancer Post-surgery Survivors**

Zhang Yajun<sup>1</sup>, Ru Wang<sup>1</sup>, Bei bei Luo<sup>1</sup>, Peijie Chen<sup>1</sup>, Dinghai Yu<sup>2</sup>. <sup>1</sup>*School of Kinesiology, Shanghai University of Sport, Shanghai, China.* <sup>2</sup>*School of Wu Shu, Shanghai University of Sport, Shanghai, China.*

(No relationships reported)

**PURPOSE:** T-lymphocyte mediating immunoreactions plays a vital role on antitumor immunity, CD4<sup>+</sup>/CD8<sup>+</sup> lymphocytes make main effects on killing cancer cells, and the T helper to suppressor cell ratio (CD4<sup>+</sup>:CD8<sup>+</sup>) implies T cellular immunity balance. Many researches proved that long term tai chi exercise could improve cellular immunity, so we hypothesize that a 16-week tai chi exercise may have positive effect on variations of total T cell (CD3+T lymphocyte) and T-lymphocyte subgroups.

**METHODS:** Thirty-two post-surgical NSCLC survivors were randomized two groups, the tai chi exercise group (TCC) and the control group (CON). Among them, 27 participants completed the study (TCC: n=14, CON: n=13). Subjects in TCC performed 24 type standardized movement every other day for 16 weeks and lasted 45 to 60 minutes every time, and the control group maintained daily life. Before and after tai chi exercise, peripheral blood sample was collected to isolate lymphocytes, then use flow cytometer to analyze percentage of CD3+T lymphocyte and CD4+/CD8+T lymphocyte subpopulation.

**RESULTS:** There were significant changes in CD3+T lymphocyte, CD4+T lymphocyte, and the ratio of T helper to suppressor cells (CD4:CD8 ratio) in post-surgical NSCLC survivors over a 16-week tai chi exercise. Percentage of CD3+T lymphocyte ( $60.26 \pm 12.38$  vs  $55.26 \pm 12.44$ ,  $P < 0.05$ ) and CD4+T lymphocyte ( $35.62 \pm 9.83$  vs  $32.97 \pm 8.27$ ,  $P < 0.05$ ) significantly declined compared to pre-training in TCC. CD4:CD8 ratio significantly ( $1.62 \pm 0.78$  vs  $1.88 \pm 0.80$ ,  $P < 0.05$ ) increased compared to pre-training in TCC, but there was no significant change in the control group.

**CONCLUSIONS:** A 16-week tai chi exercise program enhances T cellular immunity via elevating the ratio of T helper to suppressor cells.

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**3416** Board #137 June 2 8:00 AM - 9:30 AM

**Regular Tai Chi Chuan Exercise Decreases the Number Of Type 2 Cytokine-producing Cells In Postsurgical Nonsmall Cell Lung Cancer Survivors**

Ru Wang<sup>1</sup>, Jing Liu<sup>2</sup>, Yajun Zhang<sup>1</sup>, Beibei Luo<sup>1</sup>, Peijie Chen<sup>1</sup>, Dinghai Yu<sup>2</sup>. <sup>1</sup>*School of Kinesiology, Shanghai University of Sport, Shanghai, China.* <sup>2</sup>*School of Wu Shu, Shanghai University of Sport, Shanghai, China.*

(No relationships reported)

**PURPOSE:** Tai Chi Chuan (TCC) exercise is beneficial for treatment of diseases such as cardiovascular malignancies and rheumatoid arthritis. Its possible benefits to lung cancer survivors, however, remain to be determined. The effect of a 16-week TCC exercise intervention on CD4<sup>+</sup> helper T cells (Th1 and Th2) and CD8<sup>+</sup> cytotoxic T cells (Tc1 and Tc2) in postsurgical nonsmall cell lung cancer survivors was investigated.

**METHODS:** A controlled study was performed in 13 lung cancer survivors who practiced TCC and 14 control lung cancer survivors who did not practice TCC. The whole blood count, main hormone levels (cortisol, catecholamine,  $\beta$ -endorphin), and cytokines (IFN- $\gamma$ , IL-4) of Th1/Th2 and Tc1/Tc2 reaction were measured before (t = 0) and after (t = 16 weeks) a 16-week TCC exercise intervention.

**RESULTS:** Th2 and Tc2 levels at t = 16 weeks in the TCC group remained unchanged ( $1.55 \pm 0.47$  vs  $1.79 \pm 0.89$ ,  $P > 0.05$ ) and significantly decreased ( $22.41 \pm 8.94$  vs  $18.82 \pm 6.87$ ,  $P < 0.05$ ), respectively, while a significant increase in both the Th2 ( $1.61 \pm 0.75$  vs  $2.92 \pm 1.26$ ,  $P < 0.05$ ) and Tc2 ( $17.65 \pm 6.10$  vs  $19.13 \pm 5.78$ ,  $P < 0.05$ ) levels was observed in the control group at t = 16 weeks. No significant changes in the Th1 and Tc1 levels were observed, except for a significant decrease in the Tc1 level ( $24.20 \pm 10.43$  vs  $20.74 \pm 7.74$ ,  $P < 0.05$ ) at t = 16 weeks in the control group. The IFN- $\gamma$  (Type 1 cytokines including Th1 and Tc1) significantly decreased ( $37.90 \pm 11.99$  vs  $34.43 \pm 0.95$ ,  $P < 0.05$ ) in the control group and decreased, but not significantly ( $42.53 \pm 11.07$  vs  $40.58 \pm 13.16$ ,  $P < 0.05$ ), in the TCC group at t = 16 weeks. The IL-4 level (Type 2 cytokines including Th2 and Tc2) significantly increased ( $19.08 \pm 6.45$  vs  $21.69 \pm 6.41$ ,  $P < 0.05$ ) in the control group, but significantly decreased ( $23.95 \pm 8.80$  vs  $20.61 \pm 7.13$ ,  $P < 0.05$ ) in the TCC group at t = 16 weeks. A significant increase in the cortisol level was observed at t = 16 weeks in the control group and a significant decrease in the level of catecholamine was observed at t = 16 weeks in the TCC group.

**CONCLUSIONS:** A 16-week TCC exercise intervention prevented the increase of circulating Th2 and Tc2 cell levels, but not of Th1 and Tc1 cells, in nonsmall cell lung cancer survivors, suggesting that TCC may have a role in ameliorating the balance of humoral and cellular immunity and possibly potentiating human immunity against tumors.

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**3417** Board #138 June 2 8:00 AM - 9:30 AM

**A Muscle-Secreted Protein SPARC Suppresses Colon Tumorigenesis via Apoptotic Effect**

Wataru Aoi<sup>1</sup>, Yuji Naito<sup>2</sup>, Tomohisa Takagi<sup>2</sup>, Yuko Tanimura<sup>2</sup>, Yoshikazu Takanami<sup>3</sup>, Yukari Kawai<sup>4</sup>, Hiroshi Ichikawa<sup>5</sup>, Toshikazu Yoshikawa<sup>2</sup>. <sup>1</sup>*Kyoto Prefectural University, Kyoto, Japan.* <sup>2</sup>*Kyoto Prefectural University of Medicine, Kyoto, Japan.* <sup>3</sup>*Otsuna Women's University, Kyoto, Japan.* <sup>4</sup>*Louis Pasteur Center for Medical Research, Kyoto, Japan.* <sup>5</sup>*Doshisha University, Kyoto, Japan.*

(No relationships reported)

Several epidemiological studies have shown that regular exercise can prevent the onset of colon cancer, although the mechanism involved is unclear. Recently, we identified a muscle-secreted protein SPARC (secreted protein acidic and rich in cysteine) which is elevated in circulation in response to exercise. In a mouse model of colon cancer, regular exercise suppressed the generation of tumorigenesis in colon obtained from wild-type mice, but not found in SPARC-null mice.

**PURPOSE:** To investigate the mechanism of anti-tumorigenesis effect via SPARC induced by exercise.

**METHODS:** Firstly, we investigated the effect of SPARC on colon tumorigenesis in azoxymethan (AOM)-injected SPARC-null and wild-type mice. The mice carried out six weeks of regular low-intensity exercise after AOM injection. The numbers of aberrant crypt foci (ACF) and terminal deoxynucleotidyl transferase dUTP nick end labeling (TUNEL)-positive cells were counted in the colon. Expression of apoptotic-related proteins was measured by immunoblotting. Secondly, colon26 cells were cultured in the presence or absence of mouse recombinant SPARC (mrSPARC) or medium obtained from cyclic-stretched C2C12 myotubes. Cell proliferation and apoptotic effect were examined.

**RESULTS:** Regular exercise significantly reduced the formation of ACF in wild-type mice (number:  $4.8 \pm 0.7$  to  $2.0 \pm 0.6$  count,  $P < 0.01$ ) but not SPARC-null mice. TUNEL assay showed that regular exercise increased the number of apoptotic colon cells in wild-type mice (apoptotic index: from  $0.66 \pm 0.11$  to  $0.92 \pm 0.09\%$ ,  $P < 0.05$ ); however, there was no difference between the sedentary and exercised SPARC-null mice. Furthermore, regular exercise increased the levels of cleaved caspase-3 and -8 in wild-type mice but not SPARC-null mice. In vitro studies, addition of both mrSPARC and the conditioned medium significantly prevented proliferation of colon cancer cells, along with an elevation of apoptotic cells.

**CONCLUSIONS:** A muscle-secreted protein SPARC suppresses colon tumorigenesis via caspase-3 and -8 dependent apoptosis.

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**3418** Board #139 June 2 8:00 AM - 9:30 AM

**Effect Of Resistance Training On Vcam-1 And Cortisol In Hiv+ Men Recovering From Substance Abuse**

John H. Curtis<sup>1</sup>, Jakob L. Vingren<sup>1</sup>, Anthony A. Duplanty<sup>1</sup>, Carianne M. Cregar<sup>1</sup>, Julius F. Cantu<sup>2</sup>, David W. Hill, FACSM<sup>1</sup>. <sup>1</sup>*University of North Texas, Denton, TX.* <sup>2</sup>*Homeward Bound, Inc, Dallas, TX.*

(No relationships reported)

Human immunodeficiency virus (HIV) and substance abuse (drug and/or alcohol) independently impair the cardiovascular and immune systems; importantly, the combination of HIV infection and substance abuse might produce more than an additive effect on these systems. An elevated concentration of vascular cell adhesion molecule 1 (VCAM-1) is a novel risk factor for cardiovascular disease and an elevated concentration of cortisol can impair immune function. HIV infection and substance abuse can cause elevations in VCAM-1 and cortisol.

**PURPOSE:** The purpose of this study was to examine the effect of resistance training on resting concentrations of VCAM-1 and cortisol.

**METHODS:** Sixteen men (42 ± 11 years, 180.4 ± 9.1 cm, 89.2 ± 20.7 kg) infected with HIV who were enrolled in an intensive 60-day in-patient substance addiction/abuse treatment program were recruited and assigned to one of two groups using randomization: supervised resistance exercise 3 times per week (RT) or no exercise training (Control) for six weeks. Before (Pre) and after (Post) the 6-week period, resting and fasted blood samples were obtained and analyzed for VCAM-1 and cortisol concentrations.

**RESULTS:** VCAM-1 did not change following the 6-week period for RT (Pre: 352 ± 170 ng·ml<sup>-1</sup>; Post: 380 ± 182 ng·ml<sup>-1</sup>) or Control (Pre: 303 ± 224 ng·ml<sup>-1</sup>; Post: 306 ± 223 ng·ml<sup>-1</sup>). Similarly, no changes in cortisol were observed for RT (Pre: 603 ± 97 nmol·l<sup>-1</sup>; Post: 617 ± 132 nmol·l<sup>-1</sup>) or Control (Pre: 726 ± 257 nmol·l<sup>-1</sup>; Post: 720 ± 218 nmol·l<sup>-1</sup>). No adverse effects of the intervention were reported.

**CONCLUSION:** A six-week resistance training program does not elicit changes in VCAM-1 or cortisol concentrations in men infected with HIV who are undergoing an intensive in-patient substance addiction/abuse treatment program.

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## G-36 Free Communication/Poster - Exercise Immunology and Nutrition

JUNE 2, 2012 7:30 AM - 11:00 AM

ROOM: Exhibit Hall

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**3419** Board #140 June 2 9:30 AM - 11:00 AM

### Effect of Branched-chain Amino Acids Supplementation on Moderate Exercise Induced Changes In Circulating Lymphocyte Subsets

Kaori Matsuo<sup>1</sup>, Xiumin Zhang<sup>2</sup>, Farmawati Arta<sup>3</sup>, Jiro Kikuchi<sup>3</sup>, Shizuka Ogawa<sup>3</sup>, Akira Motokawa<sup>3</sup>, Izumi Tabata, FACSM<sup>1</sup>, Ryoichi Nagatomi, FACSM<sup>3</sup>.  
<sup>1</sup>Ritsumeikan University, Kusatsu, Japan. <sup>2</sup>Jilin University, Changchun, China. <sup>3</sup>Tohoku University School of Medicine, Sendai, Japan.

(No relationships reported)

**PURPOSE:** Intense long-duration exercise could lead to altered basal immune parameters probably due to a significant decrease in the circulating level of plasma glutamine. The decrease in plasma glutamine concentration as a consequence of intense long-duration exercise was shown to be reversed by BCAA supplementation. Moderate exercise induces remarkable changes in circulating number of lymphocyte subsets such as NK, NKT and T cells. However, less is known whether administration of high-dose BCAA would modulate the immune parameters to a single bout of moderate exercise. The aim of the present study is to investigate the effect of BCAA supplementation on the number of circulating immune cells during and after moderate exercise.

**METHODS:** Ten healthy, young male triathletes of age 21.8 ± 1.5 yr participated in the present double-blind, placebo-controlled study. Each subject performed four trial conditions in a random order with at least a seven-day interval: exercise + BCAA (14 g), exercise + placebo, sedentary + BCAA, and sedentary + placebo. Exercise was performed on a bicycle ergometer for 1 h at 60% VO<sub>2</sub>max. BCAA or placebo supplements were given orally 20 min before exercise. Blood samples were collected 30 min before exercise, immediately after and 2 h post-exercise. Plasma catecholamines (epinephrine, norepinephrine and dopamine) were measured by high-performance liquid chromatography. Plasma cortisol concentrations were determined by radioimmunoassay. Complete blood count analysis was performed using an automated hematology analyzer. Lymphocytes subsets were determined by flow cytometry.

**RESULTS:** Exercise induced significant elevations in the concentrations of plasma catecholamines. Plasma catecholamines were remarkably increased immediately after exercise. However, no significant change was observed in plasma cortisol. BCAA did not modify the stress hormone responses to exercise. Exercise led to significant increases in numbers of leukocytes and lymphocyte subsets including NK cells, NKT cells, CD8+ and CD3+CD8+CD45RO+ T cells. However, no significant modification effect of BCAA was observed on these basal immune parameters to exercise.

**CONCLUSIONS:** BCAA had no modification effect on the hormonal and immune parameter changes in response to moderate exercise.

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**3420** Board #141 June 2 9:30 AM - 11:00 AM

### Endurance-training Effects On Intracellular Calcium And Iron In Cd4+ Lymphocytes In Young And Old Men

Suzanne Broadbent, Dr. Southern Cross University, Lismore NSW, Australia.

(No relationships reported)

**PURPOSE:** Intracellular calcium (Ca<sup>2+</sup>) and iron (Fe<sup>3+</sup>) are critically involved in intracellular signalling within CD4<sup>+</sup> cells yet little is known of long-term exercise effects on these variables in relation to CD4<sup>+</sup> activation and function. We investigated the effects of 12 months of aerobic/endurance exercise on Ca<sup>2+</sup> and Fe<sup>3+</sup> concentrations within CD4<sup>+</sup> lymphocytes in old and young men compared to sedentary controls.

**METHODS:** We compared young (30±5 yr) trained (TRY, n=14) and sedentary (UTY, n=12) men to older (69±5) trained (TRO, n=14) and sedentary (UTO, n=10) men for 12 months. The TRY group completed daily endurance training (60-120 min day, 60-80% VO<sub>2peak</sub>) while the TRO group cycled for three 60 min sessions per week (60-75% VO<sub>2peak</sub>). Venous blood was analysed every month for resting lymphocyte counts. CD4<sup>+</sup> cells were separated and stimulated with thapsigargin to quantify Ca<sup>2+</sup>, using Fluo-3 AM and flow cytometry. Further CD4<sup>+</sup> lymphocytes were incubated with Calcein AM to assess Fe<sup>3+</sup> (flow cytometry).

**RESULTS:** The TRY group had a significantly higher CD4<sup>+</sup> concentration than UTY for 4 months (37±7%, p<0.05); no CD4<sup>+</sup> count difference between TRO and UTO. Ca<sup>2+</sup> was significantly higher in January for all groups (TRY=298±5 nM; UTY=260±15 nM; TRO=160 nM; UTO=210 nM) with significant increases also in September A and July. TRY and UTY had significantly higher peak Ca<sup>2+</sup> (70±4%, 20±3%) compared to TRO and UTO. UTO Ca<sup>2+</sup> was significantly higher in September A but lower in January compared to TRO; TRY was higher in November compared to UTY. There was an inverse relationship between Ca<sup>2+</sup> and Fe<sup>3+</sup>, with significantly lower Fe<sup>3+</sup> in January-February (all groups), July (TRO, UTO) and September A (TRY, UTY). TRY and UTY (January) had less Fe<sup>3+</sup> (-66±6%, -65±6%, p<0.05) than TRO and UTO (February). TRY had significantly higher Fe<sup>3+</sup> than UTY in November; UTO had higher Fe<sup>3+</sup> than TRO in May.

**CONCLUSIONS:** Training had little effect on Ca<sup>2+</sup> and Fe<sup>3+</sup> although CD4<sup>+</sup> increased in the TRY group. Significant spikes in Ca<sup>2+</sup> and Fe<sup>3+</sup> may relate to increased intracellular signalling and/or transcription, and seasonal changes in CD4<sup>+</sup> function, during January, July and September. Age-related differences in Ca<sup>2+</sup> and Fe<sup>3+</sup> may be due to changes in intracellular Ca<sup>2+</sup>/Fe<sup>3+</sup> storage and signalling with ageing.

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**3421** Board #142 June 2 9:30 AM - 11:00 AM

### Dietary Nucleotide Supplementation Improves The Immune Response After Strenuous Exercise In A Cold Environment

Daniel Martínez-Puig<sup>1</sup>, Joan Riera<sup>2</sup>, Victoria Pons<sup>2</sup>, Carles Chetrit<sup>1</sup>. <sup>1</sup>BIOIBERICA S.A., Palafoxs, Spain. <sup>2</sup>Centre d'Alt Rendiment (GIRSANE), Sant Cugat del Vallés, Spain.

(D. Martínez-Puig: Contracted Research - Including Principle Investigator; BIOIBERICA S.A.)

Strenuous exercise has been classically associated to immune-suppression and consequently to an increased risk of infections, especially at the upper respiratory tract.

**PURPOSE:** The aim of the present study was to test the impact of a specific nucleotide formulation (Inmunactive, Bioiberica, Spain) on the immune function of athletes after a heavy exercise bout in cold conditions.

**METHODS:** Twenty male taekwondo athletes with a mean (±SD) age, height, weight, percent body fat, of 21.4±6.3 years, 178.1 ±8.5 cm, 73.86±12.6 kg, 12.53±3.2 % were included in a double-blind placebo-controlled trial. Two weeks before the test, all the subjects performed a cycling maximal incremental test to determine his maximal oxygen uptake (VO<sub>2</sub>max), and the corresponding Watts at 60% (W1) 70% (W2) and 90% (W3) of VO<sub>2</sub>max were calculated by linear interpolation.

The subjects were randomly divided into two groups of 10 subjects and were supplemented with placebo or Inmunactive at 600mg/day during a period of 30 days. On day 0 and on day 30 each subject undertook an exhaustion exercise test using a cycloergometer at work corresponding to W1 for 10 min, W2 for 20 min and W3 until fatigue. Skin temperature (T<sub>sk</sub>), core temperature (T<sub>c</sub>), heart rate (HR), lactate [La] and rating of perceived exertion (RPE) was recorded during the test. Immediately before, 30 minutes, 150 minutes and 24 hours after the test, blood and saliva samples were obtained for determination of blood cell concentrations, index of total lymphocyte proliferation (LTP) and salivary immunoglobulin A (SIgA).



**RESULTS:** On day 30, LTP decreased at 24h after the exercise test in the placebo group but not in the Inmunactive group (-15,34±5,25 vs 13,15±4,97, P<0,01). SIgA differences between Day 1 and Day 28 were significant at 150 min post exercise with a greater decline in subjects taking placebo compared to those taking nucleotides (1,85±1,9 vs -0,50±2 mg/dL, P<0,05). No differences were detected in physiological parameters such as Tsk, Tc or HR. On day 30, the RPE was lower (P<0,05) in subjects of Inmunactive group compared to placebo after 10, 20 and 30 min of exercise.

**CONCLUSIONS:** These findings suggest that supplementation with a nucleotide-based product for 4 weeks could counteract the impairment of immune function after heavy exercise.

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**3422** Board #143 June 2 9:30 AM - 11:00 AM

**The Effect Of Docosahexaenoic-rich Fish Oil Supplementation On Cytokines Production By Neutrophils And Lymphocytes Before And After A Marathon Race**

Vinicius Coneglian Santos<sup>1</sup>, Adriana Cristina Levada-Pires<sup>1</sup>, Samia Rocha Alves<sup>2</sup>, Tânia Crisitna Pithon-Curi<sup>2</sup>, Rui Curi<sup>1</sup>, Maria Fernanda Cury-Boaventura<sup>2</sup>.

<sup>1</sup>Universidade de São Paulo, São Paulo, Brazil. <sup>2</sup>Universidade Cruzeiro do Sul, São Paulo, Brazil.

(No relationships reported)

**PURPOSE:** Prolonged intense exercise such as marathon race is associated with transient suppression of immune function and alterations on neutrophils and lymphocytes function.

**OBJECTIVE:** The aim of this study was to investigate the effect of docosahexaenoic (DHA)-rich fish oil (FO) supplementation on cytokines production by neutrophils and lymphocytes before and after a marathon race.

**METHODS:** Twenty one athletes participated in this study, eight marathon runners were supplemented with 3 g of FO daily for 60 days (FO group) and thirteen athletes were not supplemented (C group). The cytokines (IL-1ra, IL-2, IL-10 and TNF- $\alpha$ ) production by lymphocytes and neutrophils ( $2 \times 10^6$ ) were determined in the culture supernatant before and after race.

**RESULTS:** In the C group, marathon race decreased IL-2, TNF- $\alpha$  and IL-10 production by lymphocytes (by 55%, 95% and 50 %, respectively) and IL-1ra (by 80%) production by neutrophils. The FO supplementation decreased IL-1ra (by 48%) and increased IL-10 (by 82%) production by neutrophils but not altered cytokines production by lymphocytes before and after the marathon race.

**CONCLUSION:** DHA-rich FO supplementation prevented the decrease in cytokine production by lymphocytes and had a partial anti-inflammatory effect on cytokines production by neutrophils.

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**G-37 Free Communication/Poster - Exercise Training and Adaptations**

JUNE 2, 2012 7:30 AM - 11:00 AM

ROOM: Exhibit Hall

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**3423** Board #144 June 2 8:00 AM - 9:30 AM

**Training Of A Female World-elite Rower In Pre-olympic Year**

Yongming Li<sup>1</sup>, Wei Zi<sup>2</sup>, Chunmei Cao<sup>3</sup>, Xiaoping Chen<sup>4</sup>, Ulrich Hartmann<sup>1</sup>. <sup>1</sup>Faculty of Sport Science, University of Leipzig, Leipzig, Germany. <sup>2</sup>Faculty of Sport Science, Henan University, Kaifeng, China. <sup>3</sup>Department of Physical Education, Tsinghua University, Beijing, China. <sup>4</sup>Faculty of Sport Science, Ningbo University, Ningbo, China. (Sponsor: Ralph Beneke, FACSM)

(No relationships reported)

Rowing is an aerobic-dominated sport with approximate 80% of aerobic energy supply. Therefore, a huge amount of training is required to be emphasized on aerobic endurance. For training practice it is also important to know the load structure of different intensity categories.

**PURPOSE:** This study aims to analyze the training intensity distribution of a Chinese women single scull (W1x) in pre-Olympic year, who was successful several times in world championships and Olympic Games (OG).

**METHODS:** The training load of a W1x sculler (32yrs, 177cm, 71kg, 18yrs of training experience as rower) in pre-Olympic year was analyzed according to the recording of actual training. All the rowing on water and ergometer, as well as cross-training (running and cycling) from October, 2007 to OG in 2008 was documented in minutes. As established by Seiler et al., three zones of intensity were divided by lactate threshold 1 (LT1, approximate 2 mM) and lactate threshold 2 (LT2, approximate 4 mM).

**RESULTS:** In the observed period, 5827km (127km/week) were covered by the W1x, including 4202km on water, 910km on ergometer, and 715km in running and cycling. When divided by intensity zones, 75.2% of the distance was distributed in zone 1. The percentage of zone 2 and zone 3 was 22.4% and 2.4%, respectively. After dividing the training year into preparatory period (October to middle of March) and competition period (middle of March to OG), it was found that the training at or around lactate threshold (zone 2) decreased significantly from 34.4% in the preparatory period to 8.7% in the competition period, which was sacrificed by increasing the training volume in zone 1 and 3 from 63.5% to 88.6%, and from 2.1% to 2.7%, respectively.

**CONCLUSIONS:** Compared with the so-called polarized-training model on the basis of diary record of training session, the training of the studied subject on the basis of recording every actual training minute is, otherwise, pyramid-like. This is not in line to the findings of Seiler et al. Quantification of training load based on training sessions can overestimate the high intensity volume (zone 3), which deviates from the physiological background of training in endurance sports.

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**3424** Board #145 June 2 8:00 AM - 9:30 AM

**The Effect of 8 Weeks of Race Walk Training on Maximum Oxygen Capacity**

Erika R. Shaver, Anthony Caterisano, FACSM, Ian Whatley, Raymond F. Moss. *Furman University, Greenville, SC.*

(No relationships reported)

Race walking is a competitive sport that has somewhat limited popularity in the US despite its inclusion as an Olympic event. Little research has been done on the fitness benefits of this low-impact form of aerobic training compared to other higher impact aerobic activities.

**PURPOSE:** To test the efficacy of an 8-week race walking program on maximum oxygen uptake (VO<sub>2</sub>max) among untrained women.

**METHODS:** Ten untrained women (mean age = 26.3 ± 1.8 yr.) volunteered to participate in the study. All subjects were tested for VO<sub>2</sub>max via open circuit spirometry on a motorized treadmill using a modified Astrand graded exercise protocol pre- and post-training. Over the 8-week training period subjects were instructed on proper race walking technique and individually trained by a coach 2-3 days per week for 20-30 minutes per day, starting with 20 minutes per day but progressing each week until each was training 30 minutes per day 3 days per week. Data were analyzed using a T-test.

**RESULTS:** Subjects showed a significant increase in VO<sub>2</sub>max from 36.73±1.22 ml/kg/min to 39.03±1.28 ml/kg/min (P<0.01), which represents a 6.26% improvement.

**CONCLUSIONS:** The improvement in VO<sub>2</sub>max of 6.26% is in line with similar training results found in studies using the same time frame but different higher impact training modes. These results suggest that race walking is a viable alternative to other high impact modes of aerobic training with the potential for less injury risk associated with these traditional modes.

3425 Board #146 June 2 8:00 AM - 9:30 AM

**Change in Aerobic Efficiency Among Novice Female Race Walkers Following 8 Weeks of Training**

Anthony Caterisano, FACSM, Erika R. Shaver, Ian Whatley, Raymond F. Moss. *Furman University, Greenville, SC.*  
(No relationships reported)

Race walking is an Olympic track and field event that requires strict adherence to rules on proper walking form. Novice race walkers must master specific techniques for legal race walking or face disqualification for breaking form during a race.

**PURPOSE:** To measure the aerobic efficiency of novice race walkers and see how it changes during a 4 week and 8 week time period of training.

**METHODS:** Ten untrained, females (mean age = 26.3 ± 1.8 yr.) volunteered and were tested for baseline  $\text{VO}_2\text{max}$  via open circuit spirometry on a motorized treadmill, using a modified Astrand graded exercise test. Following an orientation day in which subjects learned proper race walking technique, they returned to the lab and were tested for  $\text{VO}_2$  while race walking at 14 MPH on a motorized treadmill. Subjects were individually trained 2-3 days per week for 20 - 30 minutes per workout, with a gradual progression from 20 min./workout, 2 days/wk. to 30 min./workout 3 days/wk. The 14 MPH race walking testing protocol was performed after week 4 of training. After week 8 of training the  $\text{VO}_2\text{max}$  and the 14 MPH race walking test were repeated. The  $\text{VO}_2$  data were expressed as a % of  $\text{VO}_2\text{max}$  for each testing interval. In addition, stride length and frequency were monitored during the 14 MPH trials using a Dartfish™ analysis. An ANOVA with a Tukey post hoc test was used to analyze differences between means.

**RESULTS:** As training progressed from week 1 through week 8 the subjects showed a significant decrease in the % of  $\text{VO}_2\text{max}$  needed to maintain the 14 MPH race walk. Statistical analysis showed a significant difference between % of  $\text{VO}_2\text{max}$  as follows: Week 1 (67.26 ± 2.49%) week 4 (66.54 ± 2.69%) and week 8 (63.01 ± 2.12%,  $p \leq 0.05$ ). This was accompanied by a significant increase in stride rate as follows: week 1 (141.85 ± 7.16 strides/min.) week 4 (142.85 ± 8.62 strides/min.) and week 8 (145.38 ± 9.161 strides/min.,  $p \leq 0.05$ ).

**CONCLUSIONS:** The results of this study suggest that aerobic efficiency among novice race walkers can be improved in 8 weeks of training and that the improvements appear to be related to increased stride frequency.

3426 Board #147 June 2 8:00 AM - 9:30 AM

**Effect Of Different Dose Of Exercise Volume And Intensity On Peak O2 Consumption In Adult Men**

Jiashi Lin, Yi Yan, Hao Su, Yueqin Yang, Xian Guo, Yan Zhao, Minhao Xie. *Beijing Sports University, Beijing, China.* (Sponsor: Lili Ji, FACSM)  
(No relationships reported)

**PURPOSE:** Although higher levels of cardiorespiratory fitness (CRF) associate with lower cardiovascular disease (CVD), the exercise prescription required for the optimal enhancement is not known, moreover, the mechanisms for the different effects of volume or intensity on peak  $\text{O}_2$  consumption ( $\text{VO}_{2\text{peak}}$ ) remain sparse. This study was to determine whether exercise prescriptions differing in volume or intensity also differ in their CRF after 12 weeks training, and investigate the mechanisms for increases in  $\text{VO}_{2\text{peak}}$  with different dose.

**METHODS:** A total of 67 sedentary subjects aged 40-49yr were assigned to participate for 12 weeks in a control group or in one of three exercise groups: 1) low volume/moderate intensity (LVMI, equivalent of ~19km/wk, 1200kcal/wk at 40-55% $\text{VO}_{2\text{peak}}$ ), 2) low volume/vigorous intensity (LVVI, ~19km/wk, 1200kcal/wk at 65-80% $\text{VO}_{2\text{peak}}$ ) and 3) high volume/vigorous intensity (HVVI, ~32km/wk, 2000kcal/wk at 65-80% $\text{VO}_{2\text{peak}}$ ). Participants were instructed to not change their usual diet throughout the study. The 47 subjects who complied with these guidelines served as the basis for the main analysis.  $\text{VO}_{2\text{peak}}$  and time to exhaustion (TTE) were tested before and after 12 weeks training. Maximal cardiac output (Q) and stroke volume (SV) were measured using echocardiography, maximal arterial-venous  $\text{O}_2$  difference ( $a\text{-vO}_{2\text{diff}}$ ) was calculated from the equation:  $a\text{-vO}_{2\text{diff}}(\text{ml O}_2/100\text{ml blood}) = \text{VO}_2(\text{L}/\text{min})/(\text{Q}/\text{L}/\text{min}) \times 100$ .

**RESULTS:** All exercise groups increased  $\text{VO}_{2\text{peak}}$  and TTE compared to the baseline.  $\text{VO}_{2\text{peak}}$  increased significantly ( $p < 0.05$ ) in both LVVI (29.36 ± 5.31 ml/kg/min vs 34.33 ± 4.18 ml/kg/min) and HVVI (32.11 ± 7.67 ml/kg/min vs 37.35 ± 5.80 ml/kg/min) groups, 16.9% and 16.4% respectively; the LVVI resulted in greater improvement than the LVMI (29.28 ± 3.91 ml/kg/min vs 31.71 ± 4.11 ml/kg/min). It seems that  $\text{VO}_{2\text{peak}}$  is respond to intensity not volume. Maximal  $a\text{-vO}_{2\text{diff}}$  increased in all exercise groups, but Q and SV only enhance in the two vigorous groups.

**CONCLUSIONS:** Although exercising at level of 19km/wk at 40-55% $\text{VO}_{2\text{peak}}$  is sufficient to increase  $\text{VO}_{2\text{peak}}$ , the vigorous intensity is more variable for increase  $\text{VO}_{2\text{peak}}$ . The improvement of Q and SV are better than  $a\text{-vO}_{2\text{diff}}$  for enhance  $\text{VO}_{2\text{peak}}$ .

3427 Board #148 June 2 8:00 AM - 9:30 AM

**ACSM Recommended Exercise Reduces Intrahepatic Triglyceride And VLDL-TG Secretion Rate In Obese Individuals With Nafld**

Erik Kirk<sup>1</sup>, Shelby Sullivan<sup>2</sup>, Bettina Mittendorfer<sup>2</sup>, Bruce Patterson<sup>2</sup>, Samuel Klein<sup>2</sup>. <sup>1</sup>*Southern Illinois University Edwardsville, Edwardsville, IL.* <sup>2</sup>*Washington University in St. Louis School of Medicine, Saint Louis, MO.*  
(No relationships reported)

**Nonalcoholic fatty liver disease (NAFLD) and alterations in hepatic lipoprotein kinetics are common metabolic complications associated with obesity. Caloric restriction is often advocated for treating NAFLD, however, the effects of exercise alone on intrahepatic triglyceride (IHTG) content and VLDL-triglyceride (TG) secretion rate is unknown.**

**PURPOSE:** The aim of this study was to evaluate the effect of the American College of Sports Medicine physical activity guidelines for adults on IHTG content and VLDL kinetics in obese persons with NAFLD.

**METHODS:** Eighteen obese people (BMI=38.1 ± 4.6 kg/m<sup>2</sup>) with NAFLD were randomized to 16 weeks of verified exercise training (45-55%  $\text{VO}_{2\text{peak}}$ , 30-60 min x 5 days/week; n=12) or observation (control; n=6). Liquid formula dietary supplements were provided to prevent exercise-induced weight loss. Magnetic resonance spectroscopy and stable isotope tracer infusions in conjunction with compartmental modeling were used to evaluate IHTG content and hepatic VLDL-TG secretion rates.

**RESULTS:** Exercise training resulted in a 10.3 ± 4.6% decrease in IHTG content ( $p < 0.05$ ), but did not change total body weight (103.1 ± 4.2 kg and 102.9 ± 4.2 kg before and after training) or percent body fat (38.9 ± 2.1% and 39.2 ± 2.1% before and after training). Although not significant ( $p = 0.07$ ), exercise training did show a 5% reduction in VLDL-TG secretion rate (17.7 ± 3.9  $\mu\text{mol}/\text{min}$  and 16.8 ± 5.4  $\mu\text{mol}/\text{min}$  before and after training).

**CONCLUSIONS:** Performing physical activity as recommended by the ACSM reduces IHTG content and hepatic lipoprotein kinetics in obese persons with NAFLD.

3428 Board #149 June 2 8:00 AM - 9:30 AM

**Recumbent Cross-Training is a Viable Exercise Option for Overweight Adults**

Heidi B. IglayReger, Timothy A. Muth, Christine A. Robert, Mark D. Peterson, Paul M. Gordon, FACSM. *University of Michigan, Ann Arbor, MI.*  
(No relationships reported)

Though recumbent fitness equipment is a valuable exercise and rehabilitation tool, particularly for older or physically disabled populations, it is an underutilized modality in other populations. Overweight individuals often gravitate towards recumbent equipment, as these low-impact modalities are better tolerated. However, the metabolic cost of recumbent exercise is not clearly defined in this population, precluding its endorsement by health care professionals.

**PURPOSE:** To assess the metabolic cost of recumbent cross-training (rX) and recumbent bicycling (rB) in overweight adults at prescribed and self-selected intensities.

**METHODS:** Subjects performed exercise on a recumbent cross-trainer (utilized arms and legs) and a recumbent bicycle at 60% of treadmill  $\text{VO}_2$  max (int60) and at a self-selected intensity (intSS). The orders of these testing days and intensities were counterbalanced. Resistance was varied to achieve these intensities while cadence remained constant (80 spm/rpm); subjects were blinded from workloads.  $\text{VO}_2$  and VE dynamics (K4b2, Cosmed, Rome, Italy), heart rate (Polar Team2, Polar Electro, New Hyde Park, NY), blood pressure and ratings of perceived exertion (RPE) were measured throughout condition. Subjects completed a questionnaire after both intensities of exercise on each piece of equipment (4 total) to assess overall ratings of the exercise equipment. Differences between conditions were assessed via paired t-tests. Data presented as mean ± SE.

**RESULTS:** Sixteen (n=8 female) overweight (BMI 31 ± 1 kg/m<sup>2</sup>) adults (40 ± 3y, range 20-54y) completed this study. Both objective (HR and  $\text{VO}_2$ ) and subjective (RPE) exertion were higher

in int60 vs. intSS for rX (HR, VO<sub>2</sub> RPE: 129±3bpm, 18.4±1.0 ml·kg<sup>-1</sup>, 15±1 vs. 113±6bpm, 13.8±1.1 ml·kg<sup>-1</sup>, 12±1, p<0.05 all), but not for rB (p>0.05 all). There were no differences in int60 for rX vs. rB, though intSS HR and VO<sub>2</sub> were lower in rX vs. rB (rB 131±6bpm, 16.9±0.7 ml·kg<sup>-1</sup>, p<0.05). Exercise equipment preference did not differ between modalities or intensities.

**CONCLUSIONS:** Though overweight individuals chose to exercise at a lesser intensity while rX, both rX and rB elicited metabolic responses consistent with recommended exercise intensities for weight management and provide a viable low-impact activity for this population.

Supported by NuStep, Inc.

**3429 Board #150 June 2 8:00 AM - 9:30 AM**

**The Effect Of Rubber Tube Harness Training Device On Selected Physiological Variables In Young Male Subjects**

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(No relationships reported)

**PURPOSE:** We investigated the effect of rubber tube harness training device where the rubber tubes were attached between the ankle and the lower back on selected physiological and metabolic variables during constant running speed of 30 min in healthy male subject (mean±SD: age 26.3±8.4 yrs; Wt: 74.4±2.5 kg; Ht: 178.0±8.7 cm; BMI: 23.3±1.6 kg.m-2).

**METHODS:** 18 subjects were divided into 2 groups. One group (N=10) served as experimental (EG) and the other (N=8) as comparison group (CG). Both groups underwent the same tests of 30min at constant speed of 10.5 km.h-1. Test 1 (T-1) was conducted in the beginning with and without rubber tube harness in both groups, followed by Test 2 (T-2) after 7 wk, and again 7 wk after the last test (T-3). Both groups trained for a total of 18 training sessions for 7 wk for 45min during first wk, increasing time to 50min (at wk 2) and 55min at wk 4-7; however, the CG group trained without rubber tube harness throughout 7 wk and conducted the same constant running training sessions.

**RESULTS:** Statistical analysis, repeated measure analysis of variance revealed no statistically significant difference for oxygen uptake, minute ventilation, breathing frequency, tidal volume, caloric unit cost (P>0.05). The only metabolic variable that was significant was blood lactate (LA) (P<0.05). There were statistically significant differences in blood LA in T-1 between both groups running with and without rubber tubes only (P<0.05). At T-2, there was a significant reduction in blood LA for EG with rubber tube harness running from T-1 to T-2 (P<0.006) and for CG between T-1 and T-2 for running without the tubes (P<0.05). There were no statistical differences at T-3.

**CONCLUSION:** Our results suggest that the use of this training device does not appear to yield additional training benefits but the use of rubber tube harness device may be useful as a training modality. However, changes in testing protocol, intensity of training, duration and frequency may also alter the test results as well as better control of the comparison group.

**3430 Board #151 June 2 8:00 AM - 9:30 AM**

**Comparison of Alter-G Treadmill Run Training to Land Treadmill Training**

Dustin P. Joubert<sup>1</sup>, Brad S. Lambert<sup>1</sup>, Nicholas P. Greene<sup>2</sup>, Stephen F. Crouse, FACSM<sup>1</sup>. <sup>1</sup>Texas A&M University, College Station, TX. <sup>2</sup>University of Virginia, Charlottesville, VA.

(No relationships reported)

**PURPOSE:** The Alter-G (AG) treadmill utilizes a lower-body inflation chamber to decrease an individual's body weight and impact while running. There is little research investigating the long-term training effects of this device, particularly in comparison to land treadmill (LT) training.

**METHODS:** Ten subjects (5 male, 5 female; 37 ± 12 yrs; 83 ± 29 kg) performed a Bruce treadmill protocol to determine VO<sub>2</sub>max at the beginning and end of 12-weeks of AG training at 70% body weight. Subjects trained 3 days/week progressing from 60-85% VO<sub>2</sub>max and from 250-500 kcal/session. DEXA body composition was also assessed. AG subjects were then matched with 10 subjects (5 male, 5 female; 41 ± 11 yrs; 86 ± 18 kg) who had previously completed the same training prescription for LT at full body weight and underwent the same physiological testing. For all independent variables, the change (End - Beginning) was calculated for each group. The change data were analyzed using a 2 (group) x 1 (change) SAS mixed model ANOVA with a Tukey's post hoc test for group. The main effect for group was used to determine between group significance. Within group significance was determined using p-values for least square means estimates for each group's change scores.

**RESULTS:** See table.

|                 | Body Mass (kg) | % Fat      | Fat Mass (g) | Lean Mass (g) | FM Arms (g)  | FM Trunk (g)  | Bruce Time (min) | VO <sub>2</sub> max (ml/min) | VO <sub>2</sub> max (ml/kg/min) |
|-----------------|----------------|------------|--------------|---------------|--------------|---------------|------------------|------------------------------|---------------------------------|
| AG (n=10)       | 0.8 ± 2.5      | -0.9 ± 2.0 | -330 ± 1842  | 1086 ± 1185** | 27 ± 192     | -409 ± 1247   | 0.55 ± 0.95**    | 160.5 ± 160.4**              | 2.2 ± 2.0**                     |
| LT (n=10)       | -1.2 ± 2.3     | -0.5 ± 1.3 | -1069 ± 1626 | -324 ± 1712   | -139 ± 222** | -816 ± 1205** | 1.58 ± 0.37**    | 272.2 ± 298.0**              | 3.7 ± 3.6**                     |
| Between p-value | 0.087          | 0.593      | 0.354        | 0.046*        | 0.091        | 0.467         | 0.005*           | 0.310                        | 0.281                           |

Values mean change ± SD.  
p-values in table for between group differences. \*p < 0.05 between groups.  
Within group significance indicated in group rows. \*\*p < 0.05 within group.

**CONCLUSIONS:** AG training did equally well in improving VO<sub>2</sub>max but achieved lower gains in Bruce time compared to LT. AG increased lean mass, while LT decreased fat mass in more regions. This was in line with the overall tendency towards slight body mass increases in AG and slight weight loss in LT. Overall, AG had a positive effect on fitness markers, but was less specific at improving run performance.

Partial support from HydroWorx International, Inc. and AlterG, Inc.

**3431 Board #152 June 2 8:00 AM - 9:30 AM**

**Metabolic Cost Comparison Of Running On An Aquatic Treadmill With Water Jets And Land Treadmill With Incline**

Ryan Porter, Sarah Blackwell, Gerald Smith, FACSM, Dale Wagner, Dennis Dolny. *Utah State University, Logan, UT.*

(No relationships reported)

**PURPOSE:** This study investigated whether running on a land treadmill (TM) at specific inclines provides a comparable energy expenditure (EE, oxygen consumption,

**METHODS:** Sixteen participants completed two trials on separate days on a TM and ATM. For each trial subjects performed eighteen, 3-4 min submaximal runs at three self selected speeds (slow, medium, and fast) with either water jet resistances of 0-100% of maximum jet flow capacity in 20% increments during ATM or inclines of 0-10% in 2% increments during TM. Trials were separated by at least 48 hours. Oxygen consumption (VO<sub>2</sub>), heart rate (HR), and rate of perceived exertion (RPE) were recorded during each trial. Repeated Measures ANOVA (GLM) with post hoc analysis identified location of significant differences

**RESULTS:** VO<sub>2</sub> increased (p<0.001) in linear fashion during TM with each increase in incline. When running at similar speeds with no resistance (jets or incline) or with 20% jets ATM yielded lower (p<0.001) VO<sub>2</sub> than TM. ATM with 40% jets matched EE during TM at 0% incline. ATM with 60% jets EE was similar to TM with 4% incline while EE was greater (p<0.01) during ATM 80% and 100% jets compared to TM with 8% and 10% incline. Comparable relationships were observed for HR while RPE was similar for ATM and TM except at 80 and 100% jets in ATM that were greater (p<0.01) compared to TM 8 and 10%.

**CONCLUSIONS:** While TM yields a linear increase in EE with increasing incline, ATM with jet flows yield a non-linear increase with little change in EE with jet resistance changes from 0-20%, linear increase in EE from 20-60% with an exponential increase in EE from 60-100%. This relationship may be a result of non-linear application of drag forces on the torso created by the velocities of the water jets. With appropriate selection jet resistances in ATM can be used to mimic EE during inclined TM running on land.

3432 Board #153 June 2 8:00 AM - 9:30 AM

**Effects of Intermittent Hypoxia or Hyperoxia during High-Intensity Interval Training on Endurance Determinants**

Ting Yao Wang, male, Mein Mein Lee, female, Chun Yi Shih, male, Kuei Hui Chan, female. *National Taiwan Sport University, Taoyuan County, Taiwan.*  
(No relationships reported)

Comparing with breathing normoxia, hyperoxia improves exercise performance and decreases blood lactate concentrations in steady-state and hypoxia enhances responses of cardiac output, heart rate, ventilation, and sympathoadrenergic activity during exercise. High-intensity interval training (HIT) provides an up-regulated contribution on both of aerobic and anaerobic metabolism which enhances the availability of ATP and improves the energy status in working muscle. Breathing intermittent hypoxia or hyperoxia during HIT may provide different effects in endurance determinants.

**PURPOSE:** To compare the effects of inspiring hypoxia, normoxia or hyperoxia in recovery intervals during HIT on  $\dot{V}O_{2\max}$ , ventilatory threshold (VT) and time to fatigue (Tlim).

**METHODS:** Twenty four healthy male participants were randomly assigned to hypoxia (N=8, 22.3±2.5 yrs, 16%  $O_2$ ), normoxia (N=8, 22.3±1.9 yrs, 20.9%  $O_2$ ) or hyperoxia (N=8, 21.9±3.3 yrs, 60%  $O_2$ ) groups and assessed by continuous incremental running test on treadmill before and after training. Participants performed HIT (7 bouts, 4-min interval at 90%  $\dot{V}O_{2\max}$ , 2-min rest between intervals) with different oxygen concentration provided in recovery intervals in 2 weeks (3 d-wk<sup>-1</sup>).

**RESULTS:** There was no significant difference among groups in all variables before training ( $p>0.05$ ). After training, the hypoxia and normoxia groups significantly improved VT (hypoxia: 2.73±0.22 vs. 2.94±0.13 m/s; normoxia: 2.56±0.37 vs. 2.82±0.41 m/s,  $p<0.05$ ) and Tlim (hypoxia: 1094.4±50.5 vs. 1140.0±78.5 seconds; 1090.0±52.1 vs. 1121.9±41.6 seconds,  $p<0.05$ ). The hypoxia group also increased the  $\dot{V}O_{2\max}$  (3.63±0.71 vs. 3.96±0.66 L/min,  $p<0.05$ ). However, there was no significant difference in  $\dot{V}O_{2\max}$ , VT and Tlim in hyperoxia group after training.

**CONCLUSIONS:** Intermittent hypoxia during HIT may improve more aerobic capacity than breathing normoxia in the recovery intervals. However, breathing higher oxygen concentration in recovery intervals during HIT may inhibit the improvement of aerobic capacity.

3433 Board #154 June 2 8:00 AM - 9:30 AM

**Hyperventilation-induced Alkalosis as a Strategy for Improved Intermittent Sprint Performance**

Akihiro Sakamoto, Hisashi Naito. *Juntendo University, Chiba, Japan.*  
(No relationships reported)

During high-intensity exercise, a fall in intra- and extracellular pH is a major cause of muscle fatigue. Induced alkalosis by ingesting sodium bicarbonate has been shown to improve performance when the exercise task is repeated and incurs a substantial metabolic challenge. Hyperventilation can provide similar effects on blood pH, however its effect on exercise performance has been studied using low intensities or a single bout of exercise (unsuitable exercise for maximally eliciting buffering effects), thus producing no ergogenic effect.

**PURPOSE:** To investigate the effect of hyperventilation performed during recovery separating repeated maximal pedaling.

**METHODS:** This was a randomized, crossover, counter-balanced study, where subjects performed both control and hyperventilation conditions on two occasions. Ten power-trained males (age: 21 ± 2 y-o, training experience: 6 ± 2 yrs, training frequency: 5 ± 1 times/wk) performed 10 × 10 s maximal pedaling on a cycle ergometer (7.5 % body mass, kp) with 60 s recovery between sets. Spontaneous breathing was performed during recovery for the control. For the hyperventilation condition, subjects breathed at 60 breaths/min during the last 30 s of recovery, with expired breaths being monitored breath-by-breath and the tidal volume adjusted so that the end-tidal  $PCO_2$  was below 25 mmHg before each sprint. Peak and mean power outputs, blood pH,  $PCO_2$  and  $[La^-]$  were measured during the exercise.

**RESULTS:** Blood pH was elevated and  $PCO_2$  was lowered by hyperventilation at any time points measured ( $p < 0.001$ ). Condition effect was not significant for both peak and mean power outputs. A significant condition × time interaction (peak power:  $p = 0.035$ , mean power:  $p = 0.021$ ) however meant that the progressive reduction of power output was attenuated by hyperventilation.  $[La^-]$  had been expected to become higher for hyperventilation, associated with greater  $H^+$  efflux and sustained glycolytic energy supply, but were similar between conditions. Increased activity of respiratory muscles may have accelerated  $[La^-]$  clearance and countered the anticipated increase of  $[La^-]$ ; although the exact mechanism remains unknown.

**CONCLUSION:** Hyperventilation-induced alkalosis enhanced performance recovery during repeated maximal pedaling in the later exercise bouts.

No grant for this study.

3434 Board #155 June 2 8:00 AM - 9:30 AM

**Endurance Performance, Total Haemoglobin Mass and Blood Volume Post Recombinant Human Erythropoietin Use in Trained Individuals**

Jérôme Durussel<sup>1</sup>, Tushar Chatterji<sup>1</sup>, Evangelia Daskalaki<sup>1</sup>, Diresibachew Haile<sup>2</sup>, Zeru Bekele<sup>2</sup>, Neal Padmanabhan<sup>1</sup>, Sandosh Padmanabhan<sup>1</sup>, Rajan K. Patel<sup>1</sup>, Timothy D. Noakes<sup>3</sup>, Günter Gmeiner<sup>4</sup>, John D. McClure<sup>1</sup>, Yannis P. Pitsiladis, FACSM<sup>1</sup>. <sup>1</sup>University of Glasgow, Glasgow, United Kingdom. <sup>2</sup>Addis Ababa University, Addis Ababa, Ethiopia. <sup>3</sup>University of Cape Town, Cape, South Africa. <sup>4</sup>Seibersdorf Labor GmbH, Seibersdorf, Austria.  
(No relationships reported)

Recombinant human erythropoietin (r-HuEpo) increases total haemoglobin mass (tHb), induces haemoconcentration and enhances exercise performance. Less is known about the time course of these mechanisms post r-HuEpo administration.

**PURPOSE:** To determine the effects of r-HuEpo during and post administration on tHb and related haematological profiles, plasma (PV) and blood (BV) volume and running performance.

**METHODS:** 10 endurance trained subjects (age: 26.1 ± 4.4 yrs, body mass: 68.8 ± 3.0 kg, height: 179.0 ± 5.9 cm) received r-HuEpo injections of 50 IU · kg<sup>-1</sup> body mass every two days for 4 weeks. tHb, PV and BV were weekly determined using the optimized CO-rebreathing method until 4 weeks after administration. 3,000 m time trials were performed pre, post administration and at the end of the study. Changes over time in tHb, PV and BV were assessed. Data were analyzed using t-test or repeated measures ANOVA as appropriate.

**RESULTS:** During r-HuEpo administration, tHb increased significantly by 0.59 g · kg<sup>-1</sup> · wk<sup>-1</sup> (95% confidence interval (CI) 0.45 to 0.73,  $p < 0.001$ ) from 13.2 ± 0.8 to 15.6 ± 1.2 g · kg<sup>-1</sup>, PV significantly decreased by 1.91 ml · kg<sup>-1</sup> · wk<sup>-1</sup> (CI -2.64 to -1.17,  $p < 0.001$ ) from 57.5 ± 4.1 to 51.2 ± 2.9 ml · kg<sup>-1</sup> and BV remained unchanged (-0.13 ml · kg<sup>-1</sup> · wk<sup>-1</sup> 95% CI -1.21 to 0.95,  $p = 0.78$ ). From week 1 to week 4 post r-HuEpo administration, the rate of decrease in tHb was similar to that of the increase during administration (-0.70 g · kg<sup>-1</sup> · wk<sup>-1</sup>, CI -0.91 to -0.49,  $p < 0.001$ ) but tHb was still significantly elevated at 4 weeks post administration compared to baseline (14.0 ± 0.9 vs. 13.2 ± 0.8;  $p = 0.030$ ). PV remained decreased post administration (0.06 ml · kg<sup>-1</sup> · wk<sup>-1</sup>, CI -1.30 to 1.43,  $p = 0.92$ ), while a significant decrease in BV was observed from 96.6 ± 7.1 to 90.4 ± 5.0 ml · kg<sup>-1</sup> (-1.88 ml · kg<sup>-1</sup> · wk<sup>-1</sup>, CI -3.68 to -0.07,  $p = 0.043$ ). Running performance improved by 5.5 ± 2.2% post administration (9.99 ± 0.87 min vs. 10.59 ± 1.04 min;  $p < 0.001$ ) and remained enhanced by 3.5 ± 2.5% 4 weeks after r-HuEpo compared to baseline (10.24 ± 1.01 min vs. 10.59 ± 1.04 min;  $p = 0.014$ ).

**CONCLUSION:** Running performance was improved following 4 weeks of r-HuEpo administration and remained elevated 4 weeks post administration compared to baseline. These performance effects coincided with r-HuEpo-induced elevated tHb and reduced PV compared to baseline.

3435 Board #156 June 2 8:00 AM - 9:30 AM

**High Volume Rowing Training Increases Serum Hepcidin And Ferritin**

Burkhardt Schleipen, Martina Velders, Katja Machus, Gunnar Treff, Constantin Mayer, Carola Wagner, Jürgen M. Steinacker, FACSM. *University of Ulm, Ulm, Germany.*  
(No relationships reported)

Hepcidin is a central regulator of iron metabolism through its ability to bind to the iron transporter ferroportin. Hepcidin is produced in the liver and suppresses intestinal iron absorption and stimulates iron retention in the reticuloendothelial system. Hepcidin expression increases in response to chronic infections. We hypothesized that a high intensity and high volume training increases hepcidin production.

**PURPOSE:** To analyze the effects of an intense rowing training with high volume on iron metabolism and hepcidin levels.

**METHODS:** 8 male rowers (17.8± 0.4 years, 84.3± 8.3 kg, 191.1± 4.4 cm) of the German Junior National Team were examined 5 times during a 4 week training camp in preparation for the world championships. Training intensity and volume were increased in the first two weeks followed by a tapering phase. Hepcidin, ferritin, transferrin (Tf) and soluble transferrin receptor (sTfR) were analyzed in serum samples by ELISA.

**RESULTS:** Hepcidin increased significantly during the intense phase of the training camp (11.5 ± 3.9 - 25.5 ± 13.5 µg/l, p<.05). Ferritin, with its double role as an acute phase protein and iron store, increased non-significantly in the early phase of the training camp (68.5 ± 16.9 - 90.4 ± 28.5 µg/l, ns). Both ferritin and hepcidin levels decreased during the later phase of the training camp and returned to baseline levels at the end. Tf and sTfR remained at baseline levels at all time points. Iron increased significantly during the initial phase of intense training and remained at elevated levels throughout the training camp (11.7 ± 3.2 - 19.2 ± 8.7 µmol/l).

**DISCUSSION:** The significant rise of hepcidin and the increase of ferritin in the beginning of the high volume/intensity training is most likely an acute phase reaction to the unaccustomed training load. With training adaptation and during tapering ferritin and hepcidin levels decreased to baseline levels after 3 weeks. Iron stores were not changed according to unchanged Tf and sTfR-levels. However the increased iron levels indicate a disturbance in iron metabolism. Our results show that high volume/intensity training leads to increased hepcidin levels. Further research is required to investigate the regulation of hepcidin through different training regimes and its impact on iron metabolism.

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**3436 Board #157 June 2 8:00 AM - 9:30 AM**  
**Analysis of Yoga, Pilates and Standing Abdominal Exercises: An Electromyographic Study**

Michele Olson, FACSM. Auburn University Montgomery, Montgomery, AL.

(No relationships reported)

**PURPOSE:** Yoga, Pilates and standing exercises such as the “cross chop” have become widespread in fitness and conditioning for abdominal training. However, the utility of these exercises is largely undetermined. Thus, the purpose of this study was to determine and analyze the activation of the Rectus abdominis (RA) and External obliques (EO) during these exercises using electromyography (EMG).

**METHODS:** 15 adults (26.2 yr.) participated in the study. Nine exercises were tested: Yoga Boat, Yoga Dolphin Plank on Ball, Pilates Criss Cross, Pilates Sidebend, Standard Crunch, Standing Bicycle, Standing Cross Chop, Standing Front Crunch, Standing Sidebend. For EMG analysis, electrode pairs were applied over the area of each muscle according to Juker et al. 1998. During testing, EMG signals were monitored, amplified and processed through a Biopac converter (sampling rate 2,000 Hz). Maximal Voluntary Isometric Contractions (MVIC) were determined for normalization. Repeated measures ANOVA (p < 0.05) with Bonferroni adjustments was used to determine significant differences and assess pairwise contrasts.

**RESULTS:** The normalized results for RA and EO (% MVIC) were, respectively: Yoga Boat 75.96; Dolphin Plank-Ball 65.87; Pilates Criss Cross 65.83; Sidebend 63.40; Standard Crunch 64.79; Standing Bicycle 27.34; Cross Chop 22.29; Front Crunch 18.23; (standing) Sidebend 18.22. More specifically, the following were shown for RA activity (p. < 0.05): Yoga Boat > Dolphin Plank-Ball, Pilates Criss Cross, Sidebend, Standard Crunch > Standing Bicycle > Cross Chop, Front Crunch, (standing) Sidebend. For EO activity (p. < 0.05): Yoga Boat > Dolphin Plank-Ball > Pilates Criss Cross > Standard Crunch > Pilates Sidebend > Standing Bicycle > Cross Chop > Front Crunch, (standing) Sidebend.

**CONCLUSIONS:** Results show that “mat” exercises such as Yoga, Pilates and the Standard Crunch activated the RA and EO to a substantially higher degree compared to the standing abdominal exercises producing intensities generally above 60% MVIC. Researchers have suggested a threshold activation of 60% of MVIC for strength development and more modest intensities (20-40%) for endurance. Thus, the standing abdominal exercises tested here are likely not suited for developing strength but may be more appropriate for developing muscular endurance.

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**3437 Board #158 June 2 8:00 AM - 9:30 AM**  
**Static Stretching with Short Duration Does Not Inhibit Subsequent 100-m Sprint Performance in Sprinters**

Yu-Ju Tsai<sup>1</sup>, Hsin-Wei Huang<sup>1</sup>, Pin-Hui Chen<sup>1</sup>, Yu-Hsuan Kuo<sup>1</sup>, Ching-Feng Cheng<sup>1</sup>, Wen-Tzu Tang<sup>2</sup>. <sup>1</sup>National Taiwan Normal University, Taipei, Taiwan.

<sup>2</sup>National Taiwan Sport University, Taoyuan County, Taiwan.

(No relationships reported)

Static stretching (SS), especially the total duration per muscle is longer than 90-s, before strength and power exercises has been showed to impair the performance in the untrained individuals. However, some studies reported that the performance impairments could be due to the duration of stimuli, e.g., > 30-sec for each SS, were excessively long compared with common practice.

**PURPOSE:** To determine the acute effects of SS exercise with short duration on the sprint performance in elite sprinters.

**METHODS:** Thirteen collegiate sprinters (age, 21.3 ± 2.1 yrs, height, 170.6 ± 6.3 cm, weight, 58.1 ± 8.9 kg; 6 males and 7 females) voluntarily participated in this randomized crossover designed study, and completed 2 trials separated by at least 2 days: SS and CON. After ~20-min specific warm-up, consisted of a series of dynamic movements, skip and hopping drills, and sprints, participants in the SS trial performed 4 repetitions of 15-sec SS exercise with 60-s rest interval for each muscle group (hamstrings, quadriceps, gastrocnemius and gluteus), while participants in the CON trial were asked to quietly sit on a chair for 12-min. After treatments, the sit-and-reach test was used to assess the flexibility. And then, participants were instructed to perform the 100-m sprint test, which was timed with an electronic timing system with gates set at 0, 20, 40, 60, and 100 m. Blood lactate (La) and ammonia (NH<sub>3</sub>) concentrations were also measured during the 100-m sprint test.

**RESULTS:** The flexibility in SS (25.0±10.0 cm) was significantly higher than that in CON trial (22.1±9.4 cm) (p<0.05, η<sup>2</sup>=0.36). There were no significant differences on the La and NH<sub>3</sub> levels before and after the 100-m sprint test between trials. No significant differences were found on the time of 100-m between trials (SS vs. CON, 12.14±0.87 vs. 12.15±0.86 sec, p>0.05), as well as the other segmental or cumulative time of 100-m. Changes in flexibility between SS and CON trials were significantly correlated with the changes in the last 20-m sprint time between trials (r=0.73, p<0.05).

**CONCLUSIONS:** Flexibility could be improved by the stretching stimuli with short duration, and the 100-m sprint performance in sprinters might not be inhibited by SS in this manner. However, the last 20-m sprint time might be compromised by the better flexibility of hamstrings and lower back muscles.

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**3438 Board #159 June 2 8:00 AM - 9:30 AM**  
**Walking While Carrying a Golf Bag for 18 Holes Decreases Golf Performance**

Alan P. Jung, FACSM, Jacob T. Dellinger, Jeremy G. Cox, John K. Petrella, FACSM. Samford University, Birmingham, AL.

(No relationships reported)

**PURPOSE:** To evaluate golfers' driving accuracy, driving distance, and swing pattern while walking or riding in a golf cart.

**METHODS:** Twelve collegiate golfers (7 male and 5 female, ages 19-22 years) were recruited from a university golf team to participate in this study. To be included each participant had to be capable of shooting an 18-hole round of golf of 75 or less on average (handicap 3). Each participant completed two 18-hole rounds of golf separated by at least 48 hours. In one round the participants walked the 18-hole course while carrying a golf bag with 14 clubs. In the other trial participants rode in golf carts for 18 holes and did not carry their clubs. A Vector Pro launch monitor (Winston-Salem, NC) was placed at the tee box on holes 1 and 17 to measure ball speed, club head speed, and club angle. A handheld range finder was used to determine the driving distance from tee box to fairway. A cone was placed in the middle of the fairway, and driving accuracy was determined by measuring the perpendicular (left to right) distance from the cone to the ball.

**RESULTS:** A repeated measures ANOVA was performed to determine changes from hole 1 to hole 17. In the riding trial there was a significant increase in driving distance from hole 1 (243.8±44.2 yards) to hole 17 (250.6±43.8 yards; p=0.006), while in the walking trial there was a significant decrease in driving distance from hole 1 (252.6±34.6) to hole 17 (240.3±38.1 yards; p=0.02). In the riding trials there was no difference from hole 1 to hole 17 for ball speed, club head speed, accuracy or club angle (p=0.13-0.63). However, in the walking trial there was a significant decrease in performance from hole 1 to hole 17 for accuracy (p=0.001) and club angle (p=0.02). There was no difference in ball speed or club head speed between holes 1 and 17 in the walking trial (p=0.09-0.13). Additionally, participants recorded significantly lower values for distance (p=0.001), accuracy (p=0.003), and club angle (p=0.02) in the walking trial when compared to the riding trial.

**CONCLUSIONS:** Findings indicate a decrease in golf performance when walking and carrying clubs as measured by driving distance, driving accuracy, and club angle.

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3439 Board #160 June 2 8:00 AM - 9:30 AM

**Effect Of Ultra-endurance Swimming In Open Water On Autonomic And Hormonal Responses: A Case Study**

Giuseppe Cibelli<sup>1</sup>, Mario De Rosas<sup>1</sup>, Maria I. Roselli<sup>1</sup>, Antonio I. Triggiani<sup>1</sup>, Anna A. Valenzano<sup>1</sup>, Giulia De Ioannon<sup>2</sup>, Maria F. Piacentini<sup>2</sup>, Laura Capranica<sup>2</sup>.

<sup>1</sup>University of Foggia, Foggia, Italy. <sup>2</sup>University of Roma Foro Italico, Roma, Italy. (Sponsor: Carl Foster, FACSM)

(No relationships reported)

**PURPOSE:** To investigate the effect of ultra-endurance swimming on the autonomic nervous system (ANS), the hypothalamic pituitary adrenocortical (HPA) axis, and sympatho-adrenomedullary (SAM) responses.

**METHODS:** A male athlete (48 years, 68 kg, 172 cm, BMI 23.2 kg/m<sup>2</sup>) performed an ultra-endurance swimming in open water (42.2 nm; 78.154 Km). Salivary cortisol (sC), alpha-amylase (sAA) and heart rate variability (HRV) were monitored at rest, 15 minutes before the start, at 90 min and 18 hrs of the recovery phase. Salivary biomarkers were analyzed using commercial kits. The HRV was measured in 5-min segments of paced breathing and quantified by time and frequency domain analysis and the Poincaré plot analysis. Intervals between heartbeats (R-R intervals), square root of the mean squared successive differences between normal-to-normal RR intervals (RMSSD), the ratio (%) of successive R-R interval differences >50ms (pNN50), low-frequency power (LF) (from 0.04 to 0.15 Hz), high frequency power (HF) (from 0.16 to 0.40 Hz), instantaneous beat-to-beat variability (SD1) and continuous beat-to-beat variability (SD2) of the data were considered.

**RESULTS:** the athlete finished the ultra-endurance swimming in 23:44 hr:min. During the swimming, heart rate ranged between 120-125 beats.min<sup>-1</sup>. At 90 min after arrival, marked sAA (58.1 to 117.7 U/ml) and sC (3.5 to 81.0 nmol/l) increases were observed, which returned to pre-swimming levels at 18 hrs of recovery. Compared to rest, lower R-R intervals (925.7 to 695.8 ms), RMSSD (23.1 to 14.6 ms), pNN50 (2.0 to 0.0 %), LF (824 to 197 ms<sup>2</sup>), HF (174 to 47 ms<sup>2</sup>) and SD1 (19.0 to 10.3 ms), SD2 (74.2 to 30.4 ms) values were observed at 90 min after arrival, which persisted at 18 hrs of the recovery.

**CONCLUSION:** Low-intensity long-duration swimming elicits a relevant ANS, HPA and SAM responses. In particular, HRV analysis evidenced a strong decrease of HRV parameters, thus reflecting short- and long-term variability, while the sympathovagal balance remained unchanged. Interestingly, hormonal markers returned to pre-swimming levels after 18 hrs of recovery, while HRV variables did not turn back, suggesting that the cardiac response to low-intensity long-duration workload could be differently influenced by both adaptive central and peripheral autonomic and hormonal patterns.

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3440 Board #161 June 2 8:00 AM - 9:30 AM

**Intramuscular Temperature Responses of 4 Lower Extremity Muscles to Whole Body Vibration Training**

Cameron Shumway, Kevin Myers, J. Brent Feland, Kent Crossley, A. Wayne Johnson, Dennis Eggett. *Brigham Young University, Provo, UT.* (Sponsor: J. Ty Hopkins, FACSM)

(No relationships reported)

Prior research, although very limited, has reported that whole body vibration training (WBV) can increase arterial blood flow and increase quadriceps temperature. The current popularity and widespread use of WBV platforms has suggested they are good for a warm-up effect, but only two studies exist which have only observed quadriceps temperature changes.

**PURPOSE:** The purpose of this study was to investigate the effect of WBV training on intramuscular temperature (IMT) changes in the vastus lateralis (VL), medial gastrocnemius (MG), tibialis anterior (TA), and the semitendinosus (ST), and to compare these results to a non-vibrating control condition.

**METHODS:** 40 male subjects (avg age 22.6 ± 2.4 yrs) with ½ cm or less subcutaneous fat over each muscle of interest completed this study. Subjects were randomized into one of the 4 different muscles of interest (10 per group). Subjects then completed two treatment periods (control and vibration). Treatment orders were balanced. Resting baseline IMT of the muscles were made using intramuscular thermistors (VL and ST (1.5 cm depth), TA and MG (.5 cm depth)). IMT's were measured two more times: immediately following 5 60-second bouts of standing in a semisquat position (40 degrees of knee flexion and 30-seconds between bouts), and then immediately following a second set of similar bouts. The vibration condition differed from the control by imposing oscillating WBV at 26Hz/4mm amplitude during the semisquat bouts.

**RESULTS:** Data were analyzed using a mixed models analysis of covariance blocking on individual subjects, with baseline temperature being the covariate. Tukey post hoc comparisons used where needed. A significant increase in all 4 muscles occurred with vibration (p<0.0001). In the control condition, the ST did not increase (p=0.3890) and the MG significantly decreased in temperature (p=0.0001). Main effect of control did not significantly change from 1st to 2nd bout of semisquats.

**CONCLUSIONS:** WBV produced greater temperature gains than the control condition for all muscles, with the greatest change seen in the VL (2.06 C). WBV training in standard static semisquat position is effective for increasing IMT of these 4 muscles, but how this compares to other forms of traditional warm-up remains unknown.

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3441 Board #162 June 2 8:00 AM - 9:30 AM

**Pennation Angle Changes, Muscle Architecture, and Whole Body Vibration Training**

Kent Crossley, J. Brent Feland, A. Wayne Johnson, Dennis Eggett. *Brigham Young University, Provo, UT.* (Sponsor: J. Ty Hopkins, FACSM)

(No relationships reported)

Muscle architecture changes with age, size and location, which effects force production. Whole Body Vibration (WBV) has been shown to increase strength, power and vertical jump in recent studies. One possible explanation for these acute increases in performance without cross sectional area changes could be due to pennation angle alterations.

**PURPOSE:** The purpose of this study was to determine if whole body vibration training could influence pennation angle changes of the medial gastrocnemius (MG).

**METHODS:** 21 subjects (23.95 ± 1.77yrs, 175.65 ± 8.1cm, 74.03 ± 9.59Kg) were randomly placed into two treatment groups (control, vibration). Subjects layed in a prone position for ultrasound imaging of the right MG at a point 5cm superior to the distal end of the muscle belly (10 Mhz). Images were taken with the foot placed in subtalar neutral. Vibration subjects stood in a semi-squat position on an oscillating vibration platform (26Hz, 4mm amplitude) for 10-one minute vibration bouts with 30-second rest periods between bouts. Control subjects were asked to remain seated for the same treatment time as the vibration group. Ultrasound images were taken post treatment/control from the same location. Pennation angles were measured and averaged for each image.

**RESULTS:** Data were analyzed using a one-way analysis of covariance with the pre-treatment pennation value as the covariate. Post treatment pennation angles were found to have significantly decreased in the control group (p=0.0143, 1.57° ± 2.69°) but not in the vibration group (p=0.2134, 1.38° ± 2.21°).

**CONCLUSIONS:** As a muscle shortens, the angle of pennation increases. Therefore, we might theorize that WBV limits change in the angle of pennation. This may allow the muscle to produce more force. Since we did not look at force production, further research is needed to investigate if these pennation differences translate into isolated plantar flexion force changes following WBV.

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3442 Board #163 June 2 8:00 AM - 9:30 AM

**The Effects Walking With And Without Poles On Body Composition In Women With Metabolic Syndrome**

Dortris A. Downs, Michael Holmstrup, Carla Murgia. *Delaware State University, Dover, DE.* (Sponsor: Erica M. Jackson, FACSM)

(No relationships reported)

Metabolic syndrome (MetSyn) has become common, with an estimated 50-75 million people affected in the US alone. MetSyn is characterized by obesity, dyslipidemia, high blood pressure, and a large waist circumference. Research has provided evidence that walking with Nordic poles can increase ones heart rate, and energy expenditure. The question is, if heart rate and energy expenditure are increased in normal individuals, are there similar effects for individuals diagnosed with MetSyn?

**PURPOSE:** The purpose of this study was to compare the effects of walking with and without Nordic walking poles on several indices related to MetSyn following 12-weeks of training.

**METHODS:** Nine obese women (40-64 yr) were assigned to walking groups, either with or without poles. Baseline and follow-up measurements for waist and hip circumference, blood pressure (BP), and body composition were collected. Subjects were monitored for exercise intensity during training (70% of age predicted maximum heart rate). A repeated measure ANOVA was used to analyze the effect of training on body composition variables. The confidence level was set at 95%.

**RESULTS:** Significant reductions were found between pre and post weight ( $P=0.035$ ), hip circumference ( $P=0.019$ ) and BP measurements ( $P=0.025$ ), with significantly greater improvements in the group who walked with Nordic poles. There was no significant effect of training on waist circumference ( $P=0.776$ ), lean body mass ( $P=0.431$ ), or fat mass ( $P=0.389$ ).

**CONCLUSION:** The evidence provided by this study supports the notion that walking with poles has an increased effect on lowering BP, and reducing weight and girth measurements, which may contribute towards a reduction in MetSyn risk.

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## G-38 Free Communication/Poster - Fitness

JUNE 2, 2012 7:30 AM - 11:00 AM  
ROOM: Exhibit Hall

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### 3443 Board #164 June 2 9:30 AM - 11:00 AM

#### Get Fit Together Intervention: Group Fitness Participation Produces Positive Health Benefits

Jinger S. Gottschall<sup>1</sup>, Justin L. Jones<sup>1</sup>, Jackie Mills<sup>2</sup>, Bryce Hastings<sup>2</sup>. <sup>1</sup>The Pennsylvania State University, University Park, PA. <sup>2</sup>Les Mills International, Auckland City, New Zealand. (Sponsor: W. Larry Kenney, FACSM)  
(No relationships reported)

It is no longer surprising to hear the alarming statistics regarding the rise of obesity without a parallel surge in physical activity within the United States. In response to this troubling trend, multiple federal agencies, including the American College of Sports Medicine, recommend 60 minutes of cardiovascular activity 3-5 days per week and 8-10 muscular strength as well as flexibility exercises 2 days per week. Numerous studies have quantified how these established guidelines improve cardiovascular function, augment bone density, reduce total body fat, and enhance daily living performance. These previous findings are based upon the utilization of a singular exercise modality or the quantification of lifestyle physical activity. Group fitness is one method presently promoted to meet exercise recommendations but the effectiveness of a comprehensive program has never been experimentally tested.

**PURPOSE:** To evaluate if a multimodal group fitness intervention can singularly produce physiological and musculoskeletal health benefits by utilizing the established physical activity prescription.

**METHODS:** 29 sedentary, but otherwise healthy, adults (11 men and 18 women) between the ages of 25-40 years completed the midpoint testing of a 30-week group exercise program based upon the recommended guidelines. The protocol started with a 6-week familiarization period, continued with a 12-week block of 6 group fitness classes per week (3 cardiovascular, 2 strength, 1 flexibility), and concluded with a final 12-week block of 7 classes per week (4 cardiovascular, 2 strength, 1 flexibility). We completed a submaximal oxygen consumption treadmill test, fasting blood draw and iDXA scan for each participant at 3 time points (baseline, midpoint, conclusion) and analyzed the data using a paired t-test ( $p < 0.05$ ).

**RESULTS:** Compared to the baseline measurements, the midpoint measurements demonstrated that the participants mean oxygen consumption increased by 34%, triglycerides decreased by 11%, LDL decreased by 6%, pelvic bone mineral density increased by 8%, and total body fat mass decreased by 4% (all values  $p < 0.01$ ).

**CONCLUSIONS:** Group fitness can be utilized as a modality to meet the physical activity prescription while producing optimal physiological and musculoskeletal health benefits.

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### 3444 Board #165 June 2 9:30 AM - 11:00 AM

#### Online Fitness Course Effectiveness in Increasing Physical Activity, Improving Fitness Scores, and Encouraging Healthy Choices

Karen K. Dennis, Cheri A. Toledo. Illinois State University, Normal, IL. (Sponsor: Dale D. Brown, FACSM)  
(No relationships reported)

Given the current trends of physical inactivity, overweight and obesity rates, and chronic disease prevalence, understanding appropriate levels of physical activity, healthful nutrition, and risk reduction for chronic-disease is crucial. While many colleges and universities offer, and some even require, courses that instruct students on these topics, they are offered in a traditional face-to-face environment which may limit the number of students able to receive the instruction. Online instruction as to healthy activity, nutrition, and chronic-disease-prevention techniques is a way to reach more individuals.

**PURPOSE:** The purpose of this study was to identify the effectiveness of an online personal health and fitness course in terms of enhancing or modifying choices related to physical activity, nutrition, and chronic-disease prevention, and to also identify changes in pre- and post-class fitness assessments.

**METHODS:** Study participants were 30 students, predominantly female (60%) seniors (76.7%), enrolled in a post-secondary completely online personal health and fitness course. Data sources used were a survey of activity, nutrition, and chronic disease prevention choices, and pre- and post-class fitness-testing results.

**RESULTS:** Survey results show that as a result of learning in the class, most participants (85.2%) increased physical activity during the course from what they were prior to the beginning of the course, even though the class did not meet face-to-face, most (70.3%) consciously made nutrition choices that met the dietary guidelines "Almost Always" and "Often", and most (77.7%) considered the choices they were making and how those choices might affect risk for developing chronic disease "Almost Always" and "Often." A paired samples t-test indicated that pre- and post-fitness testing changes in the mile-run time, the cardiac-fitness level, the curl-up test, the push-up test and rating, and thigh flexibility were statistically significant. Physical fitness test results show improvements ranging from 12.1 to 16.2%.

**CONCLUSION:** This online course was effective in increasing physical activity participation, fitness scores, and healthy nutrition and chronic disease prevention choices, which may be beneficial reducing the rates of physical inactivity, obesity, and chronic disease.

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### 3445 Board #166 June 2 9:30 AM - 11:00 AM

#### Cardiorespiratory Fitness And Cognition - The Dr'S Extra Study

Rainer Rauramaa, FACSM<sup>1</sup>, Pirjo Komulainen<sup>1</sup>, Maija Hassinen<sup>1</sup>, Kai Savonen<sup>1</sup>, Tuomo Hänninen<sup>2</sup>, Miia Kivipelto<sup>3</sup>. <sup>1</sup>Kuopio Research Institute of Exercise Medicine, Kuopio, Finland. <sup>2</sup>Kuopio University Hospital, Kuopio, Finland. <sup>3</sup>Karolinska Institutet, Stockholm, Sweden.  
(No relationships reported)

The clinical relevance of cardiorespiratory fitness is nowadays well understood. The connection between cardiovascular risk factors and impaired cognitive function has become more and more apparent. While randomized controlled trials have shown the potential of regular aerobic exercise in preserving cognitive function, the role of cardiorespiratory fitness in this regard is less well understood.

**PURPOSE:** To study the impact of cardiorespiratory fitness on specific cognitive domains in older individuals.

**METHODS:** A population sample of 1346 men and women aged 57-78 years who participated in the Dose-Responses to Exercise Training Study (DR's EXTRA). Cardiorespiratory fitness was assessed as maximal oxygen uptake ( $VO_{2max}$ ;  $ml \cdot kg^{-1} \cdot min^{-1}$ ) by a respiratory gas analysis in an electrically braked bicycle ergometer. Cognitive function was evaluated using the Consortium to Establish a Registry for Alzheimer's disease (CERAD) neuropsychological test battery. Sum scores for immediate memory, delayed memory, verbal performance, visual performance and Mini-Mental State Examination were calculated. Logistic regression analysis was used to analyze the relative risk of cognitive impairment during four years across baseline  $VO_{2max}$  tertiles. Linear mixed model analysis was applied to find out the association of cardiorespiratory fitness on cognitive change. :

**RESULTS:** Individuals in the highest gender specific  $VO_{2max}$  tertile at baseline had 53% lower risk for incident poor immediate memory ( $P=0.022$ ) and 45% lower risk for incident poor delayed memory ( $P=0.038$ ) compared to those in the lowest  $VO_{2max}$  tertile during four years. One unit increase in  $VO_{2max}$  was associated with improved immediate memory ( $\beta=0.06$ ,  $P<0.001$ ), delayed memory ( $\beta=0.06$ ,  $P<0.001$ ), verbal performance ( $\beta=0.09$ ,  $P=0.001$ ) and Mini-Mental State Examination ( $\beta=0.02$ ,  $P=0.059$ ), after adjustment for potential confounders. :

**CONCLUSIONS:** Higher levels of cardiorespiratory fitness associate favourably with cognition, especially with preserving memory function. The present results are an additional proof of the clinical importance of achieving and keeping fitness.

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3446 Board #167 June 2 9:30 AM - 11:00 AM

**Cardiorespiratory Fitness Among Adults with Severe Mental Illness**

Gerald J. Jerome<sup>1</sup>, Deborah Rohm Young, FACSM<sup>2</sup>, Kerry J. Stewart, FACSM<sup>3</sup>, Bernadette A. Cullen<sup>3</sup>, Arlene T. Dalcin<sup>3</sup>, Carl Latkin<sup>4</sup>, Lawrence J. Appel<sup>3</sup>, Gail L. Daumit<sup>5</sup>. <sup>1</sup>Towson University, Towson, MD. <sup>2</sup>University of Maryland, College Park, MD. <sup>3</sup>Johns Hopkins School of Medicine, Baltimore, MD. <sup>4</sup>Bloomberg School of Public Health, Baltimore, MD.

(No relationships reported)

**PURPOSE:** The feasibility of maximal and submaximal assessment of cardiorespiratory fitness (CRF) among adults with severe mental illness (SMI) was examined and their fitness levels were compared with national data. The association of CRF with psychological factors (diagnosis, severity of psychiatric symptoms, depression) and traditional cardiovascular disease risk predictors (BMI, adiposity, blood pressure, cholesterol, lipids) were also examined.

**METHODS:** The Activating Consumers to Exercise through Peer Support (ACE) trial was designed to examine the effectiveness of peer support on adherence to a 4 month pilot exercise program for adults with SMI (N = 107). Study measures included maximal (graded treadmill test) and submaximal (six-minute-walk) assessment of CRF; standardized measurements of height, weight and blood pressure; percent body fat assessed by dual-energy X-ray absorptiometry; fasting blood test; and self-report measures of depression and severity of psychiatric symptoms.

**RESULTS:** The average age was 47 years (SD = 10) with 78% females and 76% African-American. Compared to a national sample from the Cooper Center Longitudinal Study, 95% of the current sample had below average fitness levels as measured on the graded treadmill test with average MET levels of 5.9(SD = 2.2) for participants and 6.2(SD = 2.3) for peer leaders. There was a significant association between MET levels from the treadmill test and distance walked in the six-minute-walk ( $r = 0.36, p < 0.001$ ). Lower MET levels were associated with higher BMI ( $r = -0.34, p < 0.001$ ) and percent body fat ( $r = -0.37, p < 0.001$ ), but were not associated with blood pressure, cholesterol, or lipids. There was no association between MET levels and primary psychiatric diagnosis, depression, or severity of symptoms.

**CONCLUSION:** Both maximal and submaximal assessment of CRF was feasible among adults with severe mental illness. The uniformly low baseline CRF and the association of fitness with BMI and adiposity indicated programs to increase physical activity were warranted among adults with SMI.

Supported by a National Institute of Mental Health Grant 5R34MH0078613.

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3447 Board #168 June 2 9:30 AM - 11:00 AM

**Effects of 10 wk Commuter Cycling on Cardiovascular Fitness, Lipids, Insulin Sensitivity and Body Composition**

B James Novis, Elaine A. Hargreaves, Nancy J. Rehrer, FACSM. University of Otago, Dunedin, New Zealand.

(No relationships reported)

Commuter cycling interventions have resulted in mixed effects on body composition and blood lipid profiles, whereas insulin sensitivity has not been investigated.

**PURPOSE:** The purpose of this study was to examine effects of commuter cycling on body composition and health parameters.

**METHODS:** Males and females were recruited and completed a questionnaire regarding present physical activity and commuting practices and a graded cycle ergometry test (VO<sub>2</sub>peak). Group assignment was randomised and matched for sex and fitness. The intervention group (IG) (n=14, age 39 ± 7 yr, body mass 77 ± 11 kg, VO<sub>2</sub>peak 2.8 ± 0.8 l•min<sup>-1</sup>) was given bicycles and asked to cycle commute for 100+ min / wk for 10 wk. The control group (CG) (n=14, age 34 ± 8 yr, body mass 70 ± 7 kg, VO<sub>2</sub>peak 2.6 ± 0.7 l•min<sup>-1</sup>) was to continue using motorised transport. Baseline (T0) testing included cholesterol fractions, triglycerides, C-reactive protein, fasting insulin and glucose (HOMA-IR) and body composition (mass, waist-to-hip ratio (WHR), skin folds) and was repeated wk10 (T10). Data were analysed using a two-factor (group x time) repeated measures ANOVA.

**RESULTS:** Analyses included 13 participants per group. IG cycled 152 ± 60 min / wk. No change in body fat over time (P=0.910) or between groups (Interaction P=0.997) was observed (IG T0: 30 ± 8, T10: 30 ± 8; CG T0: 27 ± 7, T10: 27 ± 8 %). WHR decreased over time (P=0.005) and was different (Interaction P=0.007) between groups (IG T0: 0.85 ± 0.08, T10: 0.81 ± 0.08; CG T0: 0.81 ± 0.06, T10: 0.81 ± 0.07). No change in body mass over time (P=0.157) or between groups (Interaction P=0.686) was observed (IG T0: 76.8 ± 10.7, T10: 77.0 ± 9.5; CG T0: 69.8 ± 6.7, T10: 70.3 ± 6.7 kg). VO<sub>2</sub>peak did not change over time (P=0.181) but was different (Interaction P=0.043) between groups (IG T0: 2.8 ± 0.8, T10: 3.1 ± 0.7; CG T0: 2.7 ± 0.7, T10: 2.6 ± 0.7 l•min<sup>-1</sup>). There were no significant changes within or between groups for blood parameters.

**CONCLUSION:** Commuter cycling for ~150 min / wk for 10 wk improves cardiovascular fitness, does not alter body mass or percentage fat, but may influence fat distribution. The lack of significant changes in blood parameters may be due to inadequate volume of exercise or duration of the intervention. Supported by the New Zealand Heart Foundation.

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3448 Board #169 June 2 9:30 AM - 11:00 AM

**Effects of Physical Educational Class On Improving Physical Fitness In Stroke Out-patients**

long pio chio<sup>1</sup>, Pei Jhen Lee<sup>1</sup>, Hsuei Chen Lee<sup>1</sup>, Ku Chou Chang<sup>2</sup>, Jin Jong Chen<sup>1</sup>. <sup>1</sup>National Yang-Ming University, Taipei, Taiwan. <sup>2</sup>Chang-Gung Memorial Hospital, Kaohsiung, Kaohsiung, Taiwan.

(No relationships reported)

Stroke survivors tend to have a sedentary lifestyle due to the sequela, hence, it may increase the chance of recurrent stroke and cardiovascular diseases. Previous studies have showed that moderate intensity physical activity could improve physical fitness. Even the physicians recommend them to have more exercises to promote the fitness, the stroke out-patients still claim that the details about the exercise prescription are not clear.

**PURPOSE:** This study aimed to investigate the possibility to implement the physical education class for the mild stroke outpatients while waiting for the regular OPD consultation and to see its effects on improving the physical fitness.

**METHODS:** This was a quasi-experimental study. Exercise group received 3 sessions of supervised exercise class during the visit of the OPD (1 session/month) and 12-week home-based exercise program. Each physical educational class contained the warm-up, cardiopulmonary fitness training, strengthening and balance training for 40 minutes. Between two sessions, the patients were instructed to do the home program through telephone visit. Control group received only one exercise consultation session during the first visit. Outcome measures include body composition, muscle strength, 6-minute walk test (6MWT), gait speed, flexibility and Berg balance scale (BBS). Measurements were conducted at baseline and 12<sup>th</sup> week.

**RESULTS:** Eighty five mild stroke patients were recruited: 42 in exercise group and 43 in control group. There were 71 males and 14 females; with mean age 62.8 ± 9.5 yrs. After 12 weeks, the exercise group demonstrated greater improvements than the control group on most physical fitness measures, including the 6MWT (↑73.6 vs. ↑27.2 meters, p=0.001), 10 meter walk time (↓1.81 vs. ↓0.34 sec, p=0.004), upper limb muscle strength index (lb/kg, ↑0.31 vs. ↑0.15, p<0.001), lower limb muscle strength index (lb/kg, ↑0.55 vs. ↑0.25, p=0.003) and balance function (BBS ↑1.64 vs. ↑0.05, p=0.003).

**CONCLUSIONS:** Physical educational class combined with home exercise program potentially improved physical fitness for those mild stroke outpatients. From the result of this study, physical educational class is a practical and low cost strategy that gives a positive effect for mild stroke outpatients.

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3449 Board #170 June 2 9:30 AM - 11:00 AM

**Effects Of Hospital-based Intervention On Physical Fitness, quality Of Life For Sedentary Care-giving Housewives**

Wen-Hui Huang, Jin-Jong Chen, Hsuei Chen Lee. Yang-ming Exercise Health Science Institute, Taipei, Taiwan.

(No relationships reported)

**BACKGROUND:** Due to heavy housework and many other barriers, care-giving housewives lead a sedentary lifestyle. They tend to get overweight, low back pain, poor physical fitness, and have lower quality of life and mental health. So, we developed the eight-week hospital-based exercise intervention (HEI) using day-care treatment duration of their children twice per week to provide an accessible exercise time for them to promote their physical fitness, self-efficacy and quality of life.

**PURPOSE:** To investigate the effects of HEI on physical fitness and quality of life for sedentary care-giving housewives

**METHODS:** Sixty-six sedentary care-giving housewives were recruited as volunteers and assigned into two groups: HEI group (n=31) and control group (CG, n=35). HEI program consisted of 16 sessions including 8 walking sessions and 8 yogalates sessions. Yogalates class focused on training their core muscle groups including abdominal, back and pelvic muscles. Control group



received one exercise consultation session during the first visit. Outcome measures comprised: 1) Questionnaires: personal characteristics, self-efficacy and quality of life (SF-36); 2) Health-related physical fitness: BMI, muscle endurance, flexibility, sit-up and cardiopulmonary endurance. Measurement was conducted at baseline and 9th week.

**RESULTS:** After 8 weeks exercise intervention, the HEI had significant improvements on all physical fitness items, such as upper and lower extremity muscle endurance (from  $19.8 \pm 5.5$  to  $24.7 \pm 5.2$ ,  $p < 0.01$ ), sit up (from  $13.7 \pm 8.1$  to  $19.0 \pm 8.5$ ,  $p < 0.01$ ), flexibility (from  $22.3 \pm 10.4$  to  $27.3 \pm 9.8$ ,  $p < 0.01$ ) and cardiopulmonary endurance (from  $53.0 \pm 13.6$  to  $59.3 \pm 11.5$ ,  $p < 0.05$ ). The quality of life had significant improvement, especially on mental health (from  $55.0 \pm 16.8$  to  $66.8 \pm 17.2$ ,  $p < 0.01$ ) and self-efficacy score had elevated significantly too. (from  $19.7 \pm 3.7$  to  $22.3 \pm 3.6$ ,  $p < 0.01$ ) However, the CG had no significant improvement on physical fitness, self-efficacy and quality of life ( $p > 0.05$ ).

**CONCLUSION:** The small-group hospital-based and caregiver-focused intervention model made housewives more active and satisfied from exercise. Truly, the intervention program improved their physical fitness, self-efficacy and quality of life significantly.

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**3450** Board #171 June 2 9:30 AM - 11:00 AM

**Exercise Behaviors, Quality Of Life, And Burnout Among Physician Trainees: The Effect Of An Incentivized Fitness Program**

Jacob L. Sellon, Christopher J. Weight, Collette R. Lessard, Edward R. Laskowski, FACSM, Susan C. Karpinski, Fred M. Green, Steven H. Rose, Kerry D. Olsen, Tait D. Shanafelt. *Mayo Clinic, Rochester, MN.*

(No relationships reported)

**PURPOSE:** Resident well-being is important for providing an optimal learning environment and high quality patient care. According to the American Medical Association Code of Medical Ethics, "Residents and fellows are obligated, as are all physicians, to monitor their own health and level of alertness so that these factors do not compromise their ability to care for patients safely." Previous studies have indicated that graduate medical trainees have low overall wellness and high rates of burnout. We studied the effects of a prospective, incentivized fitness program on exercise habits, quality of life, and burnout among physician trainees in a large single institution cohort.

**METHODS:** All graduate medical trainees at Mayo Clinic Rochester ( $n=1159$ ) were invited to complete a baseline survey. Questions included demographics, fitness behavior (Department of Health and Human Services [HHS] 2008 Physical Activity Guidelines for Americans), quality of life (100-point visual analog scale), and burnout (abbreviated Maslach Burnout Inventory). All residents were then invited to participate in an incentivized fitness challenge. This consisted of 12 weeks of self-directed exercise for which points were awarded for various exercise activities. After the contest, both participants and non-participants were asked to complete a follow-up survey.

**RESULTS:** 628 trainees participated in the baseline survey (54%), and 242 (21%) enrolled in the fitness program. At baseline, there were no significant differences between program participants and non-participants with regard to demographics, medical training level, exercise habits, quality of life and burnout. 532 (46%) residents completed the follow-up survey. Following the program, participants were much more likely to meet current HHS Physical Activity Guidelines (OR 3.2 95% CI 2.2-4.8) and had a higher overall quality of life (72.4 vs 62.2,  $p < 0.0001$ ) compared to non-participants. There was a trend toward lower burnout measures in program participants compared to non-participants, but this was not statistically significant.

**CONCLUSIONS:** An incentivized fitness program significantly improved exercise behavior and quality of life ratings among physician trainees. Promoting healthy exercise behaviors among physician trainees may also decrease physician burnout.

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**3451** Board #172 June 2 9:30 AM - 11:00 AM

**Alcohol Intake is an Independent Predictor of Metabolic Syndrome Risk as well as Cardiorespiratory Fitness**

Meiko Asaka, Hiroshi Kawano, Tomoko Aoyama, Shizuo Sakamoto, Mitsuru Higuchi, FACSM. *Waseda University, Tokorozawa, Saitama, Japan.*

(No relationships reported)

Cardiorespiratory fitness (CRF) is known as an independent predictor of metabolic syndrome (MS). On the other hand, some studies show that alcohol intake is associated with risk of MS. However, little is known whether alcohol intake is also independent predictors of MS as well as CRF.

**PURPOSE:** To examine the association of CRF and alcohol intake with MS risk in Japanese adults.

**METHODS:** Participants included 227 Japanese men ( $n = 110$ ) and women ( $n = 117$ ) aged 20-70 years. Alcohol intake was assessed by a self-administered diet history questionnaire. CRF was assessed by measuring  $VO_{2max}$ . The visceral fat cross-sectional area was evaluated by MRI, and blood pressure, fasting HDL-cholesterol, triglyceride, glucose were measured as indices of MS risk factors. MS risk score was calculated by a number of the risk factors from criteria value of MS. Participants were classified into three alcohol intake status categories (Non-: 0g/day, Moderate: < 22g/day, and Heavy: > 22g/day) and two CRF categories (Low and High based on reference values established in "Exercise and Physical Activity Reference for Health Promotion 2006").

**RESULTS:**  $VO_{2max}$  and alcohol intake were significantly correlated with MS risk score ( $r = -0.256$  and  $0.284$ ,  $p < 0.001$ , respectively) after adjusting for sex, age and smoking status. Multiple linear regression analysis revealed that both  $VO_{2max}$  and alcohol intake were independently correlated with MS risk score ( $\beta = -0.26$  and  $0.24$ ,  $p < 0.001$ , respectively) after adjusting for sex, age, smoking status, energy intake and step-counts. The MS risk score of Heavy alcohol intake group (MS risk score:  $1.6 \pm 0.2$ ) was significantly higher than that of Moderate group ( $0.9 \pm 0.1$ ,  $p = 0.001$ ). MS risk score of High CRF group ( $0.9 \pm 0.1$ ) was lower than that of Low CRF group ( $1.3 \pm 0.9$ ,  $p = 0.021$ ). High CRF group had significantly and slightly lower MS risk score than Low CRF group in Non- ( $p = 0.028$ ) and Moderate ( $p = 0.059$ ) alcohol intake groups. However, there was no significant difference of MS risk score between High and Low CRF group in Heavy alcohol intake group.

**CONCLUSIONS:** These results suggested that alcohol intake is an independent predictor of MS as well as CRF in Japanese people, and heavy alcohol intake has higher risk of MS even with high CRF.

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**3452** Board #173 June 2 9:30 AM - 11:00 AM

**Body Composition, Physical Activity, Aerobic Fitness, And Metabolic Profile In High-fit High-fat 18 Year-olds**

Sigurbjörn Á. Arngrímsson, Erlingur B. Richardsson, Anna S. Ólafsdóttir. *University of Iceland, Laugarvatn, Iceland.* (Sponsor: Ellen M. Evans, FACSM)

(No relationships reported)

Although the prevalence of metabolic risk factors is well known in adults, it is not well described among individuals in their late teens.

**PURPOSE:** The purpose of the study was to examine metabolic risk factors among 18 year-old high-school students and to compare students attending vocational vs. traditional high-schools.

**METHODS:** The participants (147 boys and 130 girls) were randomly selected from three high-schools in Reykjavik, Iceland. Physical activity (PA) was assessed with pedometers and aerobic fitness (fitness) with a maximal oxygen uptake test on a treadmill. Height, weight, waist circumference (WC), and body mass index (BMI) were determined and percentage body fat (%Fat) assessed with dual energy X-ray absorptiometry. Resting blood pressure (BP) and fasting serum lipids and glucose were measured.

**RESULTS:** According to BMI, 23.3% of the students were overweight/obese, 20.4% had elevated WC, and 50.8% had higher %Fat than recommended. In addition, 11.2% of the participants had lower high-density lipoprotein, 8.4% higher low-density lipoprotein, and 8.8% higher triglycerides than advised and 10.2% had borderline or high systolic BP. In contrast, 84.4% of the students had average or higher levels of fitness. Regardless, only 34.4% of the participants reached the recommended levels of daily PA. Only a handful of the students had increased fasting glucose levels. Higher proportion of boys than girls were classified as obese (%Fat  $p = 0.042$ , BMI  $p = 0.049$ ) and with borderline or high systolic BP ( $p < 0.001$ ), but relatively more boys had also very good fitness level ( $p < 0.001$ ). No gender differences were found in the proportions across PA ( $p = 0.706$ ), diastolic BP ( $p = 0.139$ ), glucose ( $p = 0.357$ ), or serum lipids ( $p = 0.293-0.901$ ) classifications except that higher fraction of girls had elevated total cholesterol ( $p = 0.014$ ). Students in vocational schools had lower levels of fitness and PA, and higher %Fat, WC, and BP ( $p < 0.05$ ).

**CONCLUSION:** Although fitness among Icelandic 18 year-olds seems generally good, their PA is low and %Fat greatly elevated. Serum lipids and systolic BP are also raised in about 10% of the teenagers. Students in vocational schools measure worse on fitness, PA, BP and most body composition variables. Interventions aiming at increasing PA and decreasing adiposity are needed in this age group.

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3453 Board #174 June 2 9:30 AM - 11:00 AM

**Association between Age and Fitness among Men and Women Entering Basic Combat Training**

Shamola Greene, Joseph J. Knapik, FACSM, Andrea Harris, Bria Graham, Ryan Steelman, Keith Hauret, Bruce H. Jones, FACSM. *U. S. Army Institute of Public Health, Aberdeen, MD.*  
(No relationships reported)

The association between age and fitness in the military has been examined in operational units (Knapik, *J Aging Phy Fit* 4:234, 1996) but not among new recruits just entering United States (U.S.) Army Basic Combat Training (BCT). Recruits in BCT represent a broad cross section of the U.S. since they come from all parts of the country.

**PURPOSE:** This was a cross-sectional examination of age-related differences in physical fitness among men and women entering BCT.

**METHODS:** The Army Physical Fitness Test (APFT) consists of a 2-minute maximal effort push-up (PU) event, a 2-minute maximal effort sit-up (SU) event, and a 2 mile run for time (RUN). The Resident Individual Training Management System (RITMS) was queried for age and entry level APFT scores of Soldiers entering BCT from 1 October 2009 to 30 September 2010. There were a total of 53,574 men and 9,885 women who had these values. PU, SU, and RUN data was plotted by age and each event was analyzed using two-way analysis of variance (age by gender). Average yearly performance changes were estimated from the slope of the linear regression of age on PUs, SUs, or RUN.

**RESULTS:** The mean  $\pm$  standard deviation (SD) PU, SU, and RUN for men was 41  $\pm$  15 repetitions (reps), 48  $\pm$  14 reps, and 16.1  $\pm$  2.3 minutes; for women these values were 19  $\pm$  13 reps, 42  $\pm$  16 reps, and 19.9  $\pm$  2.9 minutes. The age range was 17 to 42 years with a mean SD of 22  $\pm$  4.53. PUs declined very slightly by age ( $p < 0.01$ ) but the difference was small between age groups amounting to no more than 2 reps; there was no gender by age interaction ( $p = 0.96$ ). SUs and RUN declined with age ( $p < 0.01$  for both), and there was a gender by age interaction ( $p < 0.01$  for both).

**CONCLUSION:** Among BCT recruits, and within the age groups examined here, there was little change in PU performance across the age groups. SU and RUN performance declined with age and the pattern differed slightly for men and women.

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3454 Board #175 June 2 9:30 AM - 11:00 AM

**A Twenty Year Epidemiological Analysis of Fitness and Medical Trends in College Students**

Meagan Beyers, Megan Jones, Silas Pearman. *Furman University, Greenville, SC.*  
(No relationships reported)

**PURPOSE:** This cross sectional study was designed to assess medication and orthopedic trends in college age students.

**METHODS:** A Physical Activity Readiness Questionnaires (PAR-Q) analyzed trends with regards to medical conditions, over the counter and prescription drug use, and other health issues in college students from a private liberal arts college from 1990 to 2010 (N=1413).

**RESULTS:** Over the twenty year period, there was an increase in over the counter and prescription drug use ( $p < .01$ ). Specific drugs with increased usage included digestive, ADD/ADHD, oral contraceptives, acne, anti-depressants, allergy, and medications. Women took more allergy, acne, anti-depressants, and all other medications ( $p < .01$ ) while men took more medications for ADD/ADHD ( $p < .01$ ). Overall, a total of 46% of students were on at least one medication with an additional 5% of students on two or more medications. In addition, the data showed the 5% of students had heart murmurs, 10 % of students had asthma, and 12% of students reported orthopedic issues, with women students reporting more orthopedic conditions ( $p < .01$ ).

**CONCLUSION:** Over the twenty year period, there was a significant increase in over the counter and prescription drug usage as well as increase in asthma and orthopedic conditions. These trends reflect the increased use of prescription drugs as well as possible sports specialization connected to orthopedic injuries.

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3455 Board #176 June 2 9:30 AM - 11:00 AM

**Association between Physical Fitness and Discharge and Recycling Risk among Male Army Recruits**

Andrea Harris, Joseph Knapik, Shamola Greene, Keith Hauret, Bria Graham, Ryan Steelman, Bruce Jones. *US Army Institute of Public Health, Aberdeen Proving Ground, MD.*  
(No relationships reported)

**INTRODUCTION:** Discharges are individuals who are removed from military service and in Basic Combat Training (BCT) recruits are generally discharged due to medical conditions, inability to adapt to the military for psychological reasons, or inability to perform critical military tasks. Recycling involves extending the normal training period so the recruit can have additional time to meet required BCT performance criteria. A previous study examined the association between fitness and discharge incidence (Knapik, *Milit Med* 166:641, 2001) however no prior investigation has examined fitness as a risk factor for recycling.

**PURPOSE:** To examine the relationship between entry-level physical fitness and discharge and recycle incidence among men in BCT.

**METHODS:** Resident Individual Training Management System (RITMS) was queried for all male basic trainees beginning training between October 1, 2009 and September 30, 2010. There were 99,700 male recruits in the database and 54,630 had entry-level Army Physical Fitness Test (APFT) scores. The APFT consisted of a 2-minute maximal effort push-up (PU) event, a 2-minute maximal effort sit-up (SU) event and a 2-mile run for time (RUN). The final status of the recruit (graduation, discharge or recycle) was also obtained from RITMS. Recruits were placed into performance quartiles (Q1=high performance through Q4=low performance) on each of the 3 APFT events. The association between final status and fitness were assessed by examining discharge or recycle risk at each quartile. Risk ratios (RR) and 95% confidence intervals were examined by comparing each quartile to Q4.

**RESULTS:** Men were at higher discharge risk if they had lower performance on PUs (RR[Q4/Q1]=4.5, 95% CI=3.7-5.4), SUs (RR[Q4/Q1] = 3.15, 95% CI= 2.66-3.74), or a RUN (RR[Q4/Q1] = 2.39, 95% CI= 2.04-2.80) Men were also at higher recycle risk if they had low performance on PUs (RR[Q4/Q1]=4.06, 95% CI=3.29-3.33), SUs (RR[Q4/Q1]= 3.52, 95% CI=2.84-4.37) or the RUN (RR[Q4/Q1] = 2.73, 95% CI = 2.23-3.33). For all 3 APFT events there was a dose-response such that any lower fitness level was associated with higher discharge or recycle risk, compared to the next highest fitness level.

**CONCLUSIONS:** Among men in BCT, lower fitness levels were associated with higher discharge or recycling risk in a dose-response manner.

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3456 Board #177 June 2 9:30 AM - 11:00 AM

**Different Measures of Adiposity, Cardiorespiratory Fitness, And All-cause Mortality In Men**

James R. Morrow, Jr., FACSM<sup>1</sup>, Stephen W. Farrell<sup>2</sup>, Carrie E. Finley<sup>2</sup>, Allen W. Jackson, FACSM<sup>1</sup>, Scott M. Grundy<sup>3</sup>, Gloria L. Vega<sup>3</sup>. <sup>1</sup>North Texas, Denton, TX. <sup>2</sup>The Cooper Institute, Dallas, TX. <sup>3</sup>University of Texas-Southwestern Medical Center, Dallas, TX.  
(No relationships reported)

**PURPOSE:** Examine the relationship among three differently defined adiposity categories on all-cause mortality in men stratified by cardiorespiratory fitness (CRF).

**METHODS:** A cohort of 36,836 apparently healthy men underwent a comprehensive physical examination at The Cooper Clinic between 1970 and 2006. Clinical measures included Body Mass Index (BMI), Waist Circumference (WC), Percentage of Body Fat (%Fat), and CRF determined by maximal treadmill exercise duration. Participants were grouped into 4 adiposity categories: Group 1 = normal weight for all 3 adiposity exposures, Group 2 = overweight for 1 exposure, Group 3 = overweight for 2 exposures, Group 4 = overweight for all 3 adiposity exposures. Hazard ratios (HRs) were computed with Cox regression analysis with adjustment for age, exam year, and smoking status. Because BMI and WC are more common adiposity measures, we performed additional mortality analyses using different combinations of BMI, WC, and CRF.

**RESULTS:** During a mean follow-up of 15.5  $\pm$  8.1 years, 2294 deaths occurred. Adjusted HRs across adiposity groups were 1.0 (referent), 1.10, 1.18, and 1.71 for Groups 1-4 respectively ( $p$  trend  $< 0.0001$ ). While further adjustment for CRF attenuated this pattern, the trend was still significant ( $p = 0.01$ ). When grouped into categories of fit and unfit (upper 80% and lower 20% of CRF distribution), mortality rates (per 10,000 man-years) were significantly lower in fit compared with unfit men within each of the 4 adiposity groups. Examination of the effects of various combinations of BMI, WC, and CRF on mortality, resulted in similar mortality rates in men who had normal BMI and normal WC as compared to men with high BMI and normal WC (13.4 vs. 14.4 deaths per 10,000 man-years respectively). Men with high BMI and high WC had the highest mortality (23.9 deaths per 10,000 man-years). Within all BMI and WC combinations, fit men had substantially lower mortality than unfit men.

**CONCLUSION:** Compared to men normal on all 3 adiposity exposures, men with an increasing number of adiposity exposures had greater risk of all-cause mortality. Mortality risk was attenuated in all 4 adiposity groups by achieving at least a moderate level of CRF. Utilizing various adiposity exposures to determine risk of all-cause mortality in men may be misleading unless CRF is also considered.

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**3457** Board #178 June 2 9:30 AM - 11:00 AM

**The Combined Influence Of Sedentary Behavior And Physical Activity On Cardiorespiratory Fitness**

Rute Santos<sup>1</sup>, Micheal Pratt<sup>2</sup>, Anthony D. Okely<sup>3</sup>, Jorge Mota<sup>1</sup>, Carla Moreira<sup>1</sup>, Manuel J. Coelho-e-Silva<sup>3</sup>, Susana Vale<sup>1</sup>, Luis B. Sardinha<sup>5</sup>. <sup>1</sup>Research Centre in Physical Activity, Health and Leisure. Faculty of Sport - University of Porto, Porto, Portugal. <sup>2</sup>National Center for Chronic Disease Prevention and Health Promotion, CDC, Atlanta, United States of America., Atlanta, GA. <sup>3</sup>Interdisciplinary Educational Research Institute, University of Wollongong, NSW, Australia., Wollongong, Australia. <sup>4</sup>Research Centre of Anthropology and Health. Faculty of Sport Sciences and Physical Education, University of Coimbra, Portugal, Coimbra, Portugal. <sup>5</sup>Exercise and Health Laboratory, Faculty of Human Movement-Technical University of Lisbon, Portugal., Lisbon, Portugal.

(No relationships reported)

**PURPOSE:** The aim of this study was to analyze the combined influence of objectively measured sedentary behavior and physical activity (PA) on cardiorespiratory fitness (CRF) in 2 506 Portuguese children and adolescents aged 10 to 18 years.

**METHODS:** CRF was assessed with the Fitnessgram 20m shuttle-run test. PA and sedentary behaviour were assessed with accelerometry. Participants were classified as meeting current PA guidelines for youth vs not meeting; and as low vs High sedentary (according to the median value of sedentary time/day by age and gender); and then grouped as follows: Low Active - High Sedentary; Low Active - Low Sedentary; High Active - High Sedentary; High Active - Low Sedentary. Binary logistic regression models were constructed to verify the relationship between high CRF and the combined influence of PA/sedentary behavior, adjusting for age, gender and body mass index.

**RESULTS:** Participants classified as high active/low sedentary (OR=1.849; 95%CI:1.246-2.744), as well as those classified as low active/low sedentary (OR=1.297; 95%CI:1.034-1.626) were more likely to be fit, compared with those from the low active/high sedentary group.

**CONCLUSIONS:** These findings suggest that PA levels may not overcome the deleterious influence of high sedentary time. Our data stress the importance of promoting PA and discouraging sedentary behavior.

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**3458** Board #179 June 2 9:30 AM - 11:00 AM

**Sarcopenic-obesity Is Associated With Physical Fitness Independently Physical Activity**

Junghoon Kim<sup>1</sup>, Kai Tanabe<sup>1</sup>, Noriko Yokoyama<sup>1</sup>, Suga Yoko<sup>2</sup>, Shinya Kuno<sup>1</sup>. <sup>1</sup>University of Tsukuba, Ibaraki, Japan. <sup>2</sup>Tsukuba Wellness Research. Co., Ltd., Ibaraki, Japan.

(No relationships reported)

Decreased muscle mass (sarcopenia) and increased fat mass (obesity) with aging may contribute to difficulties with physical fitness, respectively. However, a limited number of studies have examined the association between sarcopenic-obesity and physical fitness.

**PURPOSE:** The primary aim of this study was to investigate the prevalence of sarcopenic-obesity from a large cohort of Japanese. We was also examined whether sarcopenic-obesity contribute to decrease physical fitness independently level of physical activity.

**METHODS:** This cross-sectional observational study including total 7915 healthy Japanese men and women 20-80 years of age who recruited between 2006 and 2010. We measured muscle mass and body fat mass using bioelectrical impedance. Physical activity was measured using a pedometer with an accelerometer for 7 days. The physical fitness test was based on the method of the Japan Fitness Test that comprised five items, and total scores of the test were calculated (scores of each item: 1-10). Lowest gender-specific quartile in total score was defined as poor physical fitness. Sarcopenia was defined as skeletal muscle mass index of two SD below the sex-specific mean value for a younger reference group (<40 years, n=1494) from the entire study population. We also defined obesity based on criteria of the Japan Society for the Study of Obesity.

**RESULTS:** The prevalence of sarcopenia-obesity was significantly increased with aging ( $P<0.05$ ). The odds ratio for poor physical fitness was 3.7 (95%CI: 2.65-5.32) and 3.6 (95%CI: 2.70-4.83) for individuals with sarcopenic-obesity, compared with healthy body composition group in men and women, respectively ( $P<0.001$ ), after adjusted for age, BMI, and physical activity. These trends were similar across level of physical activity.

**CONCLUSIONS:** The results of this cross-sectional observational study suggest that sarcopenic-obesity is associated with poor physical fitness independently physical activity using measured a pedometer with an accelerometer.

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**3459** Board #180 June 2 9:30 AM - 11:00 AM

**Associations between Cardiorespiratory Fitness Level and Health-Related Quality of Life: A Cross-Sectional Study of Apparently Healthy Adult Females.**

Robert A. Sloan<sup>1</sup>, Susumu S. Sawada, FACSM<sup>2</sup>, Corby K. Martin, FACSM<sup>3</sup>, Robert R. Kraemer, FACSM<sup>4</sup>, Steven N. Blair, FACSM<sup>5</sup>. <sup>1</sup>Health Promotion Board, Singapore, Singapore. <sup>2</sup>Tokyo Gas, Tokyo, Japan. <sup>3</sup>Pennington Biomedical Research Center, Baton Rouge, LA. <sup>4</sup>Southeastern Louisiana University, Hammond, LA. <sup>5</sup>University of South Carolina, Columbia, SC. (Sponsor: Susumu Sawada, FACSM)

(No relationships reported)

Currently there is a dearth of evidence available on the relationship between cardiorespiratory fitness (CRF) and health-related quality of life (HRQoL) in apparently healthy adult females.

**PURPOSE:** To investigate the relationship between CRF level and HRQoL in apparently healthy adult females.

**METHODS:** We evaluated the association of CRF and HRQoL of 634 U.S. Navy and civilian (Age: 18-49 yr) females who were given a submaximal exercise test and health risk appraisal which included the Short Form-12v2 (SF-12v2) from 2005-2007. CRF was measured by using the Balke-Ware submaximal treadmill test; women were assigned to low (referent), moderate, and high CRF categories based on tertiles. Physical component summary (PCS) and mental components summary (MCS) scores were considered to be above the norm if summary scores were  $\geq 50$  respectively.

**RESULTS:** Odds Ratios (ORs) and 95% confidence intervals (95% CIs) for CRF versus MCS-12 and PCS-12 scores were obtained by using a logistic regression model. Taking into consideration age, systolic blood pressure, BMI, cigarette smoking, and alcohol intake, the table shows the associations between CRF with PCS and MCS scores.

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|                 | Low (referent) | Moderate           | High               | p for trend |
|-----------------|----------------|--------------------|--------------------|-------------|
| n               | 158            | 263                | 213                |             |
| PCS             |                |                    |                    |             |
| % PCS $\geq$ 50 | 62.7           | 68.8               | 77.9               |             |
| Age-adjusted OR | -              | 1.38 (0.91 - 2.10) | 2.32 (1.44 - 3.76) | 0.001       |
| Multivariate OR | -              | 1.26 (0.81 - 1.98) | 1.95 (1.14 - 3.34) | 0.014       |
| MCS             |                |                    |                    |             |
| % MCS $\geq$ 50 | 60.1           | 58.2               | 65.3               |             |
| Age-adjusted OR | -              | 0.94 (0.63 - 1.42) | 1.30 (0.83 - 2.03) | 0.205       |
| Multivariate OR | -              | 0.94 (0.62 - 1.45) | 1.31 (0.79 - 2.15) | 0.247       |

**CONCLUSION:** The results of this cross-sectional study suggest that higher levels of CRF are associated with an increased likelihood of PCS and MCS scores above the norm. A significant p for trend was apparent for PCS but not MCS.

**3460 Board #181 June 2 9:30 AM - 11:00 AM**

**Long-term Trends In Cardiorespiratory Fitness And The Incidence Of Dyslipidemia.**

Susumu S. Sawada, FACSM<sup>1</sup>, I-Min Lee, FACSM<sup>2</sup>, Hisashi Naito<sup>3</sup>, Takashi Okamoto<sup>1</sup>, Koji Tsukamoto<sup>1</sup>, Takashi Muto<sup>4</sup>, Yasuki Higaki<sup>5</sup>, Hiroaki Tanaka<sup>5</sup>, Steven N. Blair, FACSM<sup>6</sup>. <sup>1</sup>Tokyo Gas Health Promotion Ctr., Tokyo, Japan. <sup>2</sup>Harvard Medical School, Boston, MA. <sup>3</sup>Juntendo University, Chiba, Japan. <sup>4</sup>Dokkyo Medical University School of Medicine, Tochigi, Japan. <sup>5</sup>Fukuoka University, Fukuoka, Japan. <sup>6</sup>University of South Carolina, Columbia, SC.  
(No relationships reported)

**PURPOSE:** Cardiorespiratory fitness is associated with a lower risk of dyslipidemia. However, there are no cohort studies that have assessed the relationship between long-term trends in cardiorespiratory fitness and the incidence of dyslipidemia. Thus, we investigated this issue in Japanese males.

**METHODS:** We evaluated the long-term trends in cardiorespiratory fitness and incidence of dyslipidemia among 3,650 Japanese men (age: 22-40) who were free of dyslipidemia at baseline. Participants were given a submaximal exercise test at least four times over seven years (1979-1985). We modeled the trend in fitness over seven years for each man using simple linear regression. Participants were then divided into quartiles based on the regression coefficient (slope) from the model. During the follow-up period 1985-2004, 227 men developed dyslipidemia. The development of dyslipidemia was based on self-report of current drug therapy for dyslipidemia at a subsequent medical examination in 2004. Odds ratios and 95% confidence intervals (95% CI) for the incidence of dyslipidemia were obtained using the logistic regression model.

**RESULTS:** Men in the lowest quartile of the distribution decreased in cardiorespiratory fitness over the seven years (median slope, -1.26 ml/kg/min), while men in the highest quartile increased in fitness (median slope, 1.31 ml/kg/min). Adjusting for age, initial fitness level, body mass index, cigarette smoking, alcohol intake, and a family history of dyslipidemia, and using the lowest quartile as reference, the odds ratios and 95% CI for the 2nd through 4th quartiles were 0.74 (0.50-1.11), 0.69 (0.45-1.05), and 0.48 (0.29-0.78), respectively (P = 0.004 for trend).

**CONCLUSIONS:** These results suggest that the long-term trend in cardiorespiratory fitness is a predictor of the incidence of dyslipidemia in Japanese males.

**3461 Board #182 June 2 9:30 AM - 11:00 AM**

**Cardiorespiratory Fitness And Subclinical Atherosclerosis In Men With Type 2 Diabetes**

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(No relationships reported)

Type 2 diabetes is a major risk factor for the development of atherosclerosis and cardiovascular disease mortality. Conversely, high levels of cardiorespiratory fitness have a strong protective effect against cardiovascular disease mortality in patients with type 2 diabetes.

**PURPOSE:** We tested the hypothesis that higher levels of cardiorespiratory fitness are inversely associated with subclinical atherosclerosis in 746 (age 53 $\pm$ 7 yrs) men with type 2 diabetes.

**METHODS:** We measured brachial ankle pulse wave velocity (PWV) and common carotid intima media thickness (CIMT) as indexes of subclinical atherosclerosis. Carotid atherosclerosis was defined by carotid intima media thickness >1.0mm. Cardiorespiratory fitness (CRF) was directly measured by peak oxygen uptake using expired gases analysis during a standard treadmill test.

**RESULTS:** Peak oxygen uptake was inversely correlated with PWV (r=-0.27, p<0.05) and CIMT (r=-0.24, p<0.05). Peak oxygen uptake was independently associated with CIMT ( $\beta$ =-0.15, p<0.05), but not PWV (p=0.12), in multivariable regression models that adjusted for age, BMI, waist girth, TC/HDL-C and CRP. After adjusting for established risk factors, high and moderate cardiorespiratory fitness were associated with lower odds ratios for having carotid atherosclerosis 0.49 (95% CI, 0.30 - 0.81), and 0.59 (95% CI, 0.38 - 0.92), respectively, as compared with low cardiorespiratory fitness. Each one metabolic equivalent increment higher cardiorespiratory fitness was associated with 27% (OR = 0.73; 95% CI, 0.61 - 0.87) lower prevalence of carotid atherosclerosis.

**CONCLUSIONS:** These results suggest that high cardiorespiratory fitness is inversely associated with common carotid intima media thickness independent of established risk factors in men with type 2 diabetes.

**3462 Board #183 June 2 9:30 AM - 11:00 AM**

**Fitness, Physical Activity And Aortic Intima-media Thickness In Adolescents**

Katja Pahkala<sup>1</sup>, Olli J. Heinonen<sup>1</sup>, Olli Simell<sup>2</sup>, Jorma S.A. Viikari<sup>2</sup>, Tapani Rönnemaa<sup>2</sup>, Harri Helajärvi<sup>1</sup>, Harri Niinikoski<sup>2</sup>, Olli T. Raitakari<sup>2</sup>. <sup>1</sup>Paavo Nurmi Centre, Turku, Finland. <sup>2</sup>University of Turku, Turku, Finland. (Sponsor: Raija Laukkanen, FACSM)  
(No relationships reported)

**PURPOSE:** We recently reported a favorable association between leisure-time physical activity and a surrogate marker of atherosclerosis, aortic intima-media thickness (aIMT), in adolescents (1). The aim of this study was to investigate whether cardiorespiratory fitness is associated with aIMT independently of physical activity.

**METHODS:** Cardiorespiratory fitness was measured with maximal cycle ergometer test in 17-year-old adolescents (n=378) participating in an atherosclerosis prevention study (STRIP). To describe the data, the adolescents were divided into three groups according to tertile cut-off points for fitness. Physical activity was assessed using a self-administered standardized questionnaire. A physical activity index (MET h/wk) was calculated by multiplying weekly mean leisure-time exercise intensity, duration and frequency. Ultrasonography was used to examine aIMT. Four measurements of aIMT covering the far wall segment were taken and the mean of these measurements was used. Complete data on fitness, physical activity, aIMT and covariates used for adjustment were available among 312 adolescents. A linear regression model was used for the analyses.

**RESULTS:** Fitness was inversely associated with aIMT [beta (SE) = -0.0036 (0.0011), p=0.0012; adjusted for gender, body mass index, HOMA-IR, and HDL/total cholesterol, triglyceride and C-reactive protein concentration. Mean (SD) aIMT was 0.49 (0.10) mm in high fit girls and 0.54 (0.11) mm in low fit girls. In boys, the corresponding values were 0.53 (0.10) mm and 0.58 (0.13) mm. The inverse association between fitness and aIMT remained after further adjustment for physical activity [beta (SE) = -0.0030 (0.0013), p=0.026].

**CONCLUSIONS:** In adolescents, cardiovascular fitness is favorably associated with aIMT independently of physical activity. Since fitness can be improved only by exercise, a physically active lifestyle should be encouraged to support cardiovascular health.

Supported by the Finnish Ministry of Education and Culture, the Finnish Cultural Foundation and the Juho Vainio Foundation.

(1) Pakkala K, et al. Association of Physical Activity with Vascular Endothelial Function and Intima-Media Thickness: A Longitudinal Study in Adolescents. *Circulation*. 2011 Oct 3. [Epub ahead of print]

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**3463** Board #184 June 2 9:30 AM - 11:00 AM

**Cardiorespiratory Fitness, Body Mass Index, and Chronic Heart Failure Mortality in Men.**

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(No relationships reported)

**Cardiorespiratory Fitness, Body Mass Index, and Chronic Heart Failure Mortality in Men.** Stephen W. Farrell<sup>1</sup>, Carrie E. Finley<sup>1</sup>, Nina B. Radford<sup>2</sup>, and William L. Haskell<sup>3</sup>, FACSM

<sup>1</sup>The Cooper Institute, Dallas TX <sup>2</sup>The Cooper Clinic, Dallas TX <sup>3</sup>Stanford University, Palo Alto CA

**PURPOSE:** To examine the associations between baseline cardiorespiratory fitness (CRF) and body mass index (BMI) with chronic heart failure (CHF) mortality in men.

**METHODS:** 40,723 men without a personal history of cardiovascular disease underwent a comprehensive baseline health examination between 1971 and 2006. Clinical measures included BMI and CRF quantified as duration of a maximal treadmill exercise test. Participants were divided into low (bottom 20% of distribution), moderate (next 40% of distribution), and high (highest 40% of distribution) CRF categories. Standard cut points were used to identify BMI categories. Hazard ratios (HRs) were computed with Cox regression analysis.

**RESULTS:** During a mean follow-up period of 19.8 ± 9.4 years, 92 CHF deaths occurred. Following adjustment for age, exam year, systolic blood pressure, smoking status, and personal history of diabetes, HRs across incremental CRF categories were 1.0, 0.40, and 0.24, while adjusted HRs across incremental BMI categories were 1.0, 1.92, and 3.61 (P for trend < 0.0002 for each). When grouped into categories of fit and unfit (upper 80% and lower 20% of CRF distribution respectively), the HR was significantly lower in fit (HR=0.24) compared with unfit men (referent) within the normal weight BMI category. Within the overweight and obese BMI categories, fit men had substantially lower HRs than unfit men; however these differences did not reach statistical significance.

**CONCLUSION:** Higher baseline levels of CRF are associated with substantially lower CHF mortality rates in men. Among normal weight men, only those who attain at least a moderate level of CRF experience reduced CHF mortality.

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**3464** Board #185 June 2 9:30 AM - 11:00 AM

**Cardiorespiratory Fitness As A Predictor Of Non-cvd Non-cancer Mortality In Men**

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(No relationships reported)

**PURPOSE:** The inverse association between cardiorespiratory fitness (CRF) and mortality from cardiovascular disease (CVD) and cancer is well established. However, studies on CRF and death from other causes are scant. We sought to evaluate the five major cause-specific non-CVD and non-cancer deaths with CRF in the Aerobics Center Longitudinal Study.

**METHODS:** Participants were 35,408 men (mean±SD age 43.2±9.3 yr) who were free of known CVD and cancer at baseline, and completed a maximal treadmill exercise test during a preventive examination at the Cooper Clinic, Dallas, TX between 1974 and 2002. CRF was quantified as maximal treadmill exercise test duration and was grouped for analysis as low, moderate, and high. Cause-specific non-CVD non-cancer deaths were grouped into 5 major categories: diabetes and kidney disease; chronic respiratory disease; acute respiratory and infectious disease; injuries; and all other non-CVD non-cancer deaths.

**RESULTS:** A total of 702 non-CVD non-cancer deaths occurred during an average 17 years of follow-up. After adjusting for age, examination year, smoking, drinking, BMI, hypertension, diabetes, and hypercholesterolemia, hazard ratios (95% confidence intervals) across ascending categories of CRF were 1.00 (referent), 0.60 (0.49-0.73), 0.53 (0.41-0.67) for overall non-CVD non-cancer deaths (trend P < 0.0001); 1.00 (referent), 0.57 (0.40-0.82), 0.32 (0.19-0.54) for diabetes and kidney diseases (trend P < 0.001); 1.00 (referent), 0.30 (0.17-0.50), 0.09 (0.04-0.21) for chronic respiratory diseases (trend P < 0.001); 1.00 (referent), 0.73 (0.46-1.16), 0.43 (0.24-0.77) for acute respiratory and infectious diseases (trend P = 0.004); 1.00 (referent), 0.79 (0.58-1.09), 0.79 (0.54-1.16) for injuries (trend P = 0.28); and 1.00 (referent), 0.53 (0.38-0.74), 0.50 (0.34-0.74) for any other non-CVD non-cancer causes deaths not falling into the 4 categories above (trend P = 0.001), respectively.

**CONCLUSIONS:** Higher levels of CRF were significantly associated with lower risk of mortality from non-CVD non-cancer causes including diabetes and kidney disease, acute and chronic respiratory disease. These results suggest a physically active lifestyle may reduce non-CVD non-cancer deaths which make up a substantial portion of adult mortality. Supported by NIH grant DK088195.

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**3465** Board #186 June 2 9:30 AM - 11:00 AM

**Muscular Fitness And Nontraditional Cardiometabolic Biomarkers In Adolescents: The Helena Study**

Enrique G. Artero<sup>1</sup>, Vanesa España-Romero<sup>1</sup>, David Jiménez-Pavón<sup>2</sup>, David Martínez-Gómez<sup>3</sup>, Jeremy Vanhelst<sup>4</sup>, Anthony Kafatos<sup>5</sup>, Ascensión Marcos<sup>3</sup>, Marcela González-Gross<sup>6</sup>, Steven N. Blair, FACSM<sup>7</sup>, Luis A. Moreno<sup>2</sup>, Manuel J. Castillo<sup>1</sup>. <sup>1</sup>School of Medicine, Department of Physiology, University of Granada, Granada, Spain. <sup>2</sup>GENUD (Growth, Exercise, Nutrition and Development) Research Group, University of Zaragoza, Zaragoza, Spain. <sup>3</sup>Immunonutrition Research Group, Department of Metabolism and Nutrition, Institute of Food Science, Technology and Nutrition (ICTAN), Spanish National Research Council, Madrid, Spain. <sup>4</sup>Inserm U995, School of Medicine, IFR114, University of Lille2, Lille, France. <sup>5</sup>Department of Social Medicine, Preventive Medicine and Nutrition Clinic, University of Crete, Heraklion, Crete, Greece. <sup>6</sup>School of Physical Activity and Sport Sciences (INEF), Universidad Politécnica de Madrid, Madrid, Spain. <sup>7</sup>Department of Exercise Science, University of South Carolina, Columbia, SC.  
(No relationships reported)

**PURPOSE:** Muscular fitness is being increasingly recognized in the prevention of cardiovascular diseases. This study examines the association of muscular fitness with nontraditional cardiometabolic biomarkers in adolescents.

**METHODS:** Healthy Lifestyle in Europe by Nutrition in Adolescents (HELENA) cross-sectional study. A total of 639 adolescents (296 boys) from 9 European countries, aged from 12.5 to 17.5 y, were included in this report. A muscular fitness score was computed as sum of age- and gender-specific z-scores of handgrip strength / body weight and standing long jump. Cardiorespiratory fitness was estimated using the 20m shuttle run test. Age- and gender-specific z-scores of C-reactive protein (CRP), complement factors C3 and C4, leptin, and white blood cells were summed to create a cluster of nontraditional cardiometabolic biomarkers. Sex, age, pubertal stage and country were used as confounders. Additional models also adjusted for homeostasis model assessment of insulin resistance (HOMA-IR) and sum of 4 skinfolds.

**RESULTS:** Muscular fitness was negatively associated with single and clustered cardiometabolic biomarkers (standardized  $\beta$  from -0.393 to -0.116, all P values < 0.01). Additional adjustments for cardiorespiratory fitness and HOMA-IR weakened the associations, but they still remained significant. The association was no longer significant when adjusting for sum of skinfolds. The odds ratios (OR) for having a high clustered risk (above or equal 1 SD) was 5.0 [95% confidence interval (CI) = 2.3-11.1] in the lowest quartile of muscular fitness compared with the highest quartile, after adjusting for basic confounders plus cardiorespiratory fitness and HOMA-IR. When adjusting also for sum of skinfolds, the OR decreased to 1.8 (95%CI = 0.7-4.4). Decreasing values of clustered cardiometabolic risk were observed across incremental levels of muscular fitness in both non-overweight (P = 0.002) and overweight adolescents (P < 0.001).

**CONCLUSIONS:** Muscular fitness is inversely associated with nontraditional cardiometabolic biomarkers in adolescence, and the association seems to be at least partly mediated by adiposity. Preventive strategies for youth should focus not only on decreasing adiposity and increasing cardiorespiratory fitness, but also on enhancing muscular fitness.

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**3466** Board #187 June 2 9:30 AM - 11:00 AM

**Associations Of Physical Activity And Fitness With Cognitive Status In Community-dwelling Older Adults**

Kenji Narazaki<sup>1</sup>, Eri Matsuo<sup>1</sup>, Takatori Honda<sup>1</sup>, Yu Nofuji<sup>1</sup>, Koji Yonemoto<sup>2</sup>, Shuzo Kumagai<sup>1</sup>. <sup>1</sup>Kyushu University, Fukuoka, Japan. <sup>2</sup>Kurume University, Fukuoka, Japan. (Sponsor: Kiyoji Tanaka, FACSM)

(No relationships reported)

Physical activity is a promising intervention candidate for preventing or delaying cognitive decline often emerged in the aging process. However, association between physical activity and cognitive status has been still unclear in community-dwelling older people. Furthermore, there have been limited findings regarding the association between physical fitness and cognitive status in the population.

**PURPOSE:** To examine whether physical activity and fitness are associated with cognitive status in community-dwelling older adults.

**METHODS:** As part of a community-based cohort study for a Japanese local town, 2,629 participants older than 65 years were involved in this study (74±6 yrs, male: 41.9%). A tri-axial accelerometer device was employed to quantify daily physical activity level (PAL). Hand-grip strength (HGS) and gait speed (GAS) were measured with conventional methods as indices of physical fitness. Cognitive status (COS) was determined as a score using the Japanese version of the Montreal Cognitive Assessment (MoCA). The associations of the PAL, HGS, and GAS with the COS were tested by 3 linear regression models for respective pairs, each involving the adjustment for age, sex, and years of education. Additional one-way ANCOVA (covarying for age and education) was performed to compare the COS among sex-adjusted quintile groups formed in each physical index.

**RESULTS:** The HGS (27.0±8.1 kg) and GAS (1.7±0.4 m/s) were associated with the COS ( $\beta=0.301$  and  $\beta=0.193$ , respectively,  $p<.0001$ ). Only weak association was found between the PAL (2.6±2.2 METs-hour/day) and COS ( $\beta=0.070$ ,  $p<.0001$ ). Being consistent with the results of the regression analyses, the ANCOVAs showed significant main effects for the HGS (F=18.11,  $p<.0001$ ) and GAS (F=18.24,  $p<.0001$ ) but not for the PAL (F=2.32,  $p=0.0548$ ).

**CONCLUSION:** Hand-grip strength and gait speed were associated with the cognitive status quantified by the MoCA score in community-dwelling older adults after adjusting for age, sex, and education. In contrast, the device-based physical activity level demonstrated only weak association with the cognitive status. Further investigations are needed to examine associations of other indices regarding physical activity and fitness with cognitive status in the population. Supported by a grant from Sasaguri town, Japan to SK.

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**3467** Board #188 June 2 9:30 AM - 11:00 AM

**The Joint Association Of Fitness And Fatness To All-cause Mortality: A Meta-analysis**

Vaughn Barry<sup>1</sup>, Meghan Baruth<sup>2</sup>, Michael Beets<sup>2</sup>, Steven Blair, FACSM<sup>2</sup>. <sup>1</sup>Middle Tennessee State University, Murfreesboro, TN. <sup>2</sup>University of South Carolina, Columbia, SC.

(No relationships reported)

**PURPOSE:** Two recent systematic review articles concluded cardiorespiratory fitness (CRF) has a stronger effect than weight status on all-cause mortality. The purpose of this study was to quantify the joint association of these variables (i.e. CRF and weight status) on mortality from all causes using quantitative meta-analytical methodology.

**METHODS:** A systematic literature search was performed using PubMed (1980 to June 2010) and an assessment of recent review articles. Studies were included if they were 1) prospective studies, 2) jointly assessed CRF and body mass index (BMI) with all-cause mortality, and 3) objectively measured CRF and BMI. Articles were excluded from the analysis if the referent group was not normal weight, fit individuals. Seven articles and were included in the final analysis. CRF and BMI levels were reported as fit vs. unfit and fat vs. normal weight. Individuals were considered unfit if they were in the lowest 20% of the study cohort or had a maximal aerobic capacity of < 5 METs. BMI categories were > 18.5 kg/m<sup>2</sup> to < 25.0 kg/m<sup>2</sup> (normal weight) and  $\geq$  25.0 kg/m<sup>2</sup> (fat). Pooled hazard ratios were assessed for each subgroup using a random-effects model and fit-normal weight individuals as the referent group.

**RESULTS:** Compared to fit-normal weight individuals, unfit individuals had twice the mortality risk regardless of fatness level (unfit-normal weight, 2.07, 95% CI, 1.66-2.59; unfit-fat, 2.08, 95% CI, 1.70-2.55). Fit-fat individuals had similar mortality risks (1.10, 95% CI, 0.95-1.27) to fit-normal weight individuals.

**CONCLUSIONS:** Individuals with low CRF have twice the risk of death from all causes regardless of BMI categorization. Moderate to high CRF levels significantly reduces the all-cause mortality risk associated with excess weight. Therefore, maintaining moderate to high CRF levels is important for normal weight, overweight and obese individuals.

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**3468** Board #189 June 2 9:30 AM - 11:00 AM

**Environment Perception For PA And Nutrition: Relationship With Health-related Fitness**

Marlene M. Rodrigues, Ana P. Pascoal, Joana C. Martins, Ana J. Rodrigues, Mario A. Botelho, Helder Rodrigues, Ana P. Marques, M. Joao C A Almeida. *University of Madeira, Funchal, Portugal.*

(No relationships reported)

A shift in eating habits, patterns and levels of physical activity during the last decades, may explain the dramatic increase in the prevalence of overweight and obesity. Understanding how those changes continue to occur, and which factors may play different roles in different populations, is necessary for developing better strategies.

**PURPOSE:** The objectives of this study were to compare health-related indicators, sports participation, eating habits and perception of physical environment between adolescents from two different islands in Portugal, as well as to identify the best predictors of a high and very high percent body fat (%BF).

**METHODS:** Participants in this study were 326 boys and girls. Prevalences of overweight and obesity were determined according to Cole et al. (2000), %BF was estimated according to Slaughter et al. (1998), and participants classified in health risk categories according to Lohman (1987). Aerobic fitness was assessed with the Fitnessgram 20 m pacer test (The Cooper Institute for Aerobics Research, 2007). Sport participation, eating habits (Wilson et al., 2008) and perception of the physical environment (Evenson et al., 2006) were assessed by self-report questionnaire.

**RESULTS:** 29% of the participants were overweight or obese, 30.4% were in the high or very high categories for %BF, 61.4% were below the healthy zone for aerobic fitness, and 64.7% indicated Physical Education as the only structured physical activity they regularly participated in. There were significant differences between the two islands in prevalence of sport participation and perception of the physical environment. It was found that the perception of fruits' and vegetables' availability (OR: 0.854; 95%CI 0.746 - 0.977) and identifying geographic barriers in the physical environment (OR: 1.127; 95%CI 1.023-1.240) were both predictors of a high or very high %BF.

**CONCLUSION:** The development of intervention strategies aimed at reducing adiposity should have in mind the physical, social and cultural environment in which the participant is inserted. Sponsored by the Research Center of Sport, Health and Human Development (CIDESD) and the Department of Education in Madeira Autonomous Region

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3469 Board #190 June 2 9:30 AM - 11:00 AM

**In Search of Relationship Between Physical Fitness and Body Image**

Qin Lai<sup>1</sup>, Huihong Zhang<sup>2</sup>. <sup>1</sup>Wayne State University, Detroit, MI. <sup>2</sup>Southeast University, Nanjing, China. (Sponsor: Hermann-J Engels, FACSM)  
(No relationships reported)

A recent meta-analysis revealed exercise was strongly related to body image (Hausenblas & Fallon, 2006). An individual with higher level of self-assessments toward her/his body, particularly appearance, tended to increase physical activity and maintain a healthy body composition. However, the previous research rarely utilized a quantitative measure of fitness to analyze how body image contributed to physical fitness development in large sample sizes, especially in different cultural settings.

**PURPOSE:** To determine the relationship between physical fitness and body image to locate which dimensional body-self relations was related to fitness tests in a large sample size of college students in China.

**METHODS:** Participants (n=563, aged at 17-21) were randomly selected from three urban universities in China. A standardized fitness test battery was adopted to assess cardiovascular endurance, speed, flexibility, and strength. A Chinese version of the Multidimensional Body-Self Relations Questionnaire (MBSRQ) was distributed to the students for body image assessments after the completion of fitness tests. Fitness and body images relation was analyzed by forward stepwise regression and Pearson's correlation.

**RESULTS:** Forward stepwise regression revealed only fitness subsets of MBSRQ including self-reported fitness evaluation and orientation reliably predicted total physical fitness scores ( $R^2 = .23$ ). Pearson's correlation analysis demonstrated that self fitness evaluation or orientation had a strong relationship with cardiovascular endurance performance ( $r = .13$ ,  $p < .01$ ) and speed performance ( $r = .21$ ,  $p < .01$ ). The other subsets including appearance and health were not related to the fitness scores.

**CONCLUSION:** The findings indicated that fitness test performance could be predicted by self-evaluation of fitness and attitude toward fitness. Unlike previous studies with participants in the North America, the present research failed to detect a relationship between fitness performance and appearance and health evaluations in Chinese students. It suggested different cultural settings might regulate the effects of behavioral factors on fitness development.

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3470 Board #191 June 2 9:30 AM - 11:00 AM

**Peak Oxygen Uptake And Leisure Time Physical Activity In 4427 Healthy Adults: The Hunt Study**

Bjarne M. Nes, Inre Janszky, Lars J. Vatten, Ulrik Wisløff. Norwegian University of Science and Technology, Trondheim, Norway.  
(No relationships reported)

Leisure time physical activity (LTPA) of a sufficient dose to increase cardiorespiratory fitness ( $VO_{2peak}$ ) may yield numerous health benefits. Current guidelines suggest that adults should perform moderate intensity activity at least 150 minutes per week, or high intensity activity at least 75 minutes per week.

**PURPOSE:** The aim of the study was to examine how self-reported LTPA at different levels of weekly duration and relative intensity associates with  $VO_{2peak}$  and estimated weekly energy expenditure in a large population.

**METHODS:** A total of 4427 adults, 19-89 yrs, and free from cardiovascular disease (2158 men; mean age 48.4, BMI 26.6, and 2269 women; mean age 48.0, BMI 25.4), were tested for directly measured  $VO_{2peak}$  (mean 44.3 and 35.9  $mL \cdot kg^{-1} \cdot min^{-1}$  for men and women, respectively). Information on LTPA was collected through a detailed questionnaire containing questions on frequency, duration and relative intensity (Borg 6-20 scale). Subjects were grouped according to gender, total LTPA (min/week) and low (Borg scale 6-11), moderate (Borg scale 12-13) or high (Borg scale 14-20) relative intensity. Weekly LTPA energy expenditure was estimated by multiplying the subject's oxygen uptake in litres per minute ( $L \cdot min^{-1}$ ) at their reported Borg scale rating by 5  $kcal \cdot min^{-1}$  and further multiplying by minutes per week. A general linear model was applied adjusting for age, BMI, education, occupational physical activity and smoking.

**RESULTS:** Both men and women reporting  $<90$  min/week (group mean, 47 min/week) and high intensity had considerably higher  $VO_{2peak}$  than the inactive groups (45.1 vs. 41.0 and 35.1 vs. 32.9  $mL \cdot kg^{-1} \cdot min^{-1}$  for men and women, respectively, both p-values  $<0.001$ ). A comparable  $VO_{2peak}$  were observed among men and women reporting  $>150$  min/week (group mean, 217 min/week) and moderate intensity (44.5 and 36.3  $mL \cdot kg^{-1} \cdot min^{-1}$  for men and women, respectively). Estimated weekly energy expenditure, however, were more than 4 times higher in the moderate intensity - high duration groups compared to the high intensity-low duration groups (2988 vs. 713  $kcal/week$  in men and 1964 vs. 429  $kcal/week$  in women, both  $p < 0.001$ ).

**CONCLUSION:** LTPA patterns of high duration - moderate intensity and low duration - high intensity were associated with similar  $VO_{2peak}$ , despite large differences in weekly energy expenditure.

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3471 Board #192 June 2 9:30 AM - 11:00 AM

**Running and All-cause Mortality Risk - Is More Better**

Duck-chul Lee<sup>1</sup>, Russell R. Pate, FACSM<sup>1</sup>, Carl J. Lavie<sup>2</sup>, Steven N. Blair, FACSM<sup>1</sup>. <sup>1</sup>University of South Carolina, Columbia, SC. <sup>2</sup>Ochsner Health System, New Orleans, LA.  
(No relationships reported)

**PURPOSE:** We examined the association between running and all-cause mortality risk in 52,656 adults (26% women) aged 20-100 years (mean age 43) who had a medical examination during 1971-2002 in the Aerobics Center Longitudinal Study.

**METHODS:** Participants were free of cardiovascular disease (CVD), cancer, abnormal resting or exercise electrocardiogram, and diabetes at baseline, and had  $\geq 1$  year of follow-up. Running and other physical activities were assessed on the medical history questionnaire by self-reported leisure-time activities during the past 3 months. Mortality follow-up was through 2003 using the National Death Index. Cox regression was used to quantify the association between running and mortality after adjusting for baseline age, sex, examination year, body mass index, current smoking, heavy alcohol drinking, hypertension, hypercholesterolemia, parental CVD, and levels of other physical activities.

**RESULTS:** During an average follow-up of 15 years, 2,984 deaths occurred. Approximately 27% of adults participated in leisure-time running. Runners had 19% lower risk of all-cause mortality compared with non-runners, with U-shaped mortality curves for distance, speed, and frequency. The hazard ratios (95% confidence intervals) of all-cause mortality were 0.78 (0.64-0.96), 0.85 (0.73-0.99), 0.73 (0.60-0.89), 0.75 (0.57-0.97), 0.90 (0.67-1.22), and 0.95 (0.73-1.24) in 0.1-4.9, 5.0-9.9, 10.0-14.9, 15.0-19.9, 20.0-24.9, and  $\geq 25.0$  miles/week of running distance; 0.90 (0.75-1.08), 0.79 (0.68-0.91), 0.73 (0.61-0.86), and 0.93 (0.73-1.19) in 1-5, 6, 7, and  $\geq 8$  miles/hour of running speed; and 0.81 (0.49-1.32), 0.65 (0.46-0.92), 0.81 (0.65-0.997), 0.82 (0.71-0.94), 0.81 (0.66-0.99), 0.86 (0.65-1.14), and 0.95 (0.69-1.33) in 1, 2, 3, 4, 5, 6, and 7 days/week of running frequency, respectively, compared with no running after adjusting for confounders including levels of other physical activities.

**CONCLUSIONS:** Running distances of 0.1-19.9 miles/week, speeds of 6-7 miles/hour, or frequencies of 2-5 days/week were associated with a lower risk of all-cause mortality, whereas higher mileage, faster paces, and more frequent running were not associated with better survival.

Supported by NIH Grant AG06945, HL62508, DK088195, and an unrestricted research grant from the Coca-Cola Company.

**G-39 Free Communication/Poster - Fitness and Performance Testing V**

JUNE 2, 2012 7:30 AM - 11:00 AM  
ROOM: Exhibit Hall

**3472 Board #193 June 2 8:00 AM - 9:30 AM**  
**Relationships Between Specific Back-Fitness Tests and the Occurrence of Back Injuries in Firefighters**

Karlie J. Moore, Salvador Jaime, Katherine B. Gunter. *Oregon State University, Corvallis, OR.*  
(No relationships reported)

Firefighters (FFs) experience a high incidence of back injuries; near 50% of FFs have experienced at least one back injury throughout their career and the primary reason for early retirement from disability is back injury. An assumption exists that fit FFs experience fewer back injuries, yet the true relationship between FF's fitness level and incidence of back injury is understudied. It is not clear what specific aspects of fitness are related to the occurrence of back injuries or what tests may be conducted to better understand a FF's risk of experiencing a back injury.

**PURPOSE:** To investigate the relationships between specific back-fitness tests and the occurrence of back injuries in firefighters.

**METHODS:** 118 FFs from three fire departments completed a back injury survey and eight back-fitness tests: A modified Schober test for lumbar flexion (LF) and lumbar extension (LE), a trunk rotation flexibility test to the right (RR) and left (RL), a back endurance "row" test with 20 lb weights (BE), a back strength test using dynamometry (BS), a hamstring endurance "kickback" test (HE) and a prone chin-up test (PC). The survey asked if FFs had experienced 0, 1, 2 or 3+ back injuries throughout their careers along with other relevant parameters. A zero-inflated poisson regression was utilized to 1) identify the variables that predict injury rate, and 2) identify the variables that predict the FFs who never experience back injuries. To account for exposure time, # of years as a FF was included in the model.

**RESULTS:** 59 FFs reported 0 back injuries, 24 FFs reported 1, 14 FFs reported 2, and 21 FFs reported 3+ back injuries. The # of injuries was significantly related to LE ( $p < .01$ ) and BS ( $p = .05$ ). For FFs who reported  $\geq 1$  back injury, improving LE capability by one cm lowers the expected # of back injuries during a career by 34.4%. For every standard deviation increase in BS (27 kg), a FF's odds of never having a back injury improve tenfold. There was no association between # of back injuries and LF, RR, RL, BE, HE and PC.

**CONCLUSION:** Possessing an adequate level of back strength and lumbar flexibility appears to reduce the risk for back injuries among FFs. An intervention needs to be conducted to confirm that improving/preserving these aspects of fitness lowers the occurrence of back injuries for FF's.

**3473 Board #194 June 2 8:00 AM - 9:30 AM**  
**Physiological Measurement Comparison From A Portable Sensor System And Standard Laboratory Equipment During Graded Exercise**

Jeffrey B. Powell, Aitor Coca, Kim Jung-Hyun, W. Jon Williams, Raymon J. Roberge. *NIOSH/CDC/NPPTL, Pittsburgh, PA.*  
(No relationships reported)

Physiological monitoring in real time can offer valuable information on the biomedical status of workers engaged in strenuous activities.

**PURPOSE:** This study compares the accuracy of a commercially available portable sensor system to standard laboratory physiological monitoring equipment for real-time monitoring of heart rate (HR) and respiratory rate (RR) responses during treadmill exercise.

**METHODS:** Six healthy subjects completed a maximal graded exercise test (GXT) wearing the portable sensor system and a standard laboratory physiological monitoring system. The treadmill protocol consisted of stages in which workload increased every 30 seconds starting at 1.7mph/0% incline and ending at 3.5mph/25% incline. The study variables, HR and RR, were recorded simultaneously breathe by breathe using the two systems. The variables were then summarized at time points of rest and workloads ( $O_2$ ) equal to 30, 50, 70, 90 and maximum. Paired sample t-tests and Spearman correlation coefficients ( $r_s$ ) were calculated to compare the variables.

**RESULTS:**

| VO2  | Heart rate (beats-min-1) |             |       |     | Respiratory rate (breaths-min-1) |            |       |     |
|------|--------------------------|-------------|-------|-----|----------------------------------|------------|-------|-----|
|      | Standard                 | Portable    | p     | rs  | Standard                         | Portable   | p     | rs  |
| Rest | 72.0(7.3)                | 76.5(7.2)   | 0.04  | .89 | 16.0(6.7)                        | 16.2(4.0)  |       | .71 |
| 30%  | 96.3(5.8)                | 109.3(14.5) | 0.03  | .32 | 23.8(4.9)                        | 22.4(5.0)  |       | .94 |
| 50%  | 128.7(13.5)              | 130.3(8.7)  | > .05 | .90 | 28.2(5.9)                        | 25.7(4.8)  | > .05 | .83 |
| 70%  | 146.3(6.9)               | 146.9(6.5)  |       | .94 | 32.0(5.4)                        | 31.7(5.2)  |       | 1.0 |
| 90%  | 171.3(9.3)               | 171.7(8.4)  |       | 1.0 | 37.5(9.5)                        | 37.2(9.1)  |       | 1.0 |
| MAX  | 182.2(9.9)               | 181.2(8.3)  |       | 1.0 | 42.8(12.4)                       | 41.8(10.9) |       | .94 |

Values are mean (SD) (n=6),  $VO_{2max}$ : 50.8 (4.3) ml/kg/min, p-value: Paired samples t-test

**CONCLUSION:** The results of this study show HR and RR measurements by portable sensor system in subjects performing GXT are comparable to those from a standard physiological monitoring system. However, there was a greater HR measurement variability during rest and exercise less than 50%  $VO_{2max}$ , while HR and RR measurement accuracy increased at higher exercise intensities. This study demonstrates the accuracy of the portable sensor system for real-time monitoring of physiological parameters and suggests usefulness for physiological research in the field.

**3474 Board #195 June 2 8:00 AM - 9:30 AM**  
**Self Reported Exercise during Deployment Correlates with Measured Fitness Outcomes**

Bradley J. Warr<sup>1</sup>, Brent A. Alvar<sup>2</sup>, Marilyn A. Sharp<sup>1</sup>. <sup>1</sup>U.S. Army Research Institute of Environmental Medicine, Natick, MA. <sup>2</sup>Rocky Mountain University of Health Profession, Provo, UT.  
(No relationships reported)

There is currently little data evaluating soldiers' physical activity levels and exercise programs or the accuracy of surveys to characterize fitness training during deployment. The typical deployed unit conducts 24 hr operations, making unit level physical fitness training difficult to conduct; most soldiers maintain their fitness by completing training in an autonomous manner.

**PURPOSE:** To determine the validity of survey questions regarding frequency and duration of purposeful exercise in deployed soldiers.

**METHODS:** Seventeen male infantry soldiers (age=26±5.7 y/o, ht=178.5±6.2 cm, wt=83.9±11.8 kg) from the Arizona National Guard completed a  $VO_2$  peak test ( $VO_{2p}$ ), 1RM bench-press (BP), 1RM back-squat (BS), and survey questions pertaining to frequency and duration of aerobic exercise, strength training, and sports participation. Fitness testing and surveys were completed both prior to deployment and within 10 days of returning from deployment. Spearman Rho correlations were used to determine significant relationships between survey questions and measured physical fitness variables, with  $p \leq .05$ .



**RESULTS:** Soldiers' reported activity for the 12 months prior to deployment did not correlate with the measured pre-deployment VO<sub>2</sub>, BP, and BS. However, reported activity levels during deployment did correlate with measured VO<sub>2</sub>, BP, and BS at post-deployment. More than 47% of the soldiers performed aerobic activity at least 3 days per week, while 53% trained for 30 min or more per session. Frequency of aerobic activity was significantly correlated to VO<sub>2</sub> (r=.68), but duration was not. More than 64% performed strength training 3 or more days per week, while 76% conducted 30 min or more per session. Frequency and duration of strength training were both significantly correlated to BP (r=.69, r=.63) and BS (r=.55, r=.69). Only 18% of the soldiers participated in sports activities at least one day per week for more than 30 min per session. Frequency and duration of sports activities were both significantly correlated to VO<sub>2</sub> (r=.54 r=.55).

**CONCLUSION:** Based on the measured physical fitness variables, the survey questions utilized pertaining to purposeful exercise provide reasonable indices of the frequency and duration soldiers are exercising during deployment.

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**3475** Board #196 June 2 8:00 AM - 9:30 AM

**The Effects Of Football Equipment On 20-yard Agility In High School Seniors**

Katie C. Morgan, Brian J. Campbell, Torie M. Guidry, Cole M. Thompson, Lauren E. Miller, Stefan L. Bergeron, Brittany S. Richard. *University of Louisiana at Lafayette, Lafayette, LA.*

(No relationships reported)

Senior high school football players are more physically developed than most underclassman. The majority have experienced a minimum of four years of a regulated strength and conditioning program. Previous studies have suggested football equipment decreases high school football players' pro-agility (20-yd shuttle run), however four-year seniors may have a different profile than underclassmen.

**PURPOSE:** To assess the effects of football equipment on 20 yard Pro-agility times in senior football players.

**METHODS:** 15 high school football players (weight= 79.42 ± 7.17 kg) served as participants. Players were timed in the 20 yard Pro-agility test with (AE) and without (AN) standard football equipment. Testing was administered by experienced hand held timers on a natural grass field. Participants were randomly assigned to perform two trials under each condition and the faster of the two trials for each condition was recorded and used for analysis. A paired samples t-Test was utilized to compare AE and AN conditions.

**RESULTS:** No significant difference was noted between AE and AN [t=1.967, p > .05].

**DISCUSSION:** The results support investigating football equipment effects on different levels of high school football. Senior high school football players are more likely physically developed than most underclassman, have more experience with the presence of football equipment, and a majority have undergone four years of a regulated strength and conditioning program. Since the 20-yd agility times of seniors were not significantly affected by football equipment, the 3 levels of underclassmen must be studied further to assess where equipment starts to significantly hinder agility.

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**3476** Board #197 June 2 8:00 AM - 9:30 AM

**Comparison Between Two Gps System Device To Asses Speed And Acceleration**

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(No relationships reported)

Recently, GPS tracking systems have been used to assess the physical demands in some sports. The validity of GPS devices for measuring distance traveled in team sport and endurance athletes have been investigated and there have been studies for assessing speed in active subjects, but none so far has used GPS of 15 Hz.

**PURPOSE:** To analyze and compare two GPS system device to asses speed and acceleration in sprint races.

**METHODS:** Ten physically active male subjects (age: 19.3 ± 2.3 years, stature: 1.77 ± 0.07 m, body mass: 72.7 ± 9.6 kg) randomly chosen from a population of physically active students and sport team athletes were selected. The correlations between peak acceleration and peak speed obtained from a GPS 1 Hz and 15 Hz with sprint time (at 5, 10 and 30-m) measured with timing lights were determined. Forty-three individual sprints were recorded concurrently with timing lights (Microgate, Bolzano, Italy), a GPSports SPI Elite (1 Hz) and GPSports SPI PRO X (15 Hz) (GPSports System, Canberra, Australia). The light sensors were set at 0, 5, 10 and 15-m for the sprints of 15-m and at 0, 30, 40 and 50-m for the sprints of 50-m. From a standing start 40-cm behind the starting gates, the subjects performed a maximal effort sprint over 15m and 50-m. The subjects were instructed before the sprint to produce maximal efforts for the sprint. To determine the test-retest reliability of the GPS device, each subject completed at least two sprints of each distance on two separate. Pearson's correlation coefficients and 90% confidence intervals (90%CI) were calculated according to the methods of Hopkins.

**RESULTS:** The correlation coefficients between measures of GPS 1 Hz and GPS 15 Hz in sprints of 15m and 50m were 0.02 in acceleration, and for peak speed were significant for 15m (0.68) and 0.50m (0.96). Correlations coefficients between times 5, 10 and 15m measured with timing lights and maximum acceleration and speed measured with GPS were highly significant (r=0.95-0.98).

**CONCLUSIONS:** The results of this study demonstrated a close correlation between peak speeds measured with GPS (1 and 15 Hz) and sprint time in 30, 40 and 50m. The use of GPS may be an alternative to timing lights for assessing sprint performance in 30m and longer distances, however the low sampling rate (1 and 15 Hz) reduce the sensitivity of these measures, especially over shorter distances.

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**3477** Board #198 June 2 8:00 AM - 9:30 AM

**A Comparison Of The Physiological Demands Of Rowing On The Rowperfect And Concept II Rowing Ergometer**

Niamh Ni Cheilleachair<sup>1</sup>, Andrew Harrison<sup>1</sup>, Giles Warrington, FACSM<sup>2</sup>. <sup>1</sup>University of Limerick, Limerick, Ireland. <sup>2</sup>Dublin City University, Dublin, Ireland.

(No relationships reported)

Ergometer rowing is a popular method of optimizing dry-land training. Rowing ergometers are widely used in the assessment of rowing performance and in national selections.

**PURPOSE:** The purpose of this study was to compare the physiological demands of rowing on the Rowperfect and Concept II rowing ergometers.

**METHODS:** Thirteen trained male rowers participated in the study. Selected physiological responses to an incremental test and a 4-minute maximal test were investigated on the Rowperfect and Concept II. The submaximal incremental test consisted of 3-minute stages at a fixed exercise intensity and predetermined stroke rate followed by 30 seconds recovery. The test commenced at 170 W with 30 W increments until a clear inflection point on the workload-lactate curve was observed, after which one additional increment was completed. During each 30 seconds recovery an earlobe blood sample was taken to determine blood lactate concentration (Bla) and RPE was recorded. Heart rate (HR) (bpm) was measured continuously during the test. On completion of the final incremental stage there was a 2 minute recovery before the 4 minute maximal performance test. This test was to establish the maximal distance which could be covered and to examine the mean power output (MPO) obtained on the 2 rowing ergometers. During the test, time and stroke rate were the only variables visible to the subjects, to ensure any pacing effect was minimised. Each subjects power output and stroke rate were recorded throughout the test. A post-exercise blood lactate sample was obtained after 5 minutes to establish peak lactate concentrations.

**RESULTS:** Blood lactate was significantly higher on the Concept II for all exercise intensities from 170 to 290 W (P<0.05). In contrast no significant difference was found with HR and RPE. During the 4 minute maximal performance test MPO was significantly higher on the Rowperfect (P<0.05) while distance was significantly higher on the Concept II (P<0.05) but no significant difference in peak blood lactate was observed.

**CONCLUSION:** These results indicate that the Concept II places greater physiological demands on rowers than the Rowperfect at fixed exercise intensities. These differences may be due to the different dynamics and mechanics of the two rowing ergometers or inter-ergometer variation in displayed power output.

3478 Board #199 June 2 8:00 AM - 9:30 AM

### An Evaluation of Army Physical Fitness Scores across Classes among Reserve Officer Training Corps Cadets

Keith Leiting, Jake Reed, David Land, Michael H. Stone, Mike W. Ramsey. *East Tennessee State University, Johnson City, TN.*  
(No relationships reported)

**PURPOSE:** The goal of the study was to compare standard military physical fitness scores among Reserve Officer Training Core (ROTC) cadets of varying years of involvement.

**METHODS:** Forty four male and female cadets (38 male, 6 female) performed a scheduled APFT test at the beginning of the fall collegiate semester. Instruction and demonstration of proper technique for push-up and sit-up events was provided prior to the test. Each cadet was given two minutes to perform as many push-ups and two minutes to perform as many sit-ups as possible, followed by the two mile run for shortest time conducted on a 400 meter rubber track. All raw scores and times were recorded on the Army Physical Fitness Scorecard as per FM 21-20, following which differences were obtained used the 4x4 multivariate analysis of variance (MANOVA) (Training, 1992). Tukey's HSD post hoc test were completed to determine differences between classes once significance was found.

**RESULTS:** Significant differences were noted for push up score, sit up scores and total scores ( $p < 0.05$ ; Table 1), however 2 mile run score was not significant ( $p > 0.05$ ; Table 1). MSI cadets scored significantly lower than MSII, MSIII, MSIV in all categories ( $p < 0.05$ ; Table 1). There were no significant differences found between MSII, MSIII, and MSIV for any of the scores ( $p > 0.05$ ; Table 1).

**CONCLUSION:** MSI cadets are less physically fit as determined by the APFT scores. Interestingly the MSII, MSIII, and MSIII do not seem to increase their physical fitness levels despite their continued involvement with the FM 21-20 training protocol.

|       | Push Up Score | Sit Up Score | Two Mile Score | Total Score   |
|-------|---------------|--------------|----------------|---------------|
| MSI   | 56.6±13.00    | 60.75±29.11  | 51.75±41.13    | 169.13±69.67  |
| MSII  | 87.5±9.18*    | 87.13±11.84* | 84.88±17.11    | 259.50±34.81* |
| MSIII | 87.86±12.12*  | 88.57±13.02* | 74.00±27.39    | 250.43±45.77* |
| MSIV  | 81.86±13.13*  | 90.71±10.17* | 82.93±10.00    | 255.50±25.95* |

Table 1: Data is means ± SD. \* denotes sig. dif. ( $p < 0.05$ ) from MSI

3479 Board #200 June 2 8:00 AM - 9:30 AM

### Relationship of Body Mass to Army Physical Fitness Test Performance in College ROTC Cadets

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(No relationships reported)

A fundamental requirement of the college Army ROTC program is a successful level of achievement standing on the Army Physical Performance Test (PFT). The test includes 2-min push-ups (PU), 2-min sit-ups (SU), and 2-mile distance run (RUN). The tests are converted to point values and summed to produce a total fitness score. Traditionally, the tests are scored in absolute terms for each gender, disregarding the influence of body mass on performance. Questions have been raised whether such a scoring system is equitable across the body mass continuum.

**PURPOSE:** To evaluate the relationship of body mass and BMI to PFT components and total fitness score among college ROTC cadets.

**METHODS:** ROTC cadets (41 M and 21 F; age = 20.2 ± 1.3 y, body mass = 77.3 ± 13.1 kg, BMI = 24.4 ± 2.8 kg/m<sup>2</sup>) were evaluated for PU, SU, and RUN during routine class testing. Point values were assigned according to standard Army tables for each gender with a maximum score of 100 for each item.

**RESULTS:** Men had significantly better absolute performance scores on PU (82% higher), SU (19% higher), and RUN (20% higher) than women. Body mass (BM) was not significantly correlated in both genders with PU (M,  $r = -0.06$ ; F,  $r = -0.08$ ), SU (M,  $r = 0.00$ ; F,  $r = 0.07$ ), RUN (M,  $r = -0.02$ ; F,  $r = -0.19$ ), and total score (M,  $r = -0.03$ ; F,  $r = -0.07$ ). BMI was not significantly different between the genders and also nonsignificantly correlated with PU ( $r = -0.01$ ), SU ( $r = -0.07$ ), RUN ( $r = -0.24$ ), and total score ( $r = -0.13$ ). Although men had slightly higher scoring points on all tests, only the PU score was significantly different between genders (M = 95.2 ± 20.4 vs F = 81.8 ± 24.2). Analysis of standardized beta weights from linear regression for each gender produced equitable contributions for each tests to total performance score: PU (M = 25%; F = 27%), SU (M = 35%; F = 42%), and RUN (M = 31%, F = 39%). If a gender factor was added to the linear regression, it made no addition contribution to the explained variance in performance scores in explaining the total performance score.

**CONCLUSIONS:** Body mass and BMI differences do not appear to impact PFT in college men and women ROTC cadets. This may be related to the routine emphasis on and participation in regular physical fitness training for college ROTC cadets and may not apply to regular Army personnel.

3480 Board #201 June 2 8:00 AM - 9:30 AM

### Relationship Between Systemic And Local Physiological Response To Graded Exercise Assessed With Near-infrared Spectroscopy

Luca Pollonini<sup>1</sup>, Rebecca Re<sup>2</sup>, Patrick Howell<sup>1</sup>, Karishma Prasad<sup>1</sup>, Clifford Dacso<sup>1</sup>, Richard Simpson<sup>1</sup>. <sup>1</sup>University of Houston, Houston, TX. <sup>2</sup>Politecnico di Milano, Milan, Italy.  
(No relationships reported)

Heart rate monitors (HRM) represent an effective method for recreational and professional training. However, HRM assess only the systemic response to exercise and need to be paired with periodic assessment of exercise capacity to guide personalized training. In this project, we developed a wearable device that integrates measurements of systemic and local physiological parameters to quantitatively assess exercise capacity.

**PURPOSE:** 1) To validate an integrated device that simultaneously measures electrocardiography (ECG), photoplethysmography (PPG) and near-infrared spectroscopy (NIRS) parameters in real-time. 2) To study the interplay between systemic and local physiological response to graded exercise.

**METHODS:** We used ECG and PPG to derive systemic measures such as heart rate (HR) and systolic time intervals (STI), whereas NIRS was used to measure concentrations of oxy-hemoglobin ([HbO<sub>2</sub>]), deoxy-hemoglobin ([HHb]), total hemoglobin ([tHb]) and tissue oxygenation index (TOI%) in the right vastus lateralis. Fifteen subjects (10 males, age 25.4±4.6yrs) were asked to perform a graded exercise on a stationary bike (50W +15W/min) maintaining a pedaling cadence of 60rpm, until volitional exhaustion or inability to sustain the cycling rate. ECG, PPG and NIRS data were collected simultaneously to respiratory gas measurements with a metabolic cart.

**RESULTS:** HR and [HHb] increased linearly during the exercise, whereas STI decreased linearly. [HHb] was linearly correlated to VO<sub>2</sub> ( $r > .92$ ,  $p < .0001$ ) at individual level and the slope of such linear correlation was indicative of the VO<sub>2</sub>max of each subject ( $r = .84$ ) and the exercise time to VO<sub>2</sub>max ( $r = .69$ ). After the exercise onset, [HbO<sub>2</sub>], [tHb] and TOI% maintained their basal value for a time interval after which they decrease linearly. The ventilatory threshold (VT) determined by V-slope was linearly related to the peak value of [HHb] at the end of exercise ( $r = .67$ ). The correspondent time of VT was also related to the deflection point of TOI% ( $r = .63$ ).

**CONCLUSIONS:** The quantitative assessment of the systemic and muscular physiological response to exercise is consistent with energy expenditures measured by metabolic cart. The proposed wearable sensor represents a valid tool that complements HRM by providing a more complete description of the exercise activity.

**3481** Board #202 June 2 8:00 AM - 9:30 AM  
**Walking Performance Assessed by Incremental Shuttle and Six-minute Walking Tests among Older Tennis Practitioners**

Ricardo L. F. Guerra, Arino Anjos, Victor Zuniga Dourado. *UNIFESP, Santos, Brazil.*  
(No relationships reported)

The regular practice of physical exercise reduces the decline of functional fitness and tennis practice is a possibility for this

**PURPOSE:** Walking is an important activity of daily living, is associated to health status and balance, and also is a popular form of physical exercise for the conditioning of middle-aged and older adults. However, there are few studies assessing the effects of the practice of tennis in walking ability in this age group.

**PURPOSE:** to evaluate walking performance and body composition in middle aged and older tennis practitioners by two widely used field tests, the incremental shuttle (ISWT) and six-minute (6MWT) walking tests.

**METHODS:** Twenty-one male volunteers ( $60 \pm 5$  years) were divided into two groups: 10 subjects practicing tennis (PT) and 11 non-practicing tennis (NPT). Tennis regimen consisted of at least 3 months of practical, 3x/wk, and 1 h/day. The participants in the NPT group were non-trained (i.e., < 150 min/wk of regular exercise). Peak values of oxygen uptake ( $VO_2$ ), carbon dioxide output, minute ventilation and heart rate (HR), among others variables, were monitored by a portable telemetric system (K4 Cosmed) during each third ISWT and 6MWT. During the ISWT, the ventilatory equivalents were used to assess  $VO_2$  at ventilatory threshold ( $VO_2VT$ ). The total distances traveled on ISWT and 6MWT were registered in meters (ISWD and 6MWD) and in percentage of predicted values (%). Body composition was assessed by bioelectrical impedance. The statistic was made using student t test.

**RESULTS:** We were not able to find differences between groups related to body composition variables. During the ISWT, the PT group presented higher ( $p < 0.05$ ) peak  $VO_2$  ( $29 \pm 5$  versus  $22 \pm 2$  ml/kg/min),  $VO_2VT$  ( $19 \pm 3$  versus  $15 \pm 1$  ml/kg/min), ISWD [ $626 \pm 90$  ( $116 \pm 13$ ) versus  $540 \pm 76$  m ( $96 \pm 10\%$ )], and peak HR ( $89 \pm 10$  versus  $75 \pm 13\%$  of maximum). We did not find significant differences in physiological responses to the 6MWT as well as in 6MWD between groups.

**CONCLUSION:** These data allow us to suggest that tennis may be a field of practice for maintenance walking performance, especially aerobic capacity, in middle aged and older adults and the ISWT appears to assess this condition better than the 6MWT.

Supported by FAPESP grant n. 2007/08673-3.

**3482** Board #203 June 2 8:00 AM - 9:30 AM  
**Relationship Between Physical Fitness, Body Composition And Cardiovascular Risk Factors In Healthy Individuals**

Steven Mann, Judith Allgrove, James Brown, Alfonso Jimenez. *University of Greenwich, Medway, United Kingdom.*  
(No relationships reported)

Worldwide obesity levels have more than doubled since 1980 and in 2008 1.5 Billion adults were overweight (WHO Fact Sheet N°311). Obesity is a leading risk factor of cardiovascular (CV) disease, while high body fat percentages are associated with Type 2 diabetes and further CV complications. Behavioural change such as an increase in physical activity has been suggested as a method of reducing these risks (Pedersen & Saltin 2006).

**PURPOSE** To assess the relationship between behaviour, as reflected by physical fitness markers: maximal aerobic capacity ( $\dot{V}O_{2max}$ ) and muscular strength, health status and CV risk.

**METHODS** This is the first phase of a study into the effects of fitness centre based exercise on CV health and wellbeing. 105 participants (73 female, 32 male), mean  $\pm$ SD age:  $42.2 \pm 5.7$  yrs, height:  $168.8 \pm 8.4$  cm, weight:  $82.7 \pm 17.8$  kg, predicted  $\dot{V}O_{2max}$ :  $35.4 \pm 9.1$  ml/kg/min free from chronic health conditions, performed a battery of health assessments to measure; predicted (Modified Blake protocol - Fitmate Pro), muscular strength (sub-maximal 1rep max), estimated body fat percentage (BF%) using a BODPOD, blood pressure (BP), cholesterol (LDX Cholestech), resting heart rate (RHR) as a marker of CV efficiency, and C-Reactive Protein (CRP), a marker of chronic inflammation ( $n=29$ ) (LDX Cholestech). Participants were then randomly assigned to either structured gym based exercise or unstructured gym based exercise. A control group receiving physical activity counselling was also included.

**RESULTS** Initial baseline findings show moderate correlations between and strength in Chest Press (CP) ( $R=0.317$ ,  $P=0.002$ ) and Lateral Pull Down (LPD) ( $R=0.308$ ,  $P=0.002$ ), and strength also moderately correlated with BF% ( $R=-0.583$ ,  $P=0.000$ . CP.  $R=-0.513$ ,  $P=0.000$ . LPD.  $R=-0.476$ ,  $P=0.000$ . Leg Press.  $R=-0.340$ ,  $P=0.001$ ). BF% was positively associated with RHR ( $R=0.315$ ,  $P=0.001$ ) and CRP ( $R=0.417$ ,  $P=0.02$ ). No clear relationship was identified between markers of physical fitness and cholesterol levels or BP.

**CONCLUSION** The initial findings show that increased predicted and muscular strength as indicators of physical fitness are associated with decreased BF%. Further, increased BF% is associated with a higher RHR and CRP. However no relationship between cholesterol and BP with levels of physical fitness was found within this cohort.

**3483** Board #204 June 2 8:00 AM - 9:30 AM  
**A Comparison of Two Different Body Positions Used During Rowing**

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(No relationships reported)

The amount of power output (PO) generated during a rowing stroke is partly dependent on the length of the stroke and this can be enhanced by using a greater extension at the finish position of the stroke. However, there is little research that has compared the differences of performing the rowing stroke at varying lean-back (LB) positions.

**PURPOSE:** The purpose of this study was to compare two different LB positions during 3 different graded exercise trials on a Concept II rowing machine.

**METHODS:** Nine men and 5 women with a mean age ( $\pm$  SD), height, body mass and peak of 29 (11) yrs, 185.6 (11.4) cm, 84.8 (15.9) kg, 51.2 (6.9) ml $\times$ kg $^{-1}$  $\times$ min $^{-1}$  and 25 (4) yrs, 171.4 (8.1) cm, 74.6 (7.7) kg and 44.9 (5.3) ml $\times$ kg $^{-1}$  $\times$ min $^{-1}$  respectively, volunteered. Light reflective markers were taped to anatomical landmarked positions on the body and specific sites on the rowing machine. Motion data for the rowing exercise trials were collected at 60Hz using 5 Qualisys ProReflex motion capture cameras. Three randomized, rowing exercise bouts at 3 different intensities lasting 3-5 minutes each were performed on a Concept IID rowing machine: rowing at a PO of 125, 150 and 175 w and a stroke rate (SR) = 18, 22 and 24 strokes $\times$ min $^{-1}$  in an upright position; rowing at a PO of 125, 150 and 175 w without controlling SR; and, rowing at a SR of 18, 22 and 24 strokes $\times$ min $^{-1}$  without controlling PO. Both of these latter trials were performed at the same extended LB position.

**RESULTS:** There was a significant different hip angle of  $\sim 29^\circ$  at the finish between the upright body position and both extended LB positions regardless of the SR used or the PO generated. The distance the handle moved throughout the rowing stroke was longer ( $P < 0.05$ ) in the two LB positions ( $1.57 \pm 0.16$  and  $1.58 \pm 0.14$  m) versus the upright position ( $1.37 \pm 0.15$  m). The velocity that the handle moved was significantly faster in the greater LB position at the same SR ( $1.41 \pm 0.1$  m/s $^2$ ) versus the LB at the same PO ( $1.31 \pm 0.06$  m/s $^2$ ) or compared to the upright body position ( $1.26 \pm 0.12$  m/s $^2$ ).

**CONCLUSION:** A more extended LB body position (hip angle of  $\sim 140^\circ$ ) results in a greater rowing handle movement compared to a more upright body position regardless of the SR used or PO generated and produces a greater handle velocity at the same SR. As a result, the greater LB position produced 12% greater PO at the same SR.

**3484** Board #205 June 2 8:00 AM - 9:30 AM  
**The Comparison Of EMG And O2 Consumption Between Non-motorized And Motorized Treadmill Running**

Takahiro Nakama, Akihiro Sakamoto, Katamoto Shizuo. *Juntendo University, Inzai, Chiba, Japan.*  
(No relationships reported)

Non-motorized treadmill (NT), on which the users need to accelerate the belt themselves and require the safety and body stabilization by wearing a harness or holding onto the surrounding railing. Recently, the newly designed curve-shaped NT has been developed, and this type of NT has eliminated all the concerns above. Running can be performed upright, with the speed able to be altered freely, so that it may better simulate running situations similar to conventional motorized treadmill (MT) to a certain extent. However, because of the curved shape, belt friction and the need for belt acceleration, greater physiological stresses may be imposed on users compared to MT or track running. The knowledge of exact physiological responses on NT is necessary to precisely prescribe exercise programs when NTs become available at many fitness facilities.

**PURPOSE:** The purpose was to compare HR,  $VO_2$  and iEMG of lower limbs between NT and MT runnings.

**METHODS:** Six trained male endurance runners (aged between 20-23 years old) ran on a NT and MT at the speed of 8, 11 and 14 km/h in a randomized order (3 min for each trial), with 5 min rest between trials. For each trial, VO2 was measured between the 2nd and 3rd minutes, while HR and EMG from the gluteus maximus(GM), biceps femoris(BF), medial gastrocnemius(MG), rectus femoris(RF), vastus medialis(VM), and tibialis anterior(TA) were recorded between 2'30" and 2'40".

**RESULTS:** Faster speeds produced greater HR ( $p < 0.001$ ), VO2 ( $p < 0.001$ ) and iEMG ( $p < 0.01$ ). VO2 and HR were significantly higher for the NT compared to MT ( $p < 0.001$ ). iEMG was also significantly higher for the NT ( $p < 0.05$ ) except VM and TA. Significant condition  $\times$  speed interactions for VO2 ( $p < 0.001$ ) and iEMG ( $p < 0.05$ ) meant that the condition effects were more pronounced for faster speeds.

**CONCLUSIONS:** NT running results in higher HR, VO2 and iEMG of lower limbs (except VM and TA) than that in MT running. These discrepancies of physiological responses need to be considered when prescribing exercise programs for NT users.

Nogrant for this study.

**3485 Board #206 June 2 8:00 AM - 9:30 AM**

**Relationships Between Free Testosterone, Cortisol, and Anaerobic Performances In Recreationally-trained Subjects**

Matthew J. Andre<sup>1</sup>, Andrew C. Fry<sup>1</sup>, Jason B. Winchester<sup>2</sup>, Arnold G. Nelson, FACSM<sup>3</sup>, Jatin P. Ambegaonkar<sup>4</sup>, Shane V. Caswell<sup>4</sup>. <sup>1</sup>University of Kansas, Lawrence, KS. <sup>2</sup>Midwestern State University, Wichita Falls, TX. <sup>3</sup>Louisiana State University, Baton Rouge, LA. <sup>4</sup>George Mason University, Manassas, VA.  
(No relationships reported)

Free testosterone (FT) and its ratio to cortisol (FT/C) has been correlated with jumping and sprinting ability in football, soccer, throwing, handball, and volleyball athletes (Cardinale & Stone, 2006; Nelson et al., 2009; Winchester et al., 2008a). One study has also reported significant relationships in a recreationally-trained population (Winchester et al., 2008b).

**PURPOSE:** To examine relationships among salivary FT or FT/C and anaerobic performances in recreationally-trained individuals.

**METHODS:** Saliva was collected from 17 recreationally-trained college males, followed by testing for vertical jump (VJ), standing broad jump (SBJ), and 36.6m (40yd) sprint (SPR). Saliva samples were analyzed in duplicate for FT and cortisol (C) via ELISA. Pearson product correlation coefficients (r) examined relationships between salivary FT or FT/C and performance ( $p < 0.05$ ).

**RESULTS:** Mean VJ (cm), SBJ (m), and SPR (seconds) were  $58.1 \pm 2.3$ ,  $2.22 \pm 0.06$ , and  $5.51 \pm 0.10$ , respectively. Mean FT (nmol/L), C (nmol/L), and FT/C were  $1.09 \pm 0.2$ ,  $5.89 \pm 1.4$ , and  $0.29 \pm 0.04$ , respectively.

|                   | Vertical Jump | Standing Broad Jump | Sprint |
|-------------------|---------------|---------------------|--------|
| Free Testosterone | 0.37          | 0.08                | -0.21  |
| Cortisol          | 0.02          | 0.25                | -0.01  |
| Free Tes/Cort     | 0.21          | 0.11                | -0.22  |

No correlations were statistically significant.

**CONCLUSION:** The results of this study suggest that FT, C, and FT/C are not related to vertical jump, standing broad jump, or sprint performance in non-athletic, but physically-active, populations. Further research is needed to determine relationships between endocrine profiles and anaerobic performances for this population.

**3486 Board #207 June 2 8:00 AM - 9:30 AM**

**Stability Ball Sitting During Semi-Recumbent Exercise**

Charles R.C. Marks, Jenna Leach, Deborah Wagner, Leslie Schachinger, Blake Brennan, Steven Grapsas. *Oakland University, Rochester, MI.* (Sponsor: Tamara Hew-Butler, FACSM)  
(No relationships reported)

**PURPOSE:** This study predicted that stability ball sitting during semi-recumbent exercise will affect cardiorespiratory, electromyography, and kinematic parameters when compared to chair sitting.

**METHODS:** Sixteen healthy young adults underwent two semi-recumbent graded exercise tests to volitional fatigue over two consecutive days: one stability ball sitting, the other chair sitting (order randomized). Pedaling while sitting behind a cycle ergometer and holding onto cycle seat was used for the semi-recumbent position. VO2 and heart rate (HR) were continuously measured. During two stages of exercise right side flexor digitorum (FD), erector spinae (ES), external oblique (EO), quadriceps (QC), hamstrings (HM), and gastrocnemius (GN) % MVC EMGs were measured; also, video of the right hip back view was taken for vertical (Hip V) and lateral (Hip L) displacement. Repeated measures ANOVA with paired-t test for *post hoc* analysis ( $P < 0.05$ ) were done.

**RESULTS:** All participants achieved the same peak power output for both tests. VO2, HR, ES, and HM had non-significant sitting mode main effects and interactions ( $P \geq 0.353$ ) while EO tended towards significant sitting mode main effect ( $P = 0.113$ ). FD, GN, and QC had significant sitting mode main effects ( $P \leq 0.042$ ). Hip V and Hip L also had significant sitting mode main effects ( $P \leq 0.004$ ). The table below reports the mean  $\pm$  sd for all but ES and HM.

| Table       | Ball        | Chair         | Ball        | Chair        |
|-------------|-------------|---------------|-------------|--------------|
|             | VO2         | l/min         | HR          | b/min        |
| 50% of Peak | 1.59 + 0.31 | 1.56 + 0.39   | 140 + 14    | 142 + 11     |
| Penult      | 2.47 + 0.60 | 2.49 + 0.70   | 174 + 11    | 175 + 10     |
| Peak        | 2.89 + 0.71 | 2.80 + 0.68   | 185 + 9     | 185 + 9      |
|             | GN          | EMG %         | QC          | EMG %        |
| Stage 1     | 35.1 + 11.6 | 45.9 + 17.7 * | 15.0 + 7.6  | 14.6 + 4.8   |
| Stage 2     | 40.3 + 13.2 | 45.6 + 15.5   | 18.1 + 7.8  | 24.2 + 8.7 * |
|             | FD          | EMG %         | EO          | EMG %        |
| Stage 1     | 14.4 + 6.1  | 11.6 + 8.1 *  | 27.1 + 20.7 | 25.2 + 17.5  |
| Stage 2     | 19.4 + 7.9  | 16.8 + 8.7    | 38.6 + 42.2 | 26.3 + 16.7  |
|             | Hip V       | cm            | Hip L       | cm           |
| Stage 1     | 3.2 + 0.9   | 2.5 + 1.8     | 4.6 + 1.7   | 1.1 + 0.48 * |
| Stage 2     | 4.7 + 1.8   | 2.1 + 0.5 *   | 5.5 + 1.9   | 2.3 + 0.7 *  |

\* Ball versus Chair Paired-t  $P < 0.019$

**CONCLUSION:** It is concluded that the stability ball may alter arm and leg muscle recruitment patterns with an increase in coronal plane hip motion during semi-recumbent exercise but without affecting cardiorespiratory parameters.

Supported in part by an Oakland University Faculty grant.

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**3487** Board #208 June 2 8:00 AM - 9:30 AM

**Gross Mechanical Efficiency And Physical Strain During Submaximal Cyclic Arm-leg Cruiser@ Exercise**

Lucas H. van der Woude<sup>1</sup>, Liesbeth Simmelink<sup>2</sup>, Ilse Borgesius<sup>1</sup>, Florentina Hettinga<sup>1</sup>, Rien Dekker<sup>2</sup>. <sup>1</sup>Center for Human Movement Sciences, University Medical Center Groningen, Groningen, Netherlands. <sup>2</sup>Center for Rehabilitation, University Medical Center Groningen, Groningen, Netherlands. (Sponsor: TWJ Janssen, FACSM)

(No relationships reported)

**PURPOSE:** The Cruiser@ ergometer (Enraf Nonius, The Netherlands) is a testing and training device, which allows combined asynchronous arm-leg exercise in a stable recumbent sitting position. As such it is frequently used in Dutch rehabilitation as a cardiorespiratory fitness intervention for lower limb impaired persons.

**PURPOSE:** To compare gross mechanical efficiency (GE) and physical strain during steady state submaximal Cruiser, cycling and upper body handbike exercise.

**METHODS:** 22 Healthy men (n=10; 24±1.8yrs; 79±10.5kg) and women (n=12; 22.1±2.4; 65.8±10.2kg) enrolled in a series of 4 submaximal steady state exercise tests on the Cruiser, a bicycle ergometer, a handbike on a motor driven treadmill and again the Cruiser. In each mode subjects performed a series of six 3min bouts (PO=20-45W) at a constant cadence. Oxygen uptake, energy cost, ventilation, breathing frequency, heart rate and RPE were monitored. GE was derived from PO and energy cost.

**RESULTS:** Cruiser GEs (45W; men: 13.0±1.3%, woman: 15.0±3.1%) were not significantly different from cycling (45W; men: 13.2±1.9%, women: 14.6±1.9%), yet both were significantly higher than in handcycling (45W; men: 11.2±0.8%, women: 12.2±2.1%; P<0.05). A similar pattern was found for each of the physical strain parameters: a comparable strain between Cruiser and bicycle test, yet a significantly higher strain for handcycling (P<0.05). Apart from RPE, the repeated Cruiser tests did not show significant differences.

**CONCLUSIONS:** Submaximal Cruiser exercise is a cyclic form of large muscle exercise, comparable in efficiency and physical strain to cycling. As such it seems a safe, repeatable and effective exercise mode, involving both asynchronous upper and synchronous lower body work.

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**G-40 Free Communication/Poster - Fitness and Performance Testing VI**

JUNE 2, 2012 7:30 AM - 11:00 AM

ROOM: Exhibit Hall

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**3488** Board #209 June 2 9:30 AM - 11:00 AM

**Validation Of The Actiheart For Estimating Physical Activity Related Energy Expenditure In Pregnancy**

Katarina Melzer<sup>1</sup>, Matteo Lazzeri<sup>2</sup>, Stephane Armand<sup>3</sup>, Michel Boulvain<sup>3</sup>, Bengt Kayser<sup>2</sup>. <sup>1</sup>Swiss Federal Institute of Sports, Macolin, Switzerland. <sup>2</sup>Institute of Movement Sciences and Sports Medicine, Geneva, Switzerland. <sup>3</sup>University Hospitals of Geneva, Geneva, Switzerland.

(No relationships reported)

**PURPOSE:** The Actiheart (CamNtech Ltd., Cambridge, UK), a combined heart rate and movement sensor device, was shown to give precise estimates of activity energy expenditure (AEE) among men and non-pregnant women. The objective of this study was to assess the validity of the individually calibrated Actiheart in pregnant women against indirect calorimetry in a laboratory setting.

**METHODS:** Ten healthy pregnant women (aged 32.9±3.2 yrs, pre-pregnancy BMI=21.0±2.4 kg/m<sup>2</sup>, 36.9±2.4 weeks of gestation) walked at 3, 4, 5, and 6 km/h on a treadmill, cycled at 25W and 50W on an ergometer and stepped on and off a 15 cm high step. During each routine, AEE was measured simultaneously with the Actiheart (AEEa) and indirect calorimetry (AEEcalo). AEE measurements were compared with paired Student's t-test, and their agreement with Bland and Altman plots.

**RESULTS:** The mean AEEcalo were not significantly different from AEEa for any activity except for cycling at 50W (-45 J/kg/min, p=0.01). Cumulated AEEa and AEEcalo, combining all activities, were not different (p=0.9). All data points (100%) fell within ±2SD for all activities except for walking at 6km/h (89% of data points). All data points fell within ±2SD for the sum of all speeds of walking (3, 4, 5, and 6 km/h).

**CONCLUSIONS:** The Actiheart can be used as a valid method for AEE estimation in pregnant women. The data serve as valuable information for improving the assessment of AEE in pregnancy and clarifying the association between activity and particular health outcomes in this population group.

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**3489** Board #210 June 2 9:30 AM - 11:00 AM

**The Energy Cost Of Carrying A Portable Metabolic Analyser**

Lars McNaughton, FACSM, Andy Sparks. Edge Hill University, Ormskirk, United Kingdom.

(No relationships reported)

**PURPOSE:** Portable gas analysers, such as the Cosmed and Metamax, are commonly used in exercise and sporting activities, and such systems have been shown to be both valid and reliable. Little is known however, of the impact on energy expenditure (EE) on individuals that are required to carry them during exercise bouts.

**METHODS:** Eight male participants of (Mean ± SD) age 25.0±9.47y, body mass 78.5±8.39kg, and height 183±0.8 cm, completed two random incremental exercise bouts on a motorised treadmill. Following 4 min of standing, the participants walked at 4km.h<sup>-1</sup> and then completed a progressive exercise test with 4 min stages and 2km.h<sup>-1</sup> increments until volitional exhaustion. The experimental (PT) trial required participants to complete the exercise bout whilst wearing a portable respiratory gas analysis system (Metamax 3B, Cortex, Germany). During the control trial (C) the weight of the gas analyser was supported by a harness adjacent to the treadmill. Throughout each exercise trial, heart rate (HR) and rating of perceived exertion (RPE) were measured and respiratory gases were used to calculate EE via indirect calorimetry. All data were analysed using ANOVA with Repeated Measures; significance was p< 0.05.

**RESULTS:** During the exercise bouts, the rate of EE increased as the intensity of exercise increased (p<0.001). There was a significantly greater rate of EE during PT between the running speeds of 7 - 14 km/hr (p<0.05), but no significant differences were observed during standing, walking or at maximal exercise (p>0.05). There were no significant effects of wearing the gas analyser on VO<sub>2</sub> max. (4.10±0.53, and 4.28 ±0.75 for the C and PT trials respectively), HR or RPE.

**CONCLUSION:** Portable gas analysis systems have no effect on the energy expended during standing, walking for short periods, or during maximal exercise, but significantly increase the energy demands of submaximal running when carried on the person.

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3490 Board #211 June 2 9:30 AM - 11:00 AM

**The Energy Expenditure of Long Distance Double - Handed Offshore Sailing**

Carlo Capelli<sup>1</sup>, Christel Galvani<sup>2</sup>, Marta Alberti<sup>1</sup>, Luca Ardigo<sup>1</sup>, Federico Daniele<sup>3</sup>. <sup>1</sup>School of Exercise Science, Verona, Italy. <sup>2</sup>School of Exercise Science, Milano, Italy. <sup>3</sup>School of Exercise Science, Udine, Italy.

(No relationships reported)

The studies describing the energy expenditure during offshore sailing regattas are very rare. This is rather disappointing, if we consider that in offshore sailing several environmental and tactical factors may place a considerable physical load and mental stress on our body.

**PURPOSE:** The aim of the study consists in assessing the energy expenditure during long distance offshore sailing and in describing the physical activity intensity involved in this type of competition. **METHODS:** Six subjects (age:  $46.3 \pm 3.4$  yy; BMI:  $26.7 \pm 1.7$  kg/m<sup>2</sup>,  $\dot{V}O_{2max}$ :  $2.97 \pm 0.56$  l/min) participated in the study. During the regatta (double handed, 500 miles in the North Adriatic, lasting 3- 5 days) the subjects wore an activity monitor (Actiheart, CamNtech, E) that allows estimate energy expenditure, physical activity level (PAL) and minutes spent at each level of intensity (sedentary, S, < 1.5 MET; light, L, 1.5 - 2.9 MET; moderate, M: 3.0 - 6.0 MET; vigorous, V: > 6.0). The time spent at each level of intensity was evaluated using one-way ANOVA; pairwise comparisons were performed using Student-Newman-Keuls test.

**RESULTS:** Daily energy expenditure (TEE) amounted, on the average to  $3408 \pm 453$  kcal per day; daily activity energy expenditure (AEE) amounted to  $1208 \pm 339$  kcal per day. PAL, calculated as TEE divided by resting energy expenditure (RMR, estimated with Schofield formula), was  $1.8 \pm 0.2$ . Subjects spent a significant ( $p < 0.001$ ) longer period of time in S ( $643 \pm 193$  min per day) and L ( $516 \pm 177$  min per day) than in M ( $95 \pm 34$  min per day) and V ( $6 \pm 4$  min per day) activity. On the average, the subjects slept 5 times per day ( $\pm 1.4$ ) for about 36 minutes ( $\pm 9$ ) in each sleeping period.

**CONCLUSION:** TEE per day and PAL during double-handed offshore sailing race turned out to be similar to that measured using double-labeled water technique in single-handed offshore sailing ( $3451$  kcal/day and  $2.1$ , respectively). Moreover, this study reports for the first time, not only TEE, but also AEE and the time spent sleeping and that performing activities of different intensity. The high TEE seems to be likely the consequence of the short and rare periods of sleep spent during the competition than of the bouts of moderate to vigorous physical activity.

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3491 Board #212 June 2 9:30 AM - 11:00 AM

**Exercise Intensity and Performance Analysis of Taekwondo Combats in Master Athletes**

Francesco Tornello<sup>1</sup>, Laura Capranica<sup>1</sup>, Carlo Minganti<sup>2</sup>, Salvatore Chiodo<sup>3</sup>, Antonio Tessitore<sup>1</sup>. <sup>1</sup>University of Rome, Rome, Italy. <sup>2</sup>University of Catanzaro, Catanzaro, Italy. <sup>3</sup>University of Catanzaro, Rome, Italy. (Sponsor: Carl Foster, FACSM)

(No relationships reported)

Since martial arts are widely practiced at all ages, the main argument is about to evaluate their impact on health. In a review, Bu et al. (2010) reported a general positive influence, however most of the studies were not conducted during official combats and no information is available for master athletes.

**PURPOSE:** Thus, this study aimed to investigate heart rate (HR) responses and performance analysis of Taekwondo (TKD) master athletes combats.

**METHODS:** Twelve official combats of master athletes (age:  $39 \pm 4$  yrs) were observed during the 1st European Masters Games (Venice, Italy, 2011). The HR exercise intensities were determined by the time spent by athletes at three classes of efforts (90% of individual HRpeak). A time motion analysis was applied to measure the duration of actions in relation to three classes of combat phases: Fighting (F), No Fighting (NF) and Stoppage (ST). The technical and tactical analysis was carried out to analyze: a) the points scored with a kick (1, 2, 3 and 4 points) and punch performed with a clear technique and points scored with a not clear one; b) the strategy adopted for actions (i.e. attack, defence and evasive maneuvers, blocks, etc.); An ANOVA for repeated measure with significance set at  $p \leq 0.05$  was applied for statistical analysis.

**RESULTS:** The HR analysis showed a significant difference for classes of efforts ( $p90\%$  and  $81-90\%$  of individual HRpeak, respectively). The time motion analysis revealed a significant difference between classes of combat phases ( $p=0.002$ ) with a mean duration of  $1.94 \pm 0.48$ ,  $6.26 \pm 1.83$  and  $12.97 \pm 6.74$  seconds and a mean frequency of occurrence of  $40.8 \pm 5.1\%$ ,  $48.7 \pm 3.7\%$  and  $10.5 \pm 5.7\%$  for F, NF and ST, respectively. The technical and tactical aspects showed differences for technique and for strategy analyses. Post-hoc revealed that the "1 point scored with a kick" class ( $59.8 \pm 15.8\%$ ) and the attack class ( $50.6 \pm 18.9\%$ ) were different from all other classes of their respective specific analyses ( $p < 0.001$ ).

**CONCLUSIONS:** This study indicate that the TKD master competition posed a high load on athletes, who, probably due to being former senior athletes, were able to be engaged in a high intensity activity, which requires to be monitored to have a positive impact on health. REFERENCES: Bu et al. (2010). JEBM, 3, 205-219.

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3492 Board #213 June 2 9:30 AM - 11:00 AM

**Estimating Energy Expenditure From Accelerometry And Physiological Sensors In One Device**

Mary Rosenberger<sup>1</sup>, William Haskell, FACSM<sup>1</sup>, Fahd Albinali<sup>2</sup>, Selene Mota<sup>2</sup>, Jason Nawyn<sup>2</sup>, Stephen Intille<sup>3</sup>. <sup>1</sup>Stanford University, Palo Alto, CA. <sup>2</sup>Massachusetts Institute of Technology, Cambridge, MA. <sup>3</sup>Northeastern University, Boston, MA.

(No relationships reported)

**PURPOSE:** Estimate energy expenditure from physiological sensors contained in the Zephyr Bioharness in addition to an accelerometer using advanced analytical methods.

**METHODS:** A variety of sedentary behavior, daily activities and exercises were measured with the Zephyr Bioharness, an Actigraph, and an Oxycon Mobile portable metabolic unit in 15 men and 27 women ages 18 to 72. The Bioharness is worn similar to a heart rate monitor, but measures motion (accelerometer - ACC), heart rate (HR), respiration rate (RR), and skin temperature. The Actigraph is worn on the hip and measures motion in a summary similar to the accelerometer on the Bioharness. METs were estimated from the Bioharness data using a two regression mixed model based on the coefficient of variation (CV) of the accelerometer signal to detect activity type. This is similar to the Crouter two-regression model that was used to estimate METs from the Actigraph. A comparison of the identification of moderate to vigorous intensity physical activity (MVPA) from the individual physiologic signals using ROC analysis is also provided.

**RESULTS:** Sedentary behavior was identified on the bioharness using ROC analysis with an area under the curve of 0.77, and ambulation was separated from other non-sedentary activities with an area under the curve of 0.91 based on the CV of the accelerometer signal. Mixed model analysis provided the two-regression predictions resulting in an overall mean error of 0.17 (+/- 0.68) METs for the Bioharness. As a comparison, Crouter methods resulted in a mean error of 0.42 (+/- 1.5) METs for the Actigraph. For identifying MVPA from each of the signals, the area under the ROC was 0.73 for RR, 0.83 for HR, 0.83 for ACC, and 0.88 for the combined signal.

**CONCLUSIONS:** Estimates from this advanced analysis confirm the addition of physiological variables to accelerometer-based data improve energy expenditure calibration over a single accelerometer. For the typical measurement of interest, minutes in MVPA, HR and ACC are the best indicators of intensity, but a combination improves the separation of exercise and non-exercise activities.

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3493 Board #214 June 2 9:30 AM - 11:00 AM

**Does Exercise Mode or Protocol Alter the Chronotropic Index?**

Denise, L. Smith, FACSM<sup>1</sup>, David A. Barr<sup>1</sup>, Eric M. Hultquist<sup>1</sup>, Wesley K. Lefferts<sup>1</sup>, Jeannie M. Haller<sup>1</sup>, Patricia C. Fehling, FACSM<sup>1</sup>, Thomas W. Storer<sup>2</sup>, Christopher B. Cooper, FACSM<sup>2</sup>. <sup>1</sup>Skidmore College, Saratoga Springs, NY. <sup>2</sup>UCLA, Los Angeles, CA.

(No relationships reported)

It is well known that  $\dot{V}O_{2max}$  is protocol-dependent with higher values typically reported during treadmill protocols compared to cycle ergometry. During incremental exercise there is generally a robust coupling between heart rate (HR) and oxygen uptake ( $\dot{V}O_2$ ). However, the effect of exercise mode and protocol on the relationship between HR and  $\dot{V}O_2$ , expressed as the chronotropic index (CI) (slope of the regression line; HR vs.  $\dot{V}O_2$ ) has not been established.

**PURPOSE:** To determine if exercise mode or test protocol affects the CI.

**METHODS:** Ten male participants (age,  $21 \pm 2$  yr; height,  $177 \pm 9$  cm; weight,  $76.3 \pm 3.0$  kg) each completed 5 graded exercise tests: 3 treadmill tests (Bruce, UCLA, Wellness Fitness Initiative (WFI)), a field-based running test (Shuttle) and a cycle test.  $\text{VO}_2$  and HR were measured during each test.

**RESULTS:** Data are presented in table. All tests were considered maximal as all participants achieved  $\text{VO}_{2\text{max}}$  according to ACSM criteria.  $\text{VO}_{2\text{max}}$  during the cycle protocol was significantly lower than during Bruce and WFI ( $P < 0.05$ ). None of the other protocols differed from each other. There was no significant difference in the CI or y-intercept across protocols.

| Protocol | Peak HR (b·min <sup>-1</sup> ) | $\text{VO}_{2\text{max}}$ (ml·kg <sup>-1</sup> ·min <sup>-1</sup> ) | CI             | y-intercept     |
|----------|--------------------------------|---|----------------|-----------------|
| Bruce    | $187 \pm 9$                    | $54.9 \pm 7.5^*$  | $31.8 \pm 5.9$ | $56.1 \pm 14.2$ |
| UCLA     | $192 \pm 12$                   | $52.2 \pm 8.0$  | $33.5 \pm 8.2$ | $56.5 \pm 12.9$ |
| WFI      | $192 \pm 8$                    | $54.1 \pm 6.8^*$  | $31.7 \pm 6.6$ | $60.7 \pm 12.1$ |
| Shuttle  | $189 \pm 12$                   | $52.9 \pm 5.0$  | $35.3 \pm 9.4$ | $45.7 \pm 23.7$ |
| Cycle    | $186 \pm 11$                   | $47.8 \pm 8.3$  | $35.8 \pm 9.2$ | $59.7 \pm 12.5$ |

\* $P < 0.05$

**CONCLUSION:** The findings from this study support previous research showing that  $\text{VO}_{2\text{max}}$  is protocol-dependent. However, the robust linear relationship between HR and  $\text{VO}_2$  is unaffected by exercise mode or protocol.

Supported by contract from DHS Science and Technology awarded to UCLA.

**3494 Board #215 June 2 9:30 AM - 11:00 AM**

**Energy Expenditure During Sessions of static Stretching**

Ricardo A. Simões, Marcio A.G. Sindorf, Pamela R.G. Gonelli, Marcelo C. Cesar. *UNIMEP - Methodist University of Piracicaba, Piracicaba, Brazil.*

(No relationships reported)

American College of Sports Medicine (ACSM) recommends stretching exercises as part of a program for health to maintain and improve flexibility. Stretching exercise has also an energy expenditure that could contribute to weight maintenance programs, besides providing an efficient method of heating for more intense exercises. However, there is the need for a study to evaluate the energy cost of static stretch exercise in young women.

**PURPOSE:** To evaluate energy expenditure during a static stretch session in young women, as recommended by ACSM.

**METHODS:** Subjects were 12 women ( $23.3 \pm 3.5$  years;  $58.8 \pm 6.1$  Kg;  $1.7 \pm 0.1$  m;  $21.2 \pm 1.3$  kg/m<sup>2</sup>) engaged in physical training for a minimum of 6 months. Energy expenditure was measured in 3 non-consecutive days by metabolic gas analyzer and telemetry system. Resting energy expenditure (REE) was done with subjects on 3 hours fasting and 30 minutes rest in supine position, the measures were taken at rest for 12 minutes. The first 2 minutes were discarded and an average of the 10 remaining minutes was used to determine the REE. The stretch energy expenditure (SEE) was measured during static stretches session for about 5 minutes. Stretch exercises were done in stand position, one repetition per muscle group and each position were held for 20 seconds for major muscle groups following exactly the order - biceps, triceps, shoulders, back posterior chain, latissimus dorsi, chest, posterior lower extremity chain, quadriceps and adductor muscles. Mean and standard deviation ( $\pm$ SD) for all variables were calculated and expressed in kilocalories per minute (kcal/min). Normal distribution of the data was checked by Shapiro-Wilk's test and Friedman test was used for the comparison among the variables.

**RESULTS:** On days 1, 2 and 3 REE were respectively  $1.1 \pm 0.4$ ,  $1.0 \pm 0.3$ ,  $0.9 \pm 0.2$  and SEE were  $2.0 \pm 0.6$ ,  $1.9 \pm 0.2$  and  $1.9 \pm 0.3$  kcal/min. The results show no significant differences in the measured variables at REE and SEE among days 1, 2 and 3 ( $p > 0.05$ ) but there was a significant increase ( $p < 0.05$ ) in energy expenditure between REE and the SEE on all 3 days of evaluation.

**CONCLUSIONS:** The results show that the energy expenditure of young women is significantly increased while performing static stretches, about twice, in relation to REE.

Supported by FAPESP, CAPES and CNPq.

**3495 Board #216 June 2 9:30 AM - 11:00 AM**

**The Relationship Between Muscle Activation And Ratings Of Perceived Exertion Across Four Exercise Modes**

Ryan P. McGrath, Kathy D. Browder. *University of Idaho, Moscow, ID.*

(No relationships reported)

Previous research reported that dual action (arms & legs) elliptical trainer (ET) exercise elicits lower RPE than other forms of exercise (Hughes et al, 2005). However, why RPE is lower has not been explained.

**PURPOSE:** To determine the relationship between rating of perceived exertion (RPE) and muscle activation in ET, dual action (arms+legs) recumbent bike (DB), a treadmill (TM), and single-action (legs only) recumbent bike (SB).

**METHODS:** Ten males and four females (Age:  $21 \pm 2$  yr; Height:  $177.9 \pm 10.0$  cm; Weight:  $77.4 \pm 13.7$  kg) volunteered as subjects. Each subject warmed up 5 min on a stationary bike, and then completed 6 minutes of exercise on each machine in randomized order with 3 min rest period between bouts. The metabolic workload was standardized across machines at  $\sim 31.3$  ml·kg<sup>-1</sup>·min<sup>-1</sup>. Overall RPE (O-RPE), central RPE (C-RPE), and peripheral RPE (P-RPE) were measured at the end of each exercise bout. EMG activity of the biceps brachii (BB), pectoralis major (PM), triceps brachii (TB), middle deltoid (MD), gastrocnemius (GA), gluteus maximus (GM), vastus lateralis (VL), and biceps femoris (BF) was sampled continuously at 1000 Hz for 6 consecutive strides at the end of each minute of exercise. A one-way repeated measures ANOVA was calculated to determine differences across machines.

**RESULTS:** No significant differences were found in C-RPE ( $p = 0.256$ ; C-RPE<sub>ET</sub>:  $11 \pm 2$ ; C-RPE<sub>DB</sub>:  $12 \pm 2$ ; C-RPE<sub>SB</sub>:  $12 \pm 3$ ; C-RPE<sub>TM</sub>:  $11 \pm 3$ ) across machines. P-RPE was significantly less ( $p < 0.002$ ) in ET ( $10 \pm 2$ ) versus DB ( $12 \pm 2$ ); SB ( $13 \pm 3$ ); and TM ( $11 \pm 3$ ). O-RPE was significantly less ( $p < 0.007$ ) in ET ( $11 \pm 2$ ) and TM ( $12 \pm 3$ ) versus DB ( $13 \pm 2$ ) and SB ( $13 \pm 3$ ). GA activation was less in ET than in SB, DB, or TM ( $p < .001$ ; GA<sub>ET</sub>:  $66 \pm 27$   $\mu$ V; GA<sub>DB</sub>:  $116 \pm 51$   $\mu$ V; GA<sub>SB</sub>:  $104 \pm 42$   $\mu$ V; GA<sub>TM</sub>:  $136 \pm 51$   $\mu$ V). BB activation was greater in DB and ET ( $p < .001$ ; BB<sub>ET</sub>:  $96 \pm 93$   $\mu$ V; BB<sub>DB</sub>:  $95 \pm 68$   $\mu$ V; BB<sub>SB</sub>:  $19 \pm 10$   $\mu$ V; BB<sub>TM</sub>:  $26 \pm 18$   $\mu$ V). TB activation was greater in DB ( $p < .002$ ; TB<sub>ET</sub>:  $55 \pm 36$   $\mu$ V; TB<sub>DB</sub>:  $97 \pm 79$   $\mu$ V; TB<sub>SB</sub>:  $39 \pm 25$   $\mu$ V; TB<sub>TM</sub>:  $45 \pm 44$   $\mu$ V). MD activation was greatest in DB and TM, and least in SB ( $p < .001$ ; MD<sub>ET</sub>:  $39 \pm 23$   $\mu$ V; MD<sub>DB</sub>:  $69 \pm 40$   $\mu$ V; MD<sub>SB</sub>:  $24 \pm 15$   $\mu$ V; MD<sub>TM</sub>:  $59 \pm 33$   $\mu$ V).

**CONCLUSION:** Lower P-RPE and O-RPE in ET may be related to decreased muscle activation in the lower leg, specifically the GA, and less dependent on upper extremity muscle activation. Supported, in part, by SportsArt, Inc.

**3496 Board #217 June 2 9:30 AM - 11:00 AM**

**Relationship Of Metabolic Costs Of Aquatic Treadmill Versus Land Treadmill Running**

Sarah Blackwell, Ryan Porter, Gerald Smith, FACSM, Dale Wagner, Dennis Dolny. *Utah State University, Logan, UT.*

(No relationships reported)

**PURPOSE:** This study investigated whether running using water jets in an aquatic treadmill (ATM) reflects energy expenditure (EE, oxygen consumption,  $\text{VO}_2$ ) while running at faster speeds on a land treadmill (LTM).

**METHODS:** Sixteen participants completed two trials on separate days on a LTM and ATM. For the ATM trial subjects performed eighteen, 3-4 min submaximal runs at three self selected speeds (slow, medium, and fast) with either water jet resistances of 0-100% of maximum jet flow capacity in 20% increments. For LTM subjects ran at the same speeds at 0% incline. Trials were separated by at least 48 hours. Oxygen consumption ( $\text{VO}_2$ ), heart rate (HR), and ratings of perceived exertion (RPE) were recorded during each trial. Regression analysis estimated TM  $\text{VO}_2$  from running speed ( $\text{VO}_2$ , ml·kg·min<sup>-1</sup>) =  $6.1034 + 4.37 \cdot \text{TM speed}$  ( $R^2 = 0.95$ ,  $\text{SEE} = 0.93 + 0.87$  ml·kg·min<sup>-1</sup>). Regression analysis produced prediction equations to estimate LTM running speeds based on ATM EE with adding jet resistances.

**RESULTS:** At the same speed ATM VO<sub>2</sub> EE with 0 and 20% jet settings were lower than TM. However by ATM 40% jet resistances VO<sub>2</sub> was greater ( $p < 0.02$ ) than LTM. Differences in ATM VO<sub>2</sub> associated with each jet setting (0, 20, 40, 60, 80, and 100%) corresponded to a change (M±SD) in comparable LTM speed of -1.00 (.90), -0.96 (.82), +0.91 (.72), +1.53 (1.14), +3.05 (1.16), and 4.47 (1.32) miles per hour respectively.

**CONCLUSIONS:** These results demonstrate that the ATM jets have the potential to provide an added metabolic challenge to mimic TM running that is ~4.5 mph faster. One potential benefit is to use ATM with jets to allow subjects to experience a training load that may be much greater than their current/chronic orthopedic condition might allow.

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**3497** Board #218 June 2 9:30 AM - 11:00 AM

**Effects Of Delayed Onset Muscle Soreness On Maximal Incremental Exercise Test Results**

Bryna C r Christmas<sup>1</sup>, Lee Taylor<sup>2</sup>, Jason C. Siegler, FACSM<sup>3</sup>, Adrian W. Midgley<sup>1</sup>. <sup>1</sup>The University of Hull, Hull, United Kingdom. <sup>2</sup>The University of Bedfordshire, Bedford, United Kingdom. <sup>3</sup>The University of Western Sydney, Sydney, Australia. (Sponsor: Jason Siegler, FACSM)

(No relationships reported)

**PURPOSE:** Delayed onset muscle soreness (DOMS), is considered one of the most common forms of sports injury. Training or competing with DOMS may result in a less than optimal training intensity or significant decrements in exercise performance. Despite numerous studies investigating the effects of DOMS on exercise performance, no definitive studies have investigated the effects of DOMS on maximal incremental treadmill test results, which was the objective of the present study.

**METHODS:** Twenty healthy males, randomly allocated into a control group (n = 10) and experimental group (n = 10), completed three tests on three separate occasions (familiarisation, pre and post intervention tests). The experimental group also completed an intervention test consisting of eccentric knee extension and flexion exactly 48 h prior to the post intervention test.

**RESULTS:** No significant changes were observed in any of the dependent variables pre-post intervention in the control group. In the experimental group, the median change in perceived muscle soreness was 58, 59 and 40 mm at 24 h, 36 h and 48 h post-intervention compared to pre-test intervention ( $p = 0.001$ ). Maximum voluntary isokinetic peak torque of the knee extensors decreased by 8% ( $p = 0.006$ ) and 18% ( $p = 0.005$ ) in the dominant and non dominant leg respectively and by 37% ( $p = 0.012$ ) for knee flexion in the dominant leg. During the post-intervention test, time to exhaustion decreased by 9% ( $p = 0.001$ ) and maximal blood lactate concentration decreased by 11% ( $p = 0.005$ ) compared to the pre test intervention. Furthermore, energy expenditure for the same treadmill velocity increased by 17% ( $p = 0.04$ ).

**CONCLUSIONS:** The results from the present study suggest that performing a maximum incremental exercise test with DOMS, results in individuals failing to achieve their maximum treadmill velocity, which could invalidate the results obtained from this test. Additionally, running efficiency is reduced whilst suffering from DOMS.

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**3498** Board #219 June 2 9:30 AM - 11:00 AM

**Simultaneous Observation for Oxidative Stress and Muscle Damage with High-Intensity Kendo Training**

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(No relationships reported)

Kendo is a Japanese martial art based on traditional samurai swordsmanship. Despite kendo having a long history in Japan, few studies have examined the effects of kendo training on the human body. Human serum albumin (HSA) is the most abundant serum protein found in the bloodstream and is composed of both reduced and oxidized forms. We have developed a convenient chromatographic method for the separation of both forms of HSA and have reported dynamic changes in the redox state of HSA in health, disease and aging.

**PURPOSE:** To examine both oxidative stress and skeletal muscle damage caused by kendo training over a four-day period, we measured the ratio of reduced to oxidized HSA for oxidative stress, and serum concentrations of creatine kinase (CK) and myoglobin (Mb) for skeletal muscle damage.

**METHODS:** Seventeen male students from the National Defense Academy and Gifu University, all elite kendo athletes (20.0 ± 1.0 yrs) participated in this training camp. Blood samples for the analysis of serum levels of HSA, CK and Mb were drawn just before and after the training period. Differences between the mean values were tested for significance using paired t-test.

**RESULTS:** The four-day kendo training significantly lowered the percentage of reduced HSA from 78.9 ± 2.3% (before) to 73.9 ± 2.6% (after the training,  $p < 0.0001$ ). Simultaneously, the training also noticeably elevated serum levels of both CK (132 ± 64 IU/L before and 530 ± 255 IU/L after the training,  $p < 0.0001$ ) and Mb (23 ± 4 ng/mL before and 77 ± 34 ng/mL after the training,  $p < 0.0001$ ).

**CONCLUSION:** These findings suggest that the four-day intensive kendo training period gave rise to oxidative stress and skeletal muscle damage for male collegiate kendo athletes.

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**3499** Board #220 June 2 9:30 AM - 11:00 AM

**Menstrual Cycle Effect on Metabolic Acidosis During High Intensity Intermittent Exercise**

Deborah Van Langen, Jessica Brown, Ryanne Carmichael, Nicole Pollard, Sarah Schultz, Daniel Sheehan, Tracey Matthews, Vincent Paolone, FACSM. *Springfield College, Acton, MA.*

(No relationships reported)

Ovarian hormonal fluctuations throughout the menstrual cycle have been associated with a decline in exercise performance. When comparing genders performing the same mode of exercise, women have different fatigue characteristics such as lower lactate and CO<sub>2</sub> levels. It has been reported that females use lactate as a substrate more effectively than males during high intensity exercise. Menstrual cycle phase can have an impact on pH balance therefore influencing metabolic acidosis.

**PURPOSE:** The study was designed to determine if differences exist in metabolic acidosis in women between the luteal and follicular phase of the menstrual cycle during high intensity intermittent exercise.

**METHODS:** The subjects (N = 10) participated in two separate 75 minute cycling sessions determined by menstrual cycle phase. Each 75 minute session was divided into 5 separate 15 minute exercise bouts consisting of 5 minutes of high intensity exercise followed by 10 minutes of active and passive recovery. The intensity of the high intensity bout corresponded to 90% of maximal wattage determined by a V(dot)O<sub>2</sub>peak test. The variables evaluated were lactate (mmol/L) and CO<sub>2</sub> (ml·kg<sup>-1</sup>·min<sup>-1</sup>). Two factorial ANOVAs were computed to determine if significant interactions existed.

**RESULTS:** A significant interaction was observed between accumulation and clearance over the 75 minute time period for lactate (mmol/L) and CO<sub>2</sub> (ml·kg<sup>-1</sup>·min<sup>-1</sup>). No significant difference existed between menstrual cycle phases. These data reflect differences in acid base balance between accumulation and clearance of lactate (mmol/L) and CO<sub>2</sub> (ml·kg<sup>-1</sup>·min<sup>-1</sup>).

**CONCLUSIONS:** Impaired physical performance during menstrual cycle phases has been associated with symptoms such as fatigue, fluid retention, weight gain, mood changes, and dysmenorrhea. In this study, menstrual cycle phase had no effect on metabolic acidosis during high intensity incremental exercise therefore suggesting no effect on exercise performance. Subjects cleared less lactate (mmol/L) and CO<sub>2</sub> (ml·kg<sup>-1</sup>·min<sup>-1</sup>) during the active and passive rest periods than expected. As a result, lactate (mmol/L) and CO<sub>2</sub> (ml·kg<sup>-1</sup>·min<sup>-1</sup>) accumulation created less of a delta showing the inability to clear lactate and CO<sub>2</sub> between the exercise sessions.

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**3500** Board #221 June 2 9:30 AM - 11:00 AM

**Physiological Changes Over Four Maximal Incremental Cycling Tests Within One Day**

Friederike Scharhag-Rosenberger<sup>1</sup>, Anja Carlsohn<sup>1</sup>, Stefan Schuler<sup>1</sup>, Carsten Lundby<sup>2</sup>, Frank Mayer<sup>1</sup>, Jürgen Scharhag, FACSM<sup>1</sup>. <sup>1</sup>University of Potsdam, Potsdam, Germany. <sup>2</sup>University of Zurich, Zurich, Switzerland.

(No relationships reported)

It remains unknown to what degree one or more maximal exercise tests may influence the physiological response to yet another maximal exercise test performed within a single day. This is unfortunate since multiple tests within one day are used in scientific studies and also in the evaluation of athletes.

**PURPOSE:** To investigate the impact of repeated maximal incremental cycling tests on physiological variables in trained and untrained individuals.



**METHODS:** Eight trained (T) and eight untrained (UT) subjects (T: 4 m/4 f, 25 ± 3 yrs, BMI 23 ± 3 kg/m<sup>2</sup>, VO<sub>2</sub>max: 64 ± 6 ml/min/kg; UT: 4 m/4 f, 27 ± 3 yrs, BMI 22 ± 1 kg/m<sup>2</sup>, VO<sub>2</sub>max 44 ± 4 ml/min/kg) performed four maximal stepwise incremental cycling tests separated by 1.5 h of passive rest. Carbohydrate and energy requirements for rest and exercise were individually calculated and covered by means of standardized meals before the first and between the following tests.

**RESULTS:** Maximal power output did not change significantly over the four tests in the T group (306 ± 41 vs. 309 ± 40 vs. 307 ± 41 vs. 306 ± 41 W; P = 0.23), but decreased from the third test in the UT group (201 ± 35 vs. 198 ± 36 vs. 192 ± 33 vs. 186 ± 30 W; P < 0.01). VO<sub>2</sub>max remained unchanged in both groups (P = 0.32 and P = 0.33, respectively). The heart rate curve was elevated from the third test in the T group and from the second test in the UT group (total increase: 6 ± 6 and 9 ± 8 /min; P < 0.05). The individual anaerobic threshold (IAT; T: 183 ± 30 W; UT: 125 ± 25 W) increased in the T group from the second, and in the UT group from the fourth test (total increase: 12 ± 8 and 10 ± 10 %; P < 0.05). Pre-exercise epinephrine and norepinephrine levels increased from the first to the fourth test in the T group (P < 0.05), but not in the UT group (P = 0.24 and P = 0.11, respectively). Post-exercise catecholamine concentrations did not change in either group (P ≥ 0.14).

**CONCLUSIONS:** If maximal performance parameters are assessed, it is recommended that trained and untrained individuals perform up to four and two incremental cycling tests on one day, respectively. As submaximal cardiocirculatory and metabolic parameters changed from the second test on, only one test should be performed if these parameters are the prime focus.

**3501 Board #222 June 2 9:30 AM - 11:00 AM**

**Study Of The Linearity Relationships Between Cardiorespiratory Variables And Velocity In Maximal Incremental Exercise Test**

Jonas L. Gurgel<sup>1</sup>, Flavia Porto<sup>2</sup>, Gabriel Espinosa<sup>1</sup>, Felipe Amorim Cunha<sup>3</sup>, Paulo de Tarso Veras Farinatti<sup>3</sup>. <sup>1</sup>Fluminense Federal University, Niteroi, Brazil. <sup>2</sup>Gama Filho University, Rio de Janeiro, Brazil. <sup>3</sup>Rio de Janeiro State University, Rio de Janeiro, Brazil.  
(No relationships reported)

**PURPOSE:** The propose of this study was to evaluate the linearity relationships between cardiorespiratory variables (VO<sub>2</sub>; VO<sub>2</sub>R; HR; HRR) and velocity, and was verified witch relationship presented a better fit to the identity line.

**METHODS:** Participated on this study 33 aerobic trained men (22 ± 4 yrs, 70.8 ± 7.7kg, 1.76 ± 0.68m and 11.5 ± 3.4%BF). On the first day resting VO<sub>2</sub> and resting HR was determined, the anthropometric measurements were taken, and the participants were habituated to the equipment and test protocols. On the second day the incremental exercise testing was performed, using individualized ramp protocol and was based on predict VO<sub>2</sub>max obtained by a questionnaire. Maximum velocity was determined based on ACMS equation. Initial velocity for all subjects was 60% of maximum predict velocity. Tests were considered maximal when three of the four criteria proposed by Midgley et al. (2009) were attained. For statistical analyze, firstly Passing and Bablok regressions of each cardiorespiratory variable and velocity were obtained for every subject. Then Shapiro Wilks test were applied for confirmation of normality, after that a repeated measures analysis of variance with Post-hoc LSD Fisher's was tested. The significance level was set at α=0.05.

**RESULTS:** Data from Passing and Bablok regressions can be seen in table 1.

**Table - Results from linear regression of each tested variable**

|                               | Intercept |                     | Slope  |                  | Cusum test for linearity |
|-------------------------------|-----------|---------------------|--------|------------------|--------------------------|
|                               | a         | 95%CI               | b      | 95%CI            |                          |
| Velocity vs VO <sub>2</sub>   | -0,1731   | -0,2039 to -0,1468  | 1,1731 | 1,1415 to 1,2071 | (P>0.10)                 |
| Velocity vs VO <sub>2</sub> R | -0,247    | -0,2804 to -0,2179  | 1,247  | 1,2135 to 1,2838 | (P>0.05)                 |
| Velocity vs HRC               | 0,3447    | 0,3261 to 0,3627    | 0,6605 | 0,6392 to 0,6822 | (P<0.01)                 |
| Velocity vs HRR               | -0,01809  | -0,04970 to 0,01307 | 1,0276 | 0,9917 to 1,0649 | (P<0.01)                 |

**CONCLUSION:** The presented data showed significant differences for almost all Passing and Bablok regressions, except for HRR and velocity in which both, intercept and slope, were inside confidence interval range. These results suggest that HRR, between all tested variables, appears to be the best potential parameter for submaximal exercise prescription.

**3502 Board #223 June 2 9:30 AM - 11:00 AM**

**Analysis of Time Spent Into Four Different Intensity Levels During Regular Spinning Classes**

Luiz Guilherme G. Porto<sup>1</sup>, Daniel Saint Martin<sup>2</sup>, Giliard Lago<sup>3</sup>, Guilherme E. Molina<sup>4</sup>, Luiz Fernando Junqueira Jr.<sup>5</sup>. <sup>1</sup>Brasilia University Center - UniCEUB and Cardiovascular Laboratory - University of Brasilia Faculty of Medicine - UnB, Brasilia, Brazil. <sup>2</sup>Brasilia University Center - UniCEUB, Brasilia, Brazil. <sup>3</sup>UniEURO University Center, Brasilia, Brazil. <sup>4</sup>UniEURO - University Center and University of Brasilia Faculty of Medicine, Cardiovascular Laboratory - UnB, Brasilia, Brazil. <sup>5</sup>Cardiovascular Laboratory - University of Brasilia Faculty of Medicine - UnB, Brasilia, Brazil.  
(No relationships reported)

Created in the 80s, Spinning has hugely grown during the last 2 decades. As an indoor physical activity performed on stationary bikes, Spinning is usually commercialized as an efficient exercise to foster cardiovascular fitness and weigh loss. However, its absolute and relative intensity has been poorly described.

**PURPOSE:** To evaluate the absolute and relative time spent into four different effort intensities during regular Spinning classes performed by young and middle aged adults.

**METHODS:** A cross-sectional study was done with 12 young adults (group 1 - G1), from 18 to 35 yrs and 12 middle aged adults (group 2 - G2), from 36 to 64 yrs, recruited from 5 fitness centers randomly selected in Brasilia-Brazil. HR was registered with a RS800 Polar monitor during the whole classes each 5 seconds. Each volunteer had 3 classes monitored to obtain the mean HR of each moment. Effort intensity was defined as percentage ranges of individual maximal heart rate (MHR: 220 - age), in 4 HR zones: very heavy (VH: ≥ 94% of MHR); heavy (HY: 77 - 93% of MHR); moderate (MD: 64 - 76% of MHR) and light (LT: <64% of MHR). Absolute and relative time spent in each HR zones by G1 and G2 were compared by (Mann-Whitney test). Differences were considered significant when p-value <0.05.

**RESULTS:** Mean Spinning classes duration was 46:58min. For all volunteers (n=24), mean time in each HR zones were: VH - 3:23min (7.0%); HY - 24:27min (52.3%); MD - 11:43min (24.9%) and LT - 7:25min (15.7%). Time spent in VH zone was higher for G2 (5:37min - 11.5%) than for G1 (1:09min - 2.6%) (p=0.02). There were no significant differences for HY zone (26:58min - 55.3% for G1 vs 23:03min - 49.3% for G2); for MD zone (10:25min - 21.5% for G2 vs 13:03min - 28.3% for G1) and for LT zone (5:41min - 11.6% for G2 vs 9:11min - 19.8% for G1) (p>0.14).

**CONCLUSIONS:** We observed that most of the time (51.9% for G1 and 66.8% for G2) of Spinning classes was performed on heavy or very heavy intensity. Older participants completed their Spinning sections accumulating more time on the very heavy intensity compared to the younger group. Regarding to exercise safety, this situation should be avoided, considering that age above 45 years for men and 55 years for women is considered a risk factor for cardiovascular disease.

**3503 Board #224 June 2 9:30 AM - 11:00 AM**

**Paintball Is A Blast, But Is It Exercise? Heart Rate And Accelerometry In Boys Playing Paintball.**

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(No relationships reported)

Paintball has been played as an organized sport since the 1980's and is essentially a game of tag, except instead of touching an opponent by hand opponents are tagged by shooting them with a paintball that leaves a tell-tale mark indicating who (or what) has been eliminated. Although many people have played paintball in the past 30 years, there has only been one previous evaluation of paintball as physical activity. Procarri et al. (2004) observed an average heart rate of 68-73% of maximal while playing paintball, but noted that it could not be determined how much of the increase in heart rate was due to physical activity and how much was due to the excitement of game play.

**PURPOSE:** This project used accelerometry and heart rate monitors to evaluate the quantity and intensity of physical activity in boys playing paintball. This project also evaluated the changes in heart rate due to physical activity and excitement while playing paintball.

**METHODS.** Eleven boys ( $12.7 \pm 1.0$  y,  $51.5 \pm 11.3$  kg,  $161.8 \pm 10.1$  cm) engaged in a graded exercise test in order to develop a heart rate/oxygen consumption correlation. Then, on a separate day, the boys played 7 games of outdoor paintball while wearing a heart rate monitor and accelerometer. The games had a stated 20 minute time limit, but players who were marked were eliminated from game play. The starting and stopping time of each game was recorded, along with the time each boy was eliminated during the game. **RESULTS.** During the 6 hours of paintball playing, the boys played paintball for a total of  $80.6 \pm 10.0$  minutes with an average length of game play  $11.5 \pm 6.2$  minutes. Average heart rate during the 6 hours of paintball play was  $127.4 \pm 6.5$  beats/min, representing ~40% of heart rate reserve. During the 6 hours of paintball play the boys accumulated  $141.8 \pm 24.3$  minutes of moderate and  $6.1 \pm 4.6$  minutes of intense physical activity. During game play the boys accumulated  $63.2 \pm 15.1$  minutes of moderate intensity activity and  $2.6 \pm 2.8$  minutes of vigorous activity.

**CONCLUSIONS.** A day of paintball play provides some intense physical activity and enough moderate physical activity to promote health. However, a considerable amount of the physical activity occurred during the time before and after game play, when the boys were walking from the staging area to the playing field and vice versa.

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**3504** Board #225 June 2 9:30 AM - 11:00 AM

**The Difference in Caloric Expenditure between Walking and Jogging in Adults**

Joseph L. Andreacci, FACSM<sup>1</sup>, Curt B. Dixon, FACSM<sup>2</sup>, Kevin Moyer<sup>1</sup>, Tara Campbell<sup>1</sup>, Dustin Pine<sup>2</sup>, Rachel Hikes<sup>2</sup>. <sup>1</sup>Bloomsburg University, Bloomsburg, PA. <sup>2</sup>Lock Haven University, Lock Haven, PA.

(No relationships reported)

**PURPOSE:** To examine the energy expenditure (EE) differences between walking and jogging one-mile on a treadmill.

**METHODS:** Fifty-seven females and fifty-four males (age  $20.7 \pm 1.4$  years) participated in this study. All subjects performed a 1-mile walk and a 1-mile jog on a motorized treadmill, during the same exercise session. Oxygen consumption ( $\text{VO}_2$ ) and EE were measured continuously via a ParvoMedics metabolic measurement system. Heart rate and OMNI-RPE were measured throughout both of the exercise bouts.

**RESULTS:** When compared to walking, jogging 1-mile resulted in a significantly ( $P < 0.001$ ) higher total EE (women =  $105.3 \pm 17.7$  vs.  $82.4 \pm 13.9$  kcals; men =  $147.2 \pm 22.5$  vs.  $114.5 \pm 16.9$  kcals),  $\text{VO}_2$  (women =  $33.8 \pm 3.8$  vs.  $15.0 \pm 2.7$  mL/kg/min; men =  $37.1 \pm 6.1$  vs.  $16.3 \pm 3.8$  mL/kg/min), HR (women =  $174 \pm 15$  vs.  $120 \pm 16$  beats/min; men =  $169 \pm 16$  vs.  $115 \pm 17$  beats/min), and OMNI-RPE (women =  $4.3 \pm 2.1$  vs.  $1.3 \pm 1.0$ ; men =  $4.5 \pm 1.5$  vs.  $2.0 \pm 1.2$ ) in both genders.

**CONCLUSIONS:** Although total EE was higher when jogging, the mean difference between exercise modes was relatively small (women = 22.9 kcals; men = 32.7 kcals). From a practical standpoint, health and fitness professionals may want to determine whether the extra energy expenditure is worth the additional physiological and anatomical stress that often accompanies jogging. In unconditioned individuals, compliance with exercise programs may be improved with the less stressful walking mode with only a few less calories expended during the workout.

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**3505** Board #226 June 2 9:30 AM - 11:00 AM

**Effect of Neuromuscular Electrostimulation via the Peroneal Nerve on Muscle Soreness Following Intense Intermittent Exercise**

Richard A. Ferguson, Victoria R. Paley, Joshua C. W. Ewens, Liam M. Heaney, James Redden. Loughborough University, Loughborough, United Kingdom.

(R.A. Ferguson: Contracted Research - Including Principle Investigator; Sky Medical Technology.)

Numerous techniques are reported to enhance recovery following intense exercise, including active recovery, cryotherapy and compression garments under the premise that enhanced blood flow facilitates the removal of metabolites associated with muscle damage; however, there is equivocal support for such claims. It was recently observed that a novel technique of neuromuscular electrostimulation (NMES) of the lower limb via the peroneal nerve augments venous, arterial and microvascular blood flow (Tucker et al. Int J Angiol, 19:31, 2010). It is possible that this could enhance the recovery process following intense intermittent exercise.

**PURPOSE:** To examine the effects of NMES of the lower limb on muscle soreness following prolonged intermittent exercise.

**METHODS:** Ten ( $22 \pm 1$  yr,  $180 \pm 7$  cm,  $78 \pm 7$  kg) male games players performed a 90 min ( $2 \times 45$  min) intermittent shuttle running test on three separate occasions. Following exercise one of the following recovery interventions were applied: control passive recovery (CON); graduated compression sock (GCS); neuromuscular electrical stimulation (NMES). Interventions were applied 1 hr after the exercise and maintained for at least 12 hrs. Measurements of perceived muscle soreness (PMS) were made before, immediately, 1, 24, 48 and 72 hrs following exercise.

**RESULTS:** PMS increased ( $P < 0.05$ ) in all conditions immediately and 1 hr post-exercise, and remained elevated compared to baseline in CON at 24 and 48 hrs. At 24 and 48 hrs PMS was lower ( $P < 0.05$ ) in NMES compared to CON whereas there was no difference between GCS and CON.

**CONCLUSION:** The use of a novel NMES device reduces perceived muscle soreness and is superior to GCS in reducing perceived muscle soreness following intense intermittent exercise.

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**3506** Board #227 June 2 9:30 AM - 11:00 AM

**Physical Fitness Before and After Weight Restoration in Anorexia Nervosa**

Marta Alberti<sup>1</sup>, Carlo Capelli<sup>1</sup>, Marwan ElGhoch<sup>2</sup>, Simona Calugi<sup>2</sup>, Riccardo Dalle Grave<sup>2</sup>. <sup>1</sup>University of Verona, Verona, Italy. <sup>2</sup>Villa Garda Hospital, Garda (VR), Italy.

(No relationships reported)

No systematic data have been systematically collected to classify the functional level of cardiovascular, muscular and resistance performances in patients with Anorexia Nervosa (AN) before and after weight restoration, even though AN are considered to be more physically active and to engage longer periods of moderate-intense physical exercise than the general population.

**PURPOSE:** To investigate the effects of cognitive behavioral therapy (CBT) on physical fitness of patients with AN and to evaluate the feasibility of the Eurofit Physical Fitness Battery test (EPFTB) in this population.

**METHODS.** Physical fitness was assessed with an adapted version of the EPFTB (Endurance: 6' walking test; Arm strength: hand grip; Abdominal: sit up; Leg strength: standing broad jump; Balance: flamingo balance; Flexibility: sit and reach) administered to 24 female AN inpatients (BMI:  $14.3 \pm 1.5$  kg/m<sup>2</sup>), pre and post CBT treatment, and to 58 healthy females (BMI:  $21.17 \pm 2.57$  kg/m<sup>2</sup>) of the same age ( $24.4 \pm 9.2$  vs.  $25.9 \pm 9.1$  yy, respectively,  $z=1.39$ ,  $p = 0.165$ ). AN group underwent test on the second day of the admission and the last week before the hospital discharge.

**RESULTS.** EPFTB tests showed good feasibility, but some AN patients refused to sustain some of them at the admission. CBT was associated with a significant improvement in BMI (from  $14.3 \pm 1.5$  to  $18.8 \pm 1.2$ ,  $Z = 4.20$ ,  $p < 0.001$ ) and in 4 out of 6 EB tests ( $p < 0.05$ ) in the AN group. However, both in pre and post conditions, AN patients generally showed lower EPFTB scores than the control group (all  $p < 0.001$ ), with the exception of sit up score.

**CONCLUSIONS.** Adapted EPFTB can be recommended for evaluating physical fitness parameters in AN patients. Physical fitness is lower in AN patients than in controls both at baseline and after weight restoration. These data suggest the need to associate to the classical inpatient treatment of AN specific therapeutic strategies to improve physical fitness.

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**3507** Board #228 June 2 9:30 AM - 11:00 AM

**Improved Flexibility and Core Strength in Four Different Levels of Acute Pilates**

Bryan K. Christensen, Lori A. Burns, Sherri N. Stastny. North Dakota State University, Fargo, ND.

(No relationships reported)

Bryan K. Christensen, Lori A. Burns, Sherri N. Stastny

North Dakota State University, Fargo, ND

The popularity of Pilates has increased over the last 10 years substantially. Pilates has been shown in previous studies to improve core strength and endurance, low back pain, flexibility, posture, and body alignment.

**PURPOSE:** This study evaluated the effects of a five-week Pilates class on core strength and flexibility in four different levels of Pilates classes.

**METHODS:** Forty-one female participants ( $45.7 \pm 8.2$  yrs old) underwent a pre-test and a post-test consisting of a back saver sit-and-reach test, trunk rotation test, plank test, and an abdominal six-rep max test. Each participant was involved in either a Beginners, Essential, Essential Plus, or Intermediate Pilates class. The treatment lasted five weeks and was performed on

the STOTT Reformer. A MANOVA was used to assess the differences in effects among the four groups within the dependent variables. A univariate ANOVA was conducted for each dependent variable.

**RESULTS:** The MANOVA was found to be significant ( $p < .0001$ ). The ANOVA results showed that all four dependent variables in all four of the classes were statistically significant (F values ranged from 8.54 to 88.21,  $p$  values ranged from .029 to  $<.0001$ ). The Beginner's class improved the most in the trunk rotation test (20.95%) as well as the back-saver sit-and-reach (27.13%), while the Essential Plus class improved the most in the plank test (37.13%) and six-rep max test (28.77%).

**CONCLUSIONS:** Five weeks of Pilates was long enough to significantly increase core strength and flexibility in four different levels of classes. This was true even for the subjects in the intermediate class who had completed the three previous levels of Pilates classes prior to the study.

**3508 Board #229 June 2 9:30 AM - 11:00 AM**

**Effectiveness Of PNF On Passive And Active Range Of Motion In Ballet Dancers**

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(No relationships reported)

Flexibility is an essential physical characteristic for ballet dancers as performance artists.

**PURPOSE:** To determine the effect of proprioceptive neuromuscular facilitation (PNF-contract relax agonist contract) in passive and active range of motion on ballet students during a développé à la second maneuver.

**METHODS:** Ballet dancers were randomized into experimental (n = 34) and control (n = 23) groups. The experimental group underwent a PNF intervention twice a week for eight weeks. Training sessions included three repetitions in four different ballet positions. Baseline measures included leg angles during a passive and active développé à la second maneuver by using Dartfish™. Follow-ups were performed at four and eight weeks.

**RESULTS:** Repeated measures analysis of covariance (repANCOVA) with baseline measures and years of experience as covariates were used for analyses. Post-hoc comparisons were performed when appropriate. RepANCOVA for passive flexibility showed significant between (p = 0.30) and within (p = 0.02) group differences with the experimental group showing greater flexibility across time. Post-hoc analyses revealed significant differences between groups at four (p = 0.01) and eight (p = 0.01) weeks with greater flexibility values in the intervention group. Post-hoc analyses also show significant changes from baseline to four weeks (p < 0.01) and baseline to eight weeks (p < 0.01) in the intervention group. Active flexibility showed marginally significant differences between groups (p = 0.087) and significant changes across time (p = 0.038). Post-hoc analyses showed an increase in active flexibility in the intervention group from baseline to the fourth week (p = 0.01) and from baseline to eight week (p < 0.01).

**CONCLUSION:** Proprioceptive neuromuscular facilitation enhances dynamic flexibility during a développé à la second maneuver in ballet dancers. The addition of PNF to ballet training could enhance dancing performance by improving dynamic flexibility.

**3509 Board #230 June 2 9:30 AM - 11:00 AM**

**Lumbar And Pelvic Flexions Differ Between Men And Women Matched For Sit-and-reach Score**

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(No relationships reported)

The sit-and-reach (SR) test assesses hamstring and lumbar spine flexibilities. Compared to women who generally have greater hamstring flexibility and a higher SR score, men demonstrate a different spine posture in a full reach position. It is possible that men and women who obtain similar SR scores do so with different spine and pelvic angles.

**PURPOSE:** To compare spine and pelvic angles during the SR test in men and women matched for SR scores. We hypothesized that men would demonstrate greater thoracic (T), greater lumbar (L) and lower pelvic (P) angles.

**METHODS:** Twenty one men (Mean ± SD; age 24 ± 5 yr, body mass 79.1 ± 11.4 kg, body height 175.1 ± 7.8 cm) were matched with 21 women (age 22 ± 3 yr, body mass 65.9 ± 10.3 kg, body height 164.91 ± 7.3 cm) having the same SR score. Each participant completed a standard SR test. Markers were placed at T1, T12 and L5 vertebrae to identify T, L and P angles during video analyses (Dartfish v4.0 software). Hamstring flexibility was measured with the passive straight leg test (PSLR) using Dartfish to analyze hip joint angle. Gender differences were tested with student independent t-test.

**RESULTS:** Mean SR scores were 47.9 ± 7.0 (27.5 - 58) cm for men and 47.9 ± 6.8 (27 - 58) cm for women. Results shown in the table below indicate that men achieved the same SR score as women with greater L, lower P and similar T angles. The added effect of L and P flexions were similar between men and women.

**CONCLUSION:** Women demonstrated better hamstring flexibility evident from the PSLR test and pelvic angle during the SR. Despite this, men were capable of achieving the same SR score with greater lumbar flexion. These results show that the SR score does not adequately evaluate lumbar spine and hamstring flexibility differences between men and women.

|      | Men         | Women      | p value | Effect Size | Power |
|------|-------------|------------|---------|-------------|-------|
| T    | 54.5±10.8°  | 53.3±7.3°  | .68     |             |       |
| L    | 26.4±9.9°   | 21.2±7.3°  | .05     | .63         | .51   |
| P    | 97.1±8.7°   | 104.0±9.2° | .02     | .77         | .68   |
| L+P  | 123.5±13.2° | 125.3±8.5° | .62     |             |       |
| PSLR | 89.2±8.2°   | 97.1±10.6° | .01     | .83         | .74   |

**G-41 Free Communication/Poster - Lactid Acid and Exercise**

JUNE 2, 2012 7:30 AM - 11:00 AM

ROOM: Exhibit Hall

**3510 Board #231 June 2 8:00 AM - 9:30 AM**

**Comparison between Blood Lactate Concentrations in Different Swimming Incremental Protocols**

Kelly de Jesus<sup>1</sup>, Ana Sousa<sup>1</sup>, Karla de Jesus<sup>1</sup>, Marisa Sousa<sup>1</sup>, Pedro Figueiredo<sup>1</sup>, Susana Soares<sup>1</sup>, Carlo Baldari, FACSM<sup>2</sup>, Laura Gudetti<sup>2</sup>, João Paulo Vilas-Boas<sup>1</sup>, Ricardo Fernandes<sup>1</sup>. <sup>1</sup>Faculdade de Desporto da Universidade do Porto, Porto, Portugal. <sup>2</sup>University of Rome, Rome, Italy. (Sponsor: Carlo Baldari, FACSM)

(No relationships reported)

In intermittent incremental protocols blood lactate concentrations ([La]) are used to assess relevant variables associated with swimmer's performance, particularly the anaerobic threshold and the energy cost of exercise. However, some literature refers that to accurately determine the [La] corresponding to each step of the incremental protocol, each one should be of 4min duration (or more).

**PURPOSE:** To compare the [La] kinetics in three variants of a swimming intermittent incremental protocol (with different step lengths).

**METHODS:** Six national level swimmers (21±2.16 yrs, 1.79±0.32 m, 71.75±1.89 kg, and 11.25±3.59 yrs of competitive experience) performed, in a randomized order, 7x200, 7x300 and 7x400 m front crawl intermittent incremental protocols until exhaustion, with increments of 0.05 m/s between steps, 30 s rest intervals, and 24 h resting period in-between (the velocity of each step was common to the three protocols). Capillary blood samples were collected from the ear lobe during the intervals, at the end of exercise, and at the 3<sup>rd</sup> and 5<sup>th</sup> min of the recovery period (Lactate Pro, Japan). These data allowed assessing the blood lactate profile through the [La] vs. velocity curve modeling method using Matlab software (The Mathworks Inc., USA). Friedman's test statistic was used to compare each step of the intermittent incremental protocols with different step lengths (p<0.05).

**RESULTS:** [La] values had a similar behavior along the three variants of incremental protocols: (i) 1.2 IQR 0.9-1.6mmol/l to 7.17 IQR 6.2-8.9mmol/l in the 7x200; (ii) 1.1 IQR 0.8-1.4mmol/l to 7.03 IQR 6.3-8.6mmol/l in the 7x300; and 1.1 IQR 0.9-1.4mmol/l to 6.7 IQR 6.4-8.1mmol/l in the 7x400m. No differences were detected between each step of the three protocols (p>0.05).

**CONCLUSION:** Distances of 200, 300 or 400 m seem not to induce different [La] kinetics along the studied incremental intermittent protocol. This evidences that, due to pragmatic reasoning, coaches should use the incremental test of 200 m steps, once it's simpler and faster and swimmers will be easier motivated to perform a maximal effort. **ACKNOWLEDGEMENTS:** Supported by grants PTDC/DES/101224/2008 (FCOMP-01-0124-FEDER-009577) and CAPES 5431-10-7/2011

**3511 Board #232 June 2 8:00 AM - 9:30 AM**

**Three Phase Response of Blood Lactate Concentration in Incremental and Constant Load Exercise**

Peter Hofmann, FACSM<sup>1</sup>, Gerhard Tschakert<sup>1</sup>, Hannes Schwarz<sup>2</sup>, Alexander Mueller<sup>2</sup>, Werner Groeschl<sup>1</sup>, Rochus Pokan, FACSM<sup>3</sup>, Serge P. vonDuvillard, FACSM<sup>4</sup>. <sup>1</sup>University and Medical University of Graz, Graz, Austria. <sup>2</sup>University of Graz, Graz, Austria. <sup>3</sup>University of Vienna, Vienna, Austria. <sup>4</sup>University of Salzburg, Salzburg, Austria.

(No relationships reported)

According to the lactate shuttle theory, two turn points and three distinct phases of lactate metabolism may be detected during incremental and from several constant load exercise bouts.

**PURPOSE:** The aim of our study was to determine the three phase response in incremental and from constant load cycle ergometer exercise tests according to the lactate shuttle theory.

**METHODS:** Six healthy male subjects (age: 32.0±6.0 yrs; height: 179.9±3.6 cm; body mass: 73.1±10.5 kg; VO<sub>2max</sub>: 4.9±0.5 l.min<sup>-1</sup>) performed a maximal incremental cycle ergometer exercise (IE) test (40W start; 20W.min<sup>-1</sup> increments). The first (LTP<sub>1</sub>) and the second (LTP<sub>2</sub>) lactate turn point and the first (VT<sub>1</sub>) and the second (VT<sub>2</sub>) ventilatory turn points were determined by means of linear regression break point analysis. Constant load exercise (CE) tests (30 min) were performed at 40 W and at LTP<sub>1-1</sub>, LTP<sub>1</sub>, LTP<sub>1+1</sub>, LTP<sub>1+2</sub>, LTP<sub>2-2</sub>, LTP<sub>2-1</sub>, LTP<sub>2</sub>, LTP<sub>2+1</sub>, and LTP<sub>2+2</sub> workloads (110±37 W, 130±37; 150±37 W, 164±38 W, 188±36 W, 217±39 W, 237±38 W, 257±39 W, and 268±36 W). Heart rate (HR) and gas exchange variables were determined continuously and blood lactate concentration (La) was determined at rest, at the end of every workload step (IE), every 5 min (CE) and during 3 min of active and 3 min passive recovery.

**RESULTS:** Power output in IE was 336.7±38.8 W (max), 242.5±39.5 W (LTP<sub>2</sub>) and 135.3±40.5 W (LTP<sub>1</sub>). VT<sub>1</sub> (149.2±41.3 W) and VT<sub>2</sub> (242.8±36.7 W) were not significantly different from LTP's. La was 12.2±2.1 mmol.l<sup>-1</sup> (max), 3.8±0.8 mmol.l<sup>-1</sup> (LTP<sub>2</sub>) and 1.3±0.3 mmol.l<sup>-1</sup> (LTP<sub>1</sub>). Subjects completed 30 min of CE up to LTP<sub>2-1</sub> and stopped earlier with increasing work load (LTP<sub>2</sub>: 25 min; LTP<sub>2+1</sub>: 11.3 min; LTP<sub>2+2</sub>: 7.8 min). La values were 0.9±0.2 (40 W), 1.0±0.3 (LTP<sub>1-1</sub>), 1.2±0.4 (LTP<sub>1</sub>), 1.6±0.5 (LTP<sub>1+1</sub>), 2.0±0.6 (LTP<sub>1+2</sub>), 3.3±0.7 (LTP<sub>2-2</sub>), 6.2±1.6 (LTP<sub>2-1</sub>), 9.6±2.7 (LTP<sub>2</sub>), 11.5±2.1 (LTP<sub>2+1</sub>), and 13.7±1.4 (LTP<sub>2+2</sub>). 5 of 6 subjects obtained a lactate steady state at LTP<sub>2-1</sub>.

**CONCLUSION:** In support of the lactate shuttle theory, two distinct turn points and three phases of lactate metabolism were detected during both IE and CE. LTP's distinguished the lactate curve into different metabolic domains, were significantly related to the CE lactate response and may therefore serve as markers of exercise performance and describe the main metabolic indicators for constant load exercise training.

**3512 Board #233 June 2 8:00 AM - 9:30 AM**

**Comparison of Physiological and Perceptual Markers Identified at Ventilatory Breakpoint (Vpt) and Lactate Inflection Point (Lpt)**

Elizabeth F. Nagle, FACSM<sup>1</sup>, Nik Sachidanand<sup>2</sup>, Deborah J. Aaron, FACSM<sup>1</sup>, Vincent C. Arena<sup>1</sup>, Fredric L. Goss, FACSM<sup>1</sup>, Andrea M. Kriska, FACSM<sup>1</sup>, Kristi L. Storti<sup>1</sup>, Robert J. Robertson, FACSM<sup>1</sup>. <sup>1</sup>University of Pittsburgh, Pittsburgh, PA. <sup>2</sup>University of Buffalo, Buffalo, NY.

(No relationships reported)

Vpt and Lpt are used to prescribe exercise intensity for fitness programming and endurance training. Response normalized RPE corresponding to Vpt has been previously identified using the OMNI Scale of Perceived Exertion. Whether perceptual and physiological markers associated with the Vpt are similar to responses occurring at the Lpt has not been determined.

**PURPOSE:** To compare %VO<sub>2max</sub>, HR (b.min<sup>-1</sup>) and OMNI RPE-Overall (O), RPE-Legs (L), and RPE-Chest/Breathing (C) responses identified at the Vpt and Lpt.

**METHODS:** A combined sample of 6 males (29.0 ± 1.0 yrs) and 8 females (29.0 ± 1.0 yrs) completed graded submaximal and maximal treadmill protocols to determine Lpt, Vpt, and maximal oxygen uptake (VO<sub>2max</sub>; ml.kg<sup>-1</sup>.min<sup>-1</sup>). Vpt was determined as %VO<sub>2max</sub> at which Ve:VO<sub>2</sub> increased without accompanying increases in Ve:VCO<sub>2</sub>. Lpt was determined as the %VO<sub>2max</sub> at which there was an intersection of slopes derived from linear models expressing blood lactate as a function of power output. RPE-O, L, and C were measured during the last 30 seconds of each stage using the OMNI Scale. Exercise time associated with Vpt and Lpt was used to determine corresponding HR, %VO<sub>2max</sub>, and RPE.

**RESULTS:** Using a combined sample of males and females, similar physiological and perceptual markers were identified at the Vpt and Lpt with the exception of heart rate (p<0.05).

Table 1.

|     | HR (b.min-1)  | %VO2max     | RPE-O     | RPE-L     | RPE-C     |
|-----|---------------|-------------|-----------|-----------|-----------|
| Vpt | 152.51±23.49* | 61.39±9.45  | 4.71±2.23 | 4.71±2.12 | 4.36±2.20 |
| Lpt | 138.21±14.52  | 57.76±10.51 | 4.57±1.86 | 4.43±1.78 | 4.36±2.02 |

**CONCLUSIONS:** Results support previous studies identifying physiological links between Vpt and Lpt. Perceptual markers identified at Lpt were similar to Vpt and previous response normalized studies using the OMNI Scale. Using group normalized RPE equivalent to Lpt may provide an alternative method to prescribe self-regulated training intensities for sport performance and fitness applications.

**3513 Board #234 June 2 8:00 AM - 9:30 AM**

**Invasive And Non-invasive Specific Tests For Aerobic And Anaerobic Parameters Determination In Females Basketball Players**

Bruno H. F. Camargo<sup>1</sup>, Gustavo G. Araujo<sup>2</sup>, Claudio A. Gobatto<sup>3</sup>, Nathalia A. Vieira<sup>1</sup>, Leonardo H. D. Messias<sup>1</sup>, Fúlvio B. Manchado-Gobatto<sup>1</sup>. <sup>1</sup>Methodist University of Piracicaba - UNIMEP, Piracicaba, Brazil. <sup>2</sup>Federal University of Alagoas - UFAL, Maceió, Brazil. <sup>3</sup>University of Campinas - UNICAMP, Limeira, Brazil.

(No relationships reported)

The basketball games are composed by intermittent exercises with aerobic and anaerobic activities.

**PURPOSE:** to evaluate the aerobic and anaerobic parameters of female basketball players using non-invasive (adapted RAST and critical velocity model) and invasive (lactate minimum) methods.

**MATERIAL AND METHODS:** Twelve well trained female basketball players (19±1 yrs) were submitted to five days of tests. First, the athletes accomplished four intensities (10 to 14km/h) running in "shuttle" (20-m) exercise until exhaustion (set to occur between 1 and 10 min). The 'velocity versus 1/time to exhaustion' linear fit was used to determine the aerobic (critical velocity - CV) and anaerobic running capacity (ARC). The invasive protocol adopted was the lactate minimum test (LM), composed by two phases: hyperlactatemia induction and incremental test, separated by 8min of passive recovery. The first phase used the "running anaerobic sprint test" (RAST) adapted to basketball. The method consisted of 6 maximum "shuttle" sprints of 35-m (2 x 17.5-m), separated by 10s recovery, determining the minimal (Pmin), medium (Pmed) and maximal (Pmax) power and fatigue index (FI). The incremental phase consisted of 5 stages (3 min) of shuttle running efforts (20-m) of 7, 8, 9, 10, 12 km/h. Blood samples were collected at the end of each stage. The LM parameters (intensity and blood lactate concentration) were analyzed using a polynomial fit. Paired t-Student test and Pearson product-moment correlation were used to statistical analysis (p<0.05).

**RESULTS:** The CV was obtained at  $10.3 \pm 0.2$  km/h and estimated ARC was  $73.0 \pm 3.4$  m. The RAST promoted the lactate peak at  $5.9 \pm 0.2$  mM and determined the Pmax ( $3.6 \pm 0.2$  W/Kg), Pmed ( $2.8 \pm 0.1$  W/Kg), Pmin ( $2.3 \pm 0.1$  W/Kg) and FI ( $30 \pm 3\%$ ). The LM intensity was 8.7% lower than CV ( $9.47 \pm 0.13$  Km/h) and these parameters were not significantly correlated ( $r=0.23$ ). The LM (blood lactate) was  $3.1 \pm 0.3$  mM, showing interesting and significant correlation with lactate peak ( $r=0.78$ ).

**CONCLUSION:** The specific non-invasive method can be used to determine the aerobic and anaerobic parameters in female basketball players. However, as occurs in others sport modalities, CV upper estimate the LM intensity.

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**3514 Board #235 June 2 8:00 AM - 9:30 AM**  
**Blood Acid-Base Status Response And Running Performance At Different Constant Loads**

Thiago F. Lourenço. UNICAMP, Campinas, Brazil.  
(No relationships reported)

The maintenance of blood acid-base status (ABSb) is primarily accomplished by adjusting the partial pressure of CO<sub>2</sub> in the lungs. For exercise intensities above the respiratory compensation point (RCP), the buffering limited capacity of blood and the hyperventilation controlled by the central nervous system are insufficient to control ABSb. Despite the importance of RCP in this control, no study has investigated the ABSb response during constant load at or higher than RCP running speed (sRCP). **PURPOSE:** Analyze the runners ABSb response after 10-km running performed at three different constant loads.

**METHODS:** With at least 72 hours rest between the tests, twenty-five amateur runners ( $34.6 \pm 5.7$  yrs;  $68.7 \pm 10.2$  kg; 10-km performance  $48.9 \pm 7.3$  min e  $VO_{2max}$  de  $40.9 \pm 6.5$  ml\*kg/min) performed a maximum effort protocol to determine the running speed related to VT (sVT), RCP (sRCP) and  $VO_{2max}$  (s $VO_{2max}$ ) and three 10-km races at constant load on the sVT, sRCP and V1 (sRCP +  $[0.25 * (sVO_{2max} - sRCP)]$ ).

**RESULTS:** All runners that ran at sVT and sRCP completed 10-km with no changes in blood pH ( $7.48 \pm 0.05$  vs  $7.51 \pm 0.02$ ,  $p > 0.05$ ), even with increased in blood lactate ( $2.8 \pm 0.8$  vs  $5.5 \pm 4.2$  mmol\*L<sup>-1</sup>) and decreased in bicarbonate ( $25.4 \pm 2.8$  vs  $22.2 \pm 4.2$  mmol\*L<sup>-1</sup>,  $p < 0.05$ ). At V1 intensity, only three of sixteen runners completed 10-km. The others completed only  $5.2 \pm 2.2$  km with a significant decrease in pH ( $7.48 \pm 0.02$  vs  $7.33 \pm 0.04$ ,  $p < 0.05$ ) and bicarbonate ( $24.1 \pm 0.5$  vs  $14.6 \pm 1.0$  mmol\*L<sup>-1</sup>,  $p < 0.05$ ).

**CONCLUSIONS:** All runners that ran at sVT and sRCP completed 10-km with no changes in blood pH ( $7.48 \pm 0.05$  vs  $7.51 \pm 0.02$ ,  $p > 0.05$ ), even with increased in blood lactate ( $2.8 \pm 0.8$  vs  $5.5 \pm 4.2$  mmol\*L<sup>-1</sup>) and decreased in bicarbonate ( $25.4 \pm 2.8$  vs  $22.2 \pm 4.2$  mmol\*L<sup>-1</sup>,  $p < 0.05$ ). At V1 intensity, only three of sixteen runners completed 10-km. The others completed only  $5.2 \pm 2.2$  km with a significant decrease in pH ( $7.48 \pm 0.02$  vs  $7.33 \pm 0.04$ ,  $p < 0.05$ ) and bicarbonate ( $24.1 \pm 0.5$  vs  $14.6 \pm 1.0$  mmol\*L<sup>-1</sup>,  $p < 0.05$ ).

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**3515 Board #236 June 2 8:00 AM - 9:30 AM**  
**Applying Lactate Analysis to Establish and Monitor Intensity during Interval Training in Coronary Heart Disease Patients**

Jeffrey W. Christle<sup>1</sup>, Ulrik Wisloff<sup>2</sup>, Axel Pressler<sup>1</sup>, Martin Halle<sup>1</sup>. <sup>1</sup>Technical University of Munich, Munich, Germany. <sup>2</sup>Nowegian university of Science and Technology, Trondheim, Norway.  
(No relationships reported)

**PURPOSE:** Relatively high-intensity aerobic interval training (AIT) has been shown to be effective in coronary artery disease (CAD) therapy. To prescribe and monitor training intensity during interval training, percent heart rate (%HR) and ratings of perceived exertion (RPE) from exercise testing (CPET) are the most commonly used methods, but have limitations. This study examines the potential of arterial lactate kinetics to aid in the prescription and monitoring of exercise intensity during AIT.

**METHODS:** Thirty-five clinically stable CAD patients (age  $64 \pm 7$ , 66% male) performed stepwise peak exercise testing (CPET) to volitional exhaustion. Heart rates at 50% to 60% and 80% to 90% of peak aerobic capacity ( $VO_{2peak}$ ) were calculated and used to establish interval training intensities. Patients performed one bout of AIT (see figure). Heart rate was recorded continuously and RPE and [lactate]<sub>a</sub> data were collected at rest and during the last 10 seconds of each interval. [lactate]<sub>a</sub> data was then graphically analyzed and evaluated using a 4 mmol/L lactate steady state threshold (LSST) to indicate a relevant anaerobic contribution.

**RESULTS:** Heart rate targets were reached in  $> 85\%$  of all intervals. Mean [lactate]<sub>a</sub> was substantially over the 4 mmol/L LSST (4.14 mmol/L in moderate-intensity phases and 4.65 mmol/L in high-intensity phases). Data for HR and RPE correlated well to changes in load during exercise training ( $r^2 = 0.81$ ), whereas [lactate]<sub>a</sub> did not correlate to any of the other parameters (see table).

**CONCLUSIONS:** During aerobic interval training, a constant accumulation of lactate in both the high and low intervals results in the majority of training being performed at above the lactate steady state threshold.

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**3516 Board #237 June 2 8:00 AM - 9:30 AM**  
**Kinetics Of Lactate Removal After Brazilian Jiu Jitsu Match**

Tacito P. Souza-Junior<sup>1</sup>, Daniel Pinheiro<sup>2</sup>, André Luis Amaral Rodrigues Almeida<sup>3</sup>, César Cavinato Cal Abad<sup>4</sup>. <sup>1</sup>Federal University of Parana, Curitiba, Brazil. <sup>2</sup>Unisantana, São Paulo, Brazil. <sup>3</sup>Inforfisc, São Paulo, Brazil. <sup>4</sup>Heart Institute (InCor) of University of São Paulo Medical School, São Paulo, Brazil. (Sponsor: Carlo Baldari, FACSM)  
(No relationships reported)

The Brazilian Jiu Jitsu is one of the most practiced martial arts in the World but the number of studies about this sport is still poor. Traditionally, analysis of lactate concentrations have been used in different types of martial arts to determine the physiological profile, competitive performance, metabolic demand and the effect of physical training.

**PURPOSE:** Verify the analysis of blood lactate during two simulated Jiu-Jitsu matches.

**METHODS:** Twenty-one male athletes (age  $28.33 \pm 6.45$  years, height,  $1.75 \pm 1.0$  cm, body weight,  $78.07 \pm 9.40$  kg, percent fat,  $14.29 \pm 4.79\%$ , years of practicing,  $11.03 \pm 2.4$ ) performed two simulated 10-min match with a 48-hour interval. In both matches blood lactate were collected before and after each bout.

**RESULTS:** Lactate at rest, heating, 1, 5 and 10 min were, respectively ( $0.94 \pm 0.20$ ,  $2.19 \pm 0.78$ ,  $10.05 \pm 1.73$ ,  $7.77 \pm 1.69$ ,  $6.28 \pm 1.30$  in bout 01 and  $0.96 \pm 0.14$ ,  $1.98 \pm 0.78$ ,  $9.46 \pm 0.96$ ,  $7.24 \pm 1.24$  e  $5.74 \pm 1.10$  in bout 02). There were significant differences among all the moments of the same match (One-way ANOVA;  $p < 0.05$ ) but no difference for the same times between the bouts was found. The Pearson's correlation about the lactate of two matches was 0.95 while the correlation between the matches at rest, heating, 1, 5 and 10 minutes were, respectively 0.59, 0.60, 0.47, 0.44, 0.47 ( $p < 0.05$ ).

**CONCLUSION:** Our data suggest that the Brazilian Jiu Jitsu fight is very intense and use glycolysis to produce energy. The blood lactate concentration in two fights at 48 hours of intervals are repeatable and can be used for assessment, prescription and monitoring the specific training when performed with the same opponents.

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**3517 Board #238 June 2 8:00 AM - 9:30 AM**  
**Identification Of The Maximal Lactate Steady State In Obese Zucker Rats**

Jeeser A. Almeida. Catholic University of Brasilia, Brasilia, Brazil.  
(No relationships reported)

Exercise has been widely applied in the weight loss control, especially for obesity treatment. However, determination of an appropriate intensity of exercise for obese rats (Zucker fa/fa) it was undefined until now. It is well known that maximal lactate steady state (MLSS) has been considered the gold standard for identification of aerobic capacity. Nevertheless this value was not identified in obese Zucker rats at the moment.

**PURPOSE:** This study aims to identify the maximum lactate steady state (MLSS) in obese Zucker rats in order to provide a more effective tool for the exercise training prescription of this animal model.

**METHODS:** In order to make such determination, obese Zucker and lean Wistar rats were here utilized. After adaptation of animals to treadmill running, the MLSS was determined by using three different velocities (10 m.min<sup>-1</sup>, 12.5 m.min<sup>-1</sup> and 15 m.min<sup>-1</sup> for Zucker and 15 m.min<sup>-1</sup>, 20 m.min<sup>-1</sup> and 25 m.min<sup>-1</sup> for lean Wistar rats).

**RESULTS:** In order to ensure the differences between body weight animals, T test was applied. Significant differences were observed in Zucker (390.0 ± 18.8 g) and Wistar rats (227.3 ± 26.2 g) (P < 0.05). The MLSS was defined as the highest blood lactate concentration that increased up to 1 mmol.L<sup>-1</sup> during constant exercise. In obese Zucker rats, the MLSS was found in a considerable lower velocity (12.5 m.min<sup>-1</sup>) in comparison to lean Wistar rats (20 m.min<sup>-1</sup>).

**CONCLUSIONS:** In summary, the identification of MLSS in obese Zucker rats provides a better intensity determination for exercise on a treadmill running for this animal model.

**3518 Board #239 June 2 8:00 AM - 9:30 AM**

**The Effects of Swimming Recovery on the Clearance of Lactate after a Maximal Swim Effort**

Joshua D. Guggenheimer, Daniel de Moraes. *University of North Dakota, Grand Forks, ND.*

(No relationships reported)

Active recovery following high-intensity exercise may limit the accumulation of unwanted metabolites and prevent acidosis in active tissues, thus augmenting future performances.

**PURPOSE:** To examine the effects of different recovery protocols on the removal of lactate following a maximal-effort swim bout.

**METHODS:** 8 experienced collegiate swimmers (4 male, 4 female) were recruited for this study. Each participant took part in 4 days of testing, including a familiarization session. On 3 different occasions, participants completed a standardized warm up, a single 200yd maximal effort swim, and 15 min of either backstroke (BR), freestyle (FR), or passive (PR) recovery. Recovery paces for BR and FR were set at 175% of 100yd trial time. PR consisted of quiet sitting for 15 min. Blood lactate samples were collected before warming up (PRE), 3-min post 200yd maximal-effort swim trial (T0), after 5-min of recovery (T5), 10-min of recovery (T10), and 15-min of recovery (T15). A 3 x 5 ANOVA with repeated measures was conducted. Alpha was set at 0.05. Tukey's post hoc analysis was used to further examine main effects.

**RESULTS:** The RM ANOVA indicated a significant interaction between protocol and time (F(8, 58) = 12.29, p < 0.001) in regards to lactate. Main effects were found for both protocol (F(2, 14) = 12.18, p = 0.001), and time (F(2.22, 15.56) = 413.32, p < 0.001) as they pertained to blood lactate levels. Follow-up pairwise comparisons indicated significant differences between passive recovery and freestyle recovery (p = 0.013), and between passive recovery and backstroke recovery (p = 0.017) and their respective effects on blood lactate concentrations.

**CONCLUSION:** Both active recoveries were more efficient in metabolizing lactate when compared to passive recovery. These findings provide coaches with data suggesting that both swimming strokes are efficient methods of active recovery. In fact, 75% of the participants in this study deemed backstroke as their preferred method of recovery. Therefore, the results of this study encourage coaches to promote either recovery stroke for their swimmers, knowing that they are both equally effective methods of recuperating from high-intensity performances.

**3519 Board #240 June 2 8:00 AM - 9:30 AM**

**Muscle Fatigue And Blood Lactate Following Three Different Antagonist Pre-load Conditions**

Rodrigo L. Carregaro<sup>1</sup>, Rafael Cunha<sup>2</sup>, André Martorelli<sup>2</sup>, Saulo Martorelli<sup>2</sup>, Diego Jesus<sup>2</sup>, Saulo R. Soares<sup>2</sup>, Carlos Gomes de Oliveira<sup>3</sup>, Lee E. Brown, FACSM<sup>4</sup>, Martim Bottaro<sup>2</sup>. <sup>1</sup>Universidade Federal de Mato Grosso do Sul (UFMS), Campo Grande-MS, Brazil. <sup>2</sup>Universidade de Brasília (UnB), Brasília-DF, Brazil. <sup>3</sup>Universidade Federal do Rio de Janeiro (UFRJ), Rio de Janeiro-RJ, Brazil. <sup>4</sup>California State University Fullerton, Fullerton-CA, CA.

(No relationships reported)

Preload of antagonist muscles can be achieved by reciprocal actions (RA) or by opposing muscle actions with reduced rest between sets. However, studies comparing different strategies of antagonist preload are scarce and present insufficient evidence concerning neuromuscular responses.

**PURPOSE:** To evaluate the acute effects of three different antagonist pre-load conditions on knee extensor neuromuscular fatigue and blood lactate responses.

**METHODS:** 24 healthy men (23.5 ± 3.6 years) were tested across 4 days on 3 different preload isokinetic (60°.s<sup>-1</sup>) exercise protocols with 1 minutes rest between sets, separated by 72 hours: 1) Traditional (TR; 4 sets of 10 unilateral isokinetic knee flexions [KF] followed by 4 sets of 10 unilateral isokinetic knee extensions [KE]); 2) RA (4 sets of 10 reciprocal isokinetic concentric KF and KE); and 3) Super-set (SS; 4 sets of 10 KF immediately followed by 10 KE). Vastus medialis (VM) EMG muscle fatigue was measured using Dimitrov's (2001) Fatigue Index (FI). Blood lactate concentration was measured at rest, 3, and 5 min after the 4 sets for each protocol.

**RESULTS:** VM FI and blood lactate concentrations are presented in Table 1. During SS, the FI was greater than RA and TR (p < 0.05). The SS protocol also presented greater (p < 0.05) concentrations of blood lactate when compared to RA and TR.

**Table 1.**

|    | VM Fatigue Index (%) |           |           |           | Blood Lactate [mmol/L] |               |               |               |
|----|----------------------|-----------|-----------|-----------|------------------------|---------------|---------------|---------------|
|    | 1st set              | 2nd set   | 3rd set   | 4th set   | Rest                   | Immediate     | 3 min         | 5 min         |
| TR | 109 ± 7              | 93 ± 7    | 98 ± 7    | 98 ± 7    | 0.89 ± 0.34            | 4.99 ± 0.93†  | 5.92 ± 1.06†  | 5.98 ± 1.11†  |
| RA | 121 ± 7              | 100 ± 7   | 93 ± 7    | 111 ± 7   | 0.92 ± 0.30            | 4.86 ± 0.92†  | 5.82 ± 1.45†  | 6.08 ± 1.41†  |
| SS | 130 ± 10*            | 120 ± 10* | 117 ± 10* | 122 ± 10* | 0.86 ± 0.31            | 6.05 ± 1.05*† | 7.10 ± 1.16*† | 7.15 ± 1.15*† |

\*Greater than RA and TR (p < 0.02)

†Greater than rest (p < 0.05).

**CONCLUSION:** These results indicate that when compared to TR and RA antagonist preload protocols, the SS protocol provides greater levels of neuromuscular fatigue and is more metabolic demanding. Thus, trainers and physical therapists should avoid prescription of the SS protocol in special populations such as elderly, children and individuals undergoing cardiac or pulmonary rehabilitation.

**3520 Board #241 June 2 8:00 AM - 9:30 AM**

**Timing of Blood Lactate Collection Following Maximal Anaerobic and Aerobic Exercise in Female Adolescent Athletes**

Catherine Gaul, Lynne A. Stuart-Hill, Leanne J. Dickau. *University of Victoria, Victoria, BC, Canada.*

(No relationships reported)

Peak blood lactate concentration (BL) is regularly used to reflect the contribution of anaerobic metabolism to exercise performance. Serial blood samples are often collected at 1, 3, and 5 min post-exercise to account for any delay in lactate transport from muscle to blood and to enhance accuracy of peak measures being obtained. Such procedures were developed with adult populations and are used for both aerobic and anaerobic exercise.

**PURPOSE:** To determine optimal timing protocols for BL measurement in adolescent female athletes following maximal anaerobic and aerobic exercise tests.

**METHODS:** Seventeen elite adolescent female soccer players (16.3 ± 0.8 yrs) completed two maximal tests to exhaustion on a motorized treadmill, with continuous monitoring of heart rate, on separate days: 1) Cunningham Anaerobic Speed test (AST), involving sprint running at 20mph and an 8% incline, and 2) Maximal Graded Exercise test (MGXT) to measure maximal aerobic power. For each test, finger prick BL was measured 5 min pre-test and at 1, 3 and 5 min post-test following standardized procedures using a Lactate Pro analyzer.

**RESULTS:** BL did not differ between the three post-AST collection times, however 9 of the 15 participants (60%) reached peak BL at 3 min post-AST (11.4 ± 2.3 mmol.L<sup>-1</sup>) with 5 participants reaching peak BL at 1 min and 3 others reaching it at 5 min post-AST. All participants (100%) attained peak BL at 1 min post-MGXT (9.6 ± 2.3 mmol.L<sup>-1</sup>, p < 0.05). BL was significantly higher (p < 0.05) at 1 min than at 3 min (8.3 ± 2.2 mmol.L<sup>-1</sup>) or 5 min (7.1 ± 2.1 mmol.L<sup>-1</sup>) post-MGXT. Mean peak BL values were significantly higher post-AST (11.9 ± 2.2 mmol.L<sup>-1</sup>) than post-MGXT (p < 0.05).

**CONCLUSION:** Appropriate timing of BL samples in adolescent female athletes depends upon the type of exercise performed. Collecting BL at 1 minute post-maximal aerobic performance and at 3 min post-maximal anaerobic running in adolescent female athletes provides the most consistent and accurate peak values. The advantage of a single BL measurement following maximal exercise includes fewer risks related to serial collection, reduced potential participant stress and substantially lower testing costs. These findings will help direct timing of blood sample collection to improve the accuracy of this metabolic measurement in paediatric populations.

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**3521 Board #242 June 2 8:00 AM - 9:30 AM**  
**The Relationship Between Onset Of Blood Lactate Accumulation, Body Weight, And Balance Ability In 20-70 Years-old Subjects**

Burkhard Weisser, Julia Last. *University of Kiel, Kiel, Germany.* (Sponsor: Reinhard Ketelhut, FACSM)  
(No relationships reported)

Good balance ability is an important predictor not only for the prevention of falls but also for general health. The decrease in balance ability during aging is well documented. Balance training is able to increase balance ability in all age groups, but only few elderly subjects participate in specific programs. It is unclear, which other factors might influence the decrease in balance with aging.

**PURPOSE:** To investigate the correlation of balance ability with aerobic exercise performance (onset of blood lactate accumulation at lactate 4nM, OBLA) and with body weight.

**METHODS:** OBLA was measured using standard bicycle testing (Watt/kg body weight). Balance ability was determined by a validated one-way frontal moving slap with integrated sensor and associated software. Correlations were calculated for balance ability with OBLA and body weight in 296 subjects (age 20-70 years, 147 female, 149 male). In addition, results were analysed in subgroups; younger versus older (20-44 and 45-77 years of age) and active versus sedentary (less than 2 hours vs. > 2 hours of moderate activity per week)

**RESULTS:** Body weight (mean value +/- standard deviation) was 74 +/- 15 kg, OBLA was 2.0 +/- 0.6 Watt/ per kg body weight and balance ability was 4.8 +/- 1.3 (arbitrary units). There was a positive correlation between OBLA and balance ( $r=0.38$ ;  $p<0.05$ ) and a negative correlation between body weight and balance ( $r=-0.41$ ;  $p<0.05$ ). Balance ability decreased with age, whereas the correlations remained significant in the group 45-70 years of age both in active and sedentary persons.

**CONCLUSION:** Balance ability decreases with age. Aerobic capacity is positively associated with balance ability, whereas there was a negative correlation between body weight and balance. Thus, elderly subjects might benefit not only from specific balance training but also from general aerobic activity. Higher body weight is a risk factor for worsening balance ability, although a causal relationship remains to be shown.

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**3522 Board #243 June 2 8:00 AM - 9:30 AM**  
**Determination of Anaerobic Threshold by the Breakpoint of Locomotor Respiratory Coupling**

Masanori Takemura<sup>1</sup>, Mitsuharu Kaya<sup>2</sup>, Junzo Tsujita<sup>1</sup>, Yoshitaka Oku<sup>1</sup>. <sup>1</sup>*Hyogo College of Medicine, Nishinomiya, Japan.* <sup>2</sup>*Hyogo University of Health Science, Kobe, Japan.*  
(No relationships reported)

Locomotion and respiration are coupled during various exercises such as running and cycling, a phenomenon called locomotor respiratory coupling (LRC). We have reported that ventilatory efficiency is optimized during LRC, and that LRC is most often observed at the ventilatory threshold (VT). Then, in the present study, we developed a novel method to determine anaerobic threshold (AT), the breakpoint of LRC (BPLRC).

**PURPOSE:** To evaluate whether BPLRC corresponds to AT such as the respiratory compensation point (RC), VT, and onset of blood lactate accumulation (OBLA).

**METHODS:** Seventeen healthy subjects (8 females and 9 males; age, 25 ± 7 years) volunteered for this study. Ten subjects (Group 1) underwent the incremental exercise test using a cycle ergometer twice, which included a spontaneous breathing trial and a controlled breathing trial to measure BPLRC. The other 7 subjects (Group 2) underwent the incremental exercise test with controlled breathing to measure BPLRC, and blood lactate concentrations were measured. During a controlled breathing trial, we forced subjects to achieve LRC by adjusting their breathing frequency at 30 breaths per min and their pedaling rate at 60 rpm. Subjects declared the breakpoint when they could not maintain LRC (BPLRCself). Additionally, we calculated the breakpoint from the time course of workload and breathing frequency using the two-line regression method (BPLRCcalc). We evaluated the correlations between BPLRCs and several ATs, including RC, VT, and OBLA. ATs and BPLRCs being expressed as workload (W).

**RESULTS:** In Group 1 (n=10), the single regression analysis indicated that BPLRCself (162 ± 35W) was most suitable for predicting RC (161 ± 33W) during spontaneous breathing (R = 0.877; regression coefficient, 0.823;  $p < 0.001$ ). Then in all subjects, it indicated that BPLRCself (156 ± 31W) was suitable for predicting RC (154 ± 37W) during controlled breathing (R = 0.742; regression coefficient, 0.898;  $p < 0.01$ )

**CONCLUSION:** BPLRC, the self-reported breakpoint during incremental exercise at which a subject cannot maintain LRC with controlled breathing at 30 bpm and a pedaling speed of 60 rpm, is a good predictor of RC. Because determining BPLRC does not require special equipment and the threshold is easily determined by self-reporting, we conclude that BPLRC is a practical AT variable.

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**3523 Board #244 June 2 8:00 AM - 9:30 AM**  
**Blood Lactate Levels are Lower Following Intense Exercise with the Use of a Mouthpiece**

Wesley D. Dudgeon<sup>1</sup>, Timothy P. Scheett<sup>2</sup>, Larry A. Buchanan<sup>1</sup>, Ashley E. Strickland<sup>1</sup>, Dena P. Garner<sup>1</sup>. <sup>1</sup>*The Citadel, Charleston, SC.* <sup>2</sup>*The College of Charleston, Charleston, SC.* (Sponsor: Gregory A. Hand, FACSM)  
(No relationships reported)

Custom fit lower mandible performance mouthpieces (MP) have recently been shown to decrease cortisol during both anaerobic and aerobic exercise as well as improved gas exchange (O<sub>2</sub> utilization & CO<sub>2</sub> production) during aerobic exercise, thus showing the potential to improve performance and/or recovery.

**PURPOSE:** This study examined the effect of a performance mouthpiece (ArmourBite Mouthwear) on blood lactate levels in 12 collegiate males who regularly performed lower body resistance exercises.

**METHODS:** At least 7 days following determination of a one repetition maximum (1RM), subjects completed 2 trials of 6 sets of 10 repetitions of back squats with 2 minutes rest between sets, and were given 7 days between trials. Resistance was set at 80% of each subject's 1RM and resistance was adjusted during testing so 10 repetitions were completed during each set. The order of treatment (i.e. use of MP) was randomized and blood was sampled as follows for determination of blood lactate (Lactate Plus, Nova Biomedical, Waltham, MA): pre exercise, after 3 sets (mid), post exercise, 30, 60 and 120 minutes post exercise.

**RESULTS:** There was no difference in lactate (mmol/L) immediately pre exercise ( $0.88 \pm 0.23$  (MP) vs.  $0.97 \pm 0.29$ ;  $P=.25$ ) or 120 min post exercise ( $1.30 \pm 0.70$  (MP) vs.  $1.28 \pm 0.33$ ;  $P=.45$ ) and there was a trend for a difference at mid-point ( $9.95 \pm 2.03$  (MP) vs.  $11.95 \pm 2.91$ ;  $P=.09$ ). The MP group had lower lactate immediately post exercise ( $11.65 \pm 2.31$  (MP) vs.  $13.85 \pm 2.80$ ;  $P=.006$ ), 30 minutes post exercise ( $4.53 \pm 2.14$  (MP) vs.  $6.06 \pm 1.57$ ;  $P=.03$ ) and 60 minutes post exercise ( $2.13 \pm 1.03$  (MP) vs.  $2.82 \pm 0.88$ ;  $P=.03$ ).

**CONCLUSIONS:** This data shows that the use of a custom fit lower mandible MP can reduce blood lactate levels following intense resistance exercise. When viewed in light of the published effect of MPs on lowering cortisol levels, this suggests that MP use decreases stress during exercise recovery, potentially improving human performance.

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## G-42 Free Communication/Poster - Lower Extremity

JUNE 2, 2012 7:30 AM - 11:00 AM  
ROOM: Exhibit Hall

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3524 Board #245 June 2 9:30 AM - 11:00 AM

### Effects of Metatarsal Pad and Foot orthotics on Leg Muscle Activities and Foot Pressure

Hongjae Lee<sup>1</sup>, Jung-Ja Kim<sup>2</sup>, Jung-kyu Choi<sup>2</sup>, In-Sik Park<sup>2</sup>. <sup>1</sup>Ilsanpaik Hosp., Inje Univ, Goyang, Korea, Republic of. <sup>2</sup>Chonbuk National University, Jeonju, Korea, Republic of.

(No relationships reported)

**PURPOSE:** to evaluate the effects of metatarsal pad (MP) and foot orthotics on leg muscle activities and foot pressure.

**METHODS:** 15 healthy young females who had no cavus foot or flat foot were participated in this study. The subjects walked on a treadmill under four different experimental conditions: 1) barefoot, 2) MP only (Pad Only), 3) a soft insole with MP (Soft+MP), and 4) a rigid insole with MP (Rigid+MP). During walking, foot pressure data such as force, peak pressure, mean pressure, force-time integral and pressure-time integral were collected. Also, EMG activities of lower limb muscles such as tibialis anterior(TA), lateral gastrocnemius(GCM), rectus femoris(RF), and biceps femoris(BF) were gathered.

**RESULTS:** In the foot pressure analysis, the peak pressures(kPa) of 2.3 metatarsal head area were 303.1 with Barefoot, 293.8 with MP Only, 288.4 with Soft+MP(p<.05), and 301.6 with Rigid+MP. The pressure-time integrals (kPa\*sec) were 7439.7, 7071.2, 6330.4(p<.05), and 7084.4 respectively in the same order. The dynamic EMG findings (uV) of TA muscle showed that 17.69 with Barefoot, 15.75 with MP Only, 13.43 with Soft+MP, 12.52 with Rigid+MP (p<.05). The findings of lateral GCM showed 19.15, 19.42, 17.85 and 17.67. That of RF showed 10.29, 8.81, 7.14, and 6.31(p<.05). That of BF showed 8.61, 7.93, 7.51, and 7.73 respectively in the same order above.

**CONCLUSIONS:** In the foot pressure analysis, there was significant reduction in case of soft insole with MP than rigid insole. On the other hand, the EMG study showed significant reduction of leg muscles activity in case of rigid insole with MP than soft insole, especially in TA muscle.

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3525 Board #246 June 2 9:30 AM - 11:00 AM

### Use of Tekscan Matscan® to Detect Static Rearfoot Position Through the Evaluation of Rearfoot Pressure.

David A. Titcomb, Mark Blais, Richard Lane. Liberty University, Lynchburg, VA. (Sponsor: Melvin Williams, FACSM)

(No relationships reported)

With the advancement of technology, many clinicians have been able to complement their foot examinations with the use of computerized foot pressure analysis systems.

**PURPOSE:** The purpose of this study was to test the hypothesis that a biomechanical pressure mat system would reliably detect static rearfoot position based on static heel pressure analysis compared to clinical examination by a licensed podiatrist.

**METHODS:** Static plantar pressure profiles of 35 subjects across a wide age range (20-89 years; mean age ± SD, 41.0 ± 22.1 years) were obtained using a biomechanical pressure mat system. Subjects with acute injury or clinical evidence of calcaneal fat pad atrophy were excluded from the study. Each subject underwent static plantar pressure assessment by standing barefoot on the calibrated pressure mat with feet in rectus position. A one frame "snapshot" (digital foot pressure image) of both right and left feet was recorded once the subject was standing in a static state. After plantar pressure data were collected, the distribution of both right and left rearfoot pressures of each foot was analyzed. Clinical software was utilized to create two separate masks over each rearfoot digital image, equally dividing it into medial and lateral regions. In each mask, average medial and lateral rearfoot pressure was determined and compared. Each rearfoot was then placed into one of three categories: inverted (greater lateral pressure), everted (greater medial pressure) or neutral (medial and lateral pressures within .03kg). After the plantar pressure assessment was performed, both of the subject's feet were examined by a licensed podiatrist to categorize their standing rearfoot position as being either inverted, everted, or neutral (rectus). A chi-square analysis with Kappa concordance test was performed comparing the pressure mat results to clinical examination findings.

**RESULTS:** A non-significant chi-square ( $p = .365$  ( $p > .05$ )). Kappa = .17 indicated no significant relationship between the two measures.

**CONCLUSIONS:** The biomechanical pressure mat did not reliably detect static rearfoot position based on rearfoot pressure distribution when compared rearfoot position observed during clinical examination. Grant funding provided by The Center for Research and Scholarship Fund of Liberty University #014\_022610.

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3526 Board #247 June 2 9:30 AM - 11:00 AM

### Intrasession Reliability Of Insole In-shoe Plantar Pressure Measurements In Different Foot Areas

Niklas Koenig, Andreas Stoll, Frank Mayer, Heiner Baur. University of Potsdam, Potsdam, Germany.

(No relationships reported)

In-shoe plantar pressure distribution measurements have shown good reliability. However, controversy still exists about the minimum number of steps required to collect reliable data.

Intrasession protocols reduce systematic and random error to a minimum and can therefore evaluate the maximal precision of a measurement tool. Consequently, it allows the determination of requirements that are prerequisite for the application as well as the analysis of day-to-day variability.

**PURPOSE:** To determine the intrasession reliability of plantar pressure measurements of an average of 3, 10 and 20 steps in five foot areas and thus, to assess the minimal number of steps which should be collected.

**METHODS:** Seventeen healthy participants ( $27 \pm 4y$ ,  $180 \pm 8cm$ ,  $74 \pm 9kg$ ) walked at 5km/h on a treadmill. Custom-made synthetic shoes were used to attach the pressure measurement insoles (99 sensors, 100Hz) to the foot. For each subject 50 steps of the right foot were collected. Clinically relevant parameters (e.g.: peak-pressure [PP], peak-mean-pressure [PMP in kPa]) as well as time related measures (e.g.: force-time-integral [FTI in N\*s], pressure-time-integral [PTI in kPa\*s]) were calculated. The first and last 3 (Ave3), 10 (Ave10) or 20 (Ave20) steps were averaged for statistical analysis. Intrasession reliability was analysed by the intraclass correlation coefficient (ICC), the test-retest-variability (TRV in %) and the Bland-Altman bias and limits of agreement.

**RESULTS:** Overall ICC was  $>0.90$ . TRV ranges 1.30-31.82% with highest values in the midfoot (PTI=20.44%) and toe (PTI=23.24%) area for Ave3. Inclusion of more steps reduces TRVs (Ave20: Midfoot PTI=6.23%) and increases ICC (Midfoot PTI=0.97). FTI showed the highest systematic error in all measurements (Ave10=1.63%).

**CONCLUSIONS:** Plantar pressure distribution measurements reveal good intrasession reliability. Limitations are present in low loading sites like the toe and the midfoot area. Here, inclusion of more steps increases reliability. Consequently, ten steps are recommended for the collection of reliable plantar pressure measurements.

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3527 Board #248 June 2 9:30 AM - 11:00 AM

### Changes In Achilles Forces During Locomotion After 6 Months Of Growth In Youth 10-14 Years

Jennifer Neugebauer, David Hawkins. University of California, Davis, Davis, CA.

(No relationships reported)

For youth, Achilles tendon (AT) forces during locomotion may differ as a result of sex, growth over time, and/or physical activity level (PAL).

**PURPOSE:** The purposes of this study were (1) determine if peak force in the AT (FAT) and peak normalized FAT (nFAT) during walking and running in growing youth differed at the start and end of 6 months, and (2) test if sex, PAL, and/or growth rate (GR) affected FAT and nFAT.



**METHODS:** 22 girls (11.2 ± 0.2 years) and 20 boys (13.6 ± 0.1 years) were tested at the start of the study (0 months (mos)) and after 6 mos. These age ranges represent the primary growth years. Subject height and mass were measured. GR was calculated as the change in height between testing sessions. PAL was assessed by Physical Activity Questionnaire (PAQ). Subjects completed 3 target-speed walk (TSW), 3 target-speed run (TSR), 3 self-selected speed walk (SSW) and 3 self-selected run (SSR) trials (1.2 ± 0.1 m/s and 2.6 ± 0.1 m/s TSW and TSR). Kinematics and ground reaction forces were collected using a video system (Motion Analysis, Santa Rosa, CA) and a force plate (Kistler, Amherst, NY) respectively. FAT (N) and nFAT (BW) were determined using inverse dynamics. Repeated measures multiple regressions were used to determine if testing session, PAL, GR, and sex had significant relationships with FAT and nFAT (Bonferroni adjusted  $p < 0.004$ ).

**RESULTS:** GR was similar for boys (2.1%) and girls (2.4%). FAT and nFAT during SSW and SSR did not differ at 0 and 6 mos (mean FAT at 0 and 6 mos: SSW 1243 ± 31 N; SSR 2168 ± 112 N;  $p > 0.06$ ). Sex was not a significant predictor of FAT or nFAT in SSW, SSR, TSW, or TSR ( $p > 0.008$ ). GR and PAL were not significant predictors of FAT or nFAT during SSW or SSR ( $p > 0.005$ ). FAT during TSW increased at 6 mos (1163 ± 62 N at 0mos, 1230 ± 57 N at 6mos). FAT during TSR (mean FAT 0 and 6 mos: 2089 ± 46 N) and nFAT during TSW and TSR did not differ at 0 and 6 mos ( $p > 0.006$ ). Growth and PAQ had a significant negative relationship with nFAT during TSR.

**CONCLUSIONS:** nFAT during walking and running did not differ at 6 mos compared with 0 mos. AT forces (both FAT and nFAT) during walking and running did not differ between sexes. FAT increased at 6 mos only in TSW. GR and PAQ affected nFAT in TWR only and otherwise did not affect AT forces. Of the factors investigated, no consistent relationship between GR, PAL, and sex with AT forces during locomotion were found.

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**3528** Board #249 June 2 9:30 AM - 11:00 AM

**An Analytic Transformation of Hallux Dorsiflexion Measured using Skin Marker Set and Bone-mounted Marker Array**

Rebecca Frimenko, Patrick Riley, W. B. Lievers, Jeff Crandall, Richard Kent. *University of Virginia, Charlottesville, VA.*

(No relationships reported)

**PURPOSE:** Assessment of risk in injury biomechanics requires both living subjects for normal range of motion tasks and cadaver subjects for injury and tolerance definition. Motion capture consisting of arrays of optical markers uses skin-mounted marker sets on living subjects and bone-mounted arrays on cadavers. The presence of soft tissue and simplified anatomical representations in skin-based measurement methods introduce error between the motion of the joint and the skin-based estimate. This study develops a function for relating sagittal plane dorsiflexion of the 1<sup>st</sup> metatarsophalangeal (1MTP) joint from skin-based markers to measurements from bone-mounted arrays.

**METHODS:** 5 cadaver limbs were instrumented with 8 skin markers and 3 arrays of 4 markers rigidly attached to the bone (Skin: tibia, medial and lateral malleolus, heel, proximal and distal 1<sup>st</sup> and 5<sup>th</sup> metatarsals, distal hallux. Bone: calcaneus, 1<sup>st</sup> metatarsal, proximal hallux). An 8-camera Vicon system was used as each foot was moved from flat-foot through toe-off. 1MTP joint angle estimates were obtained from the skin marker set using OpenSim. 6-degree-of-freedom motion of the 1st metatarsal and the 1st proximal phalanx was determined from the motion of the bone-mounted marker array (Shaw et al. 2009).

**RESULTS:** A linear regression to the cross-plot of the two definitions was found to adequately capture the relationship between the two definitions of 1MTP dorsiflexion angle ( $r^2 = 0.8414$ ) (Fig. 1).

**CONCLUSION:** A relationship was found between the 1MTP dorsiflexion angle estimated using an 8-marker skin set and that based on marker arrays mounted directly to bone.

**Reference:** Shaw G et al. *Stapp Car Crash J.* 53,1-48. 2009.

Fig. 1 - data reported by the skin and bone marker sets.

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**3529** Board #250 June 2 9:30 AM - 11:00 AM

**Effects of Semi-Rigid Ankle Orthoses on Athletic Tasks Following a Fatiguing Bout of Exercise**

James A. Yaggie, Christina Smith, Andrew Miller, Rebekah Trimbach. *University of Findlay, Findlay, OH.*

(No relationships reported)

Articulated semi-rigid ankle orthoses (SRAO) are used prophylactically in sport to aid in the functional stability of the ankle and to reduce the incidence of recurring injury. The literature suggests that many of these injuries occur late in activity when the lower extremity may be fatigued and refined technique begins to diminish. Despite the perceived protection of the SRAO, athletes, coaches and clinicians are often concerned with the restriction the SRAO may pose on athletic performance.

**PURPOSE:** Determine the effect of SRAO on performance selected tasks, following fatiguing activity.

**METHODS:** 20 subjects (age = 22.7 yrs ± 1.2; wt = 71.7 kg ± 13.0; ht = 171.7 cm ± 9.4; leg length = 90.9 cm ± 4.7) without lower extremity trauma within 2 years, consented participation. Randomized trials for balance [Star Excursion Balance Test (SEBT)], agility [shuttle run (SR)], and power [vertical jump (VJ)] were compared between 4 conditions [fatigued, braced (FB); fatigued, un-braced (FUB); non-fatigued, braced (NFB); non-fatigued, un-braced (NFUB)]. Participants were bilaterally fitted with a well-known, commercially available SRAO for all braced trials. Two, Wingate supramaximal exercise bouts were used as the fatiguing protocol. RMANOVA was performed to determine main effects using (task x condition; SPSS, IL;  $\alpha = .05$  for all tests).

**RESULTS:** No main effects for VJ & SR were observed under any of the bracing conditions. Main effect for bracing was observed for the raw SEBT scores. Tukey pairwise comparisons revealed that there were significant increases in distance reached for the posterior-medial direction (NFB = 82.7 cm ± 2.6; FB = 86.4 ± 1.9;  $\Delta = 3.7\%$ ;  $p = .046$ ) and medial direction (NFB = 67.3 cm ± 3.1; FB = 71.8 ± 2.2;  $\Delta = 4.1\%$ ;  $p = .039$ ) during the braced conditions. Although subjects reported that the SRAO anecdotally restricted ROM during most SEBT directions involving inversion and eversion, overall performance was not hindered by the application of the brace. Further, the only main effects observed with functional performance involved increases in SEBT that could likely be attributed to comfort and confidence of motion while wearing an ankle device.

**CONCLUSION:** An articulated, semi-rigid orthosis effectively limits motions at the ankle, but does not appear to hinder athletic performance following a fatiguing bout.

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**3530** Board #251 June 2 9:30 AM - 11:00 AM

**Mechanics of a Biomechanical Energy Harvesting Ankle Device During Walking**

Robert W. Gregory, Rebecca A. Zifchock, William F. Brechue, FACSM. *United States Military Academy, West Point, NY.*

(No relationships reported)

With the increasing use of portable electronics in the military, the need for mobile electrical power sources has increased. The power demand for these devices is typically met by batteries. However, conventional batteries take up a significant percentage of a soldier's combat load. Therefore, biomechanical energy harvesting devices have been considered as an alternative to batteries. One such device has been designed to harvest energy from the motion of the ankle joint during walking.

**PURPOSE:** To investigate the differences in gait kinematics and kinetics when walking with and without a biomechanical energy harvesting ankle device (SPARK; Spring Active, Inc.; Tempe, AZ).

**METHODS:** Kinematic (step length and step rate) and kinetic (peak vertical ground reaction force and impulse) variables were measured during treadmill walking in 6 (4 male, 2 female) healthy adult subjects. The subjects walked 7-10 min at 4.83 km/h for each of four conditions: 1) No rucksack/No SPARK, 2) No rucksack w/SPARK, 3) Rucksack (30% BW)/No SPARK, and 4) Rucksack (30% BW) w/SPARK.

**RESULTS:** There were no significant differences in step length, step rate, and impulse when walking with and without the SPARK device for both the rucksack and no rucksack conditions. However, there was a strong trend ( $p = 0.07$ ) towards larger peak vertical ground reaction forces when using the SPARK device. The kinematic and kinetic results are presented in the table below (mean ± SD).

|                    | Walk w/o Rucksack |             | Walk w/Rucksack |             |
|--------------------|-------------------|-------------|-----------------|-------------|
|                    | No SPARK          | SPARK       | No SPARK        | SPARK       |
| Step Length (m)    | 0.74 ± 0.02       | 0.73 ± 0.07 | 0.75 ± 0.03     | 0.74 ± 0.04 |
| Step Rate (step/s) | 1.82 ± 0.07       | 1.87 ± 0.19 | 1.81 ± 0.07     | 1.83 ± 0.11 |
| Peak vGRF (BW)     | 1.25 ± 0.05       | 1.36 ± 0.10 | 1.23 ± 0.08     | 1.32 ± 0.05 |
| Impulse (BW·s)     | 0.57 ± 0.02       | 0.58 ± 0.06 | 0.57 ± 0.02     | 0.56 ± 0.03 |

**CONCLUSION:** The SPARK device allowed the subjects to maintain normal gait kinematics and kinetics while achieving 2.5-3.5 W continuous power output (single foot) while walking at 4.83 km/h. This prototype demonstrates the feasibility of a soldier-ready biomechanical energy harvesting device for field use.

**3531** Board #252 June 2 9:30 AM - 11:00 AM

**Lateral Foot Loading Pattern Concurs With Increased Disintegration Of The Postero-medial Achilles Tendon Region**

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(No relationships reported)

Research suggest that excessive pronation (EP) of the foot contributes to Achilles tendinopathy, however it is still not possible to predict who is at risk. From a biomechanical perspective, EP generates a more rapid and repeated transition of the foot from supination to pronation and backwards. This creates a "bow string" loading of the Achilles tendon (AT). In accordance, ultrasonographic (US) and MR imaging of symptomatic ATs often show irregularities in the medial midportion.

**PURPOSE:** To study foot biomechanics as etiological factor in subclinical AT tendinosis.

**METHODS:** AT structure of 20 healthy, asymptomatic subjects (18-60 yr) was examined through ultrasonographic tissue characterization (UTC).[1] In contiguous US images, 3D-stability of echo-patterns was quantified with dedicated algorithms and 4 echo-types were discriminated: I) intact and aligned tendon bundles; II) discontinuous or waving tendon bundles; III) fibrillar components; IV) mainly cellular components and fluid in amorphous tissue. Tendon disintegration was quantified as the sum of echo-types III + IV. Dynamic plantar pressure measurements from a 2m pressure plate during 5 walking trials were documented and normalized for foot size, foot progression angle and total pressure.[2]

**RESULTS:** The percentage level of tissue type III+IV (%III+IV) postero-medial (PM) in the AT (7.03±9.53%) was significantly higher than lateral (2.19±2.64%, p < 0.05) or central (1.16±3.31% p < 0.05) regions. Foot pressure dynamics from AT with PM %III+IV > 3.50 (n=20 feet) showed a more lateral center of pressure and roll-over pattern (0.56±0.89%) when compared to AT with PM %III+IV < 3.50 (-1.585±0.88%, p<0.05), with a lower roll-over speed (> 3.50: 0.49±0.16 nU/s vs < 3.50: 0.64±0.19 nU/s, p<0.05). Hallux-to-Meta-I pressure ratio, as indicator for functional hallux stiffening,[3] was higher in AT with PM %III+IV < 3.50.

**CONCLUSION:** AT disintegration in PM region may be related to a more lateral foot loading pattern. Functional hallux stiffening may protect against AT tendinosis.

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**3532** Board #253 June 2 9:30 AM - 11:00 AM

**The Effect Of Foot Orthoses On Peroneal H-reflex In Treadmill Walking, A Pilot Study**

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(No relationships reported)

Although the biomechanical effect of foot orthoses is not completely understood, positive effects are attributed to sensorimotor adaptations next to mechanical processes. The analysis of H-reflex response of the ankle stabilizer M. peroneus longus (PL) may give further insight into foot orthoses triggered adaptations.

**PURPOSE:** To investigate the influence of a foot orthosis with medial arch support (O) compared to no orthosis (NO) on PL motor neuron excitability in treadmill walking.

**METHODS:** 35 healthy physically active participants were recruited. From 11 subjects (26.5 ± 2.5 yrs., 1.78 ± 0.08 m, 72 ± 10 kg, 4 ± 1.6 training sessions/wk) H-reflex of PL could be deduced. This cohort performed 2 randomized walking trials on a treadmill at 5 km/h. The stimulating electrode was placed on the nervus fibularis communis in the fossa poplitea and PL-EMG was recorded. Stimulus was applied with a 300 ms delay after initial heel strike in midstance. Accordingly, recruitment curves were created (50 measuring points, square impulse: 300 V; 500 µs duration; stimulation-interval: 10 s; increase interval of stimulation intensity: 0.2 mA). Maximum H-reflex amplitude and M-wave were obtained and Hmax/Mmax-ratio was calculated. Descriptive analysis was followed by t-test for dependent samples (p<0.05) (mean and SD of Hmax/Mmax-ratio and 95% CI of the difference).

**RESULTS:** 7 of 11 participants showed an enhanced H-reflex activity of PL among the insole condition compared with no insole. The foot orthoses modification resulted in higher but not statistically significant mean PL Hmax/Mmax-ratio compared to no arch support (NO: 0.16 (± 0.07)/ O: 0.22 (± 0.17); CI of the difference: -0.18 - 0.06 (p= 0.32).

**CONCLUSIONS:** Wearing a medial arch support insole had no significant effect on sensorimotor response of PL muscle during treadmill walking in healthy persons. However, individual responses to a standardized arch support were highly variable. This pilot work suggests the systematic analysis of different arch heights, velocities and stimulation instants during gait. Moreover a higher number of subjects and patients with chronic ankle instability may help to further validate the approach of sensorimotor effects of foot orthoses.

**3533** Board #254 June 2 9:30 AM - 11:00 AM

**Experimentally Induced Anterior Knee Pain Immediately Reduces Involuntary And Voluntary Quadriceps Activation**

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(No relationships reported)

**PURPOSE:** To examine the immediate effects of experimentally induced anterior knee pain on involuntary and voluntary quadriceps activation.

**METHODS:** A 3X3 randomised controlled laboratory study with repeated measures was used. Thirteen, neurologically sound volunteers (age: 21.9 ± 3.2 year, height: 1.7 ± 3.1 m, mass: 76.6 ± 10.1 kg) underwent three different conditions (pain, sham, and control). The vastus medialis peak Hoffmann reflex normalized by the peak Motor response (H:M ratio) was used to measure involuntary quadriceps activation. Quadriceps central activation ratio (CAR) using maximal isometric knee extension torque (Nm) was calculated to assess voluntary quadriceps activation. Measurements were recorded at precondition (baseline), condition (immediate post injection), and 20min-postcondition. To induce anterior knee pain and sham condition, 5% sodium chloride and 0.9% sodium chloride (total volume of 1.0 ml for each condition), respectively, were injected into the infrapatellar fat pad on the dominant leg. No injection was performed for the control condition. The visual analogue scale was measured every two minutes throughout the data collection.

**RESULTS:** Our pain model increased perceived pain immediately after the 5% hypertonic saline injection and pain lasted for 12 minutes on average (F<sub>40,743</sub>=16.85, P<0.0001). During the pain condition subjects showed a 12% decrease in H:M ratio (F<sub>2,59</sub>=8.64, P<0.001), a 34% decrease in maximal isometric knee extension torque (F<sub>2,59</sub>=5.89, P=0.005), and a 5% decrease in CAR (F<sub>2,59</sub>=3.83, P=0.03).

**CONCLUSIONS:** Our data showed that joint pain may be an independent factor to alter function of the muscles surrounding the painful joint. Both involuntary and voluntary inhibitory pathways may play a role in an immediate reduction of muscle activation. Pain control in the acute stage of a joint injury and during chronic joint injury is important not only to decrease perceived pain but also to initiate disinhibition of the surrounding musculature and prevent chronic joint loading.

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**3534** Board #255 June 2 9:30 AM - 11:00 AM  
**Hip Muscle Recruitment During Weightbearing and Non-Weightbearing Exercises**

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(No relationships reported)

**INTRODUCTION:** Studies have suggested that hip strength is a modifiable risk factor for knee osteoarthritis. The purpose of this study was to examine the recruitment of hip musculature during various therapeutic exercises. **PARTICIPANTS:** Twenty healthy active volunteers between the ages of 18-25 years old participated in the study.

**METHODS:** Surface EMG recorded the muscle activity of the gluteus maximus (GMax) and gluteus medius (GMed) as subjects performed three sets of five repetitions of the following exercises: (1) Forward Step-up, (2) Side Step-up, (3) 10 repetition maximum (RM) sidelying hip abduction and (4) 10 RM prone hip extension. The normalized peak EMG was determined during each repetition and then averaged across all trials. Using repeated measure ANOVAs, comparisons of the peak EMG activity were made between each exercise. Alpha was set at 0.05.

**RESULTS:** Performing a 10 RM sidelying exercise recruited GMed significantly greater than remaining exercises ( $P<0.05$ ). GMed demonstrated greater activity than GMax during each exercise with the exception of the prone hip extension ( $P<0.05$ ).

**DISCUSSION:** These results suggest that performing a 10 RM non-weightbearing exercise results in greater muscle activity than a functional weightbearing exercise without load. In addition, forward and side-step ups fail to effectively recruit GMax. GMed was recruited to a higher extent during the stepping tasks; however, further research is needed to examine the impact of external loading on GMed recruitment during stair stepping exercise.

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**3535** Board #256 June 2 9:30 AM - 11:00 AM  
**Coupled Valgus Collapse Due To Internal Rotation: An Important Factor In the ACL Injury Mechanism**

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(No relationships reported)

Valgus collapse has been associated with cases of ACL injury. Keen debate has focused on the roles of valgus and tibial internal rotation on loading of the anterior cruciate ligament (ACL). The relative importance and nature of this interaction in the ACL injury mechanism are controversial.

**PURPOSE:** To understand the coupling between internal rotation and valgus orientation, and their effects on ACL strain.

**METHODS:** 17 cadaveric legs (45±7 yrs) potted at the mid-femur and fixed at 25° of flexion to a 6-DOF force couple testing apparatus. An unconstrained pure moment was applied to the tibia over a continuous range of ±50 Nm abduction-adduction under 1200 N quadriceps and 800 N hamstrings loads. Joint kinematics were collected using an Optotrak 3020 system. A DVRT transducer was used to calculate ACL strain. Specimens were first tested under isolated abduction-adduction loading. Subsequently, tests were repeated with the addition of 20 Nm internal rotation. Subsequently, specimens were evaluated in a series of impact tests simulating landing under combinations of valgus, internal rotation and anterior shear. Specimens were tested until failure.

**RESULTS:** 20 Nm pure internal rotation moment produced significant 6.4±3° coupled valgus rotation of the tibia ( $P<0.0005$ ) with 4.2±3% ACL strain. 50 Nm pure abduction moment produced 6.2±3° valgus rotation with 3.6±3% ACL strain. ACL strain and valgus under either 20 Nm pure internal rotation or 50 Nm pure abduction were not statistically different. No significant coupled internal rotation was observed under 50 Nm pure abduction moment. Axial impact generated a mean 9.1±8 mm anterior tibial translation (ATT) and 15 ACL injuries in 17 limbs. A general regression model showed that internal rotation significantly decreased ATT under axial impact ( $P=0.03$ ), while valgus did not play a significant role on ATT ( $p=0.12$ ).

**CONCLUSION:** Data demonstrated unidirectional coupling between internal rotation and valgus. Our data indicate that while internal rotation may play an important role in ACL injury, it is the coupled valgus motion associated with internal rotation that acts to load the ACL. Supported by NIH Grants RO1 AR056259 and RO1 AR049375.

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**3536** Board #257 June 2 9:30 AM - 11:00 AM  
**Previous Hamstring Strain Injury Reduces Knee Strength And Biceps Femoris Activation**

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(No relationships reported)

Hamstring strain injuries (HSI) are the primary injury sustained across a number of sports. A concern is that re-injury rates are also high and previous hamstring injury is the most significant risk factor for future injury. These observations suggest that the maladaptations that occur following HSI require attention, particularly neural maladaptations. Of interest is whether alterations in neural function are responsible for the prolonged eccentric weakness seen following HSI.

**PURPOSE:** To determine if previous HSI lead to reductions in voluntary activation during concentric and eccentric contraction at fast and slow movement velocities.

**METHODS:** Thirteen participants had a history of unilateral HSI within the last 18 months but were currently active in their chosen sport. A further 15 participants formed the control group and had no history of HSI. All participants completed a familiarisation session and one testing session which consisted of maximal isokinetic concentric and eccentric contractions of the knee flexors at ±60°.s<sup>-1</sup> and 180°.s<sup>-1</sup> and maximal isokinetic concentric contractions of the knee extensors at +60°.s<sup>-1</sup> and 180°.s<sup>-1</sup>. Medial hamstring and biceps femoris activation was assessed using surface electromyography.

**RESULTS:** Previous HSI resulted in lower knee flexor torque at -180°.s<sup>-1</sup> (Mean diff = 21Nm; 95%CI = 10-31Nm;  $p<0.05$ ), -60°.s<sup>-1</sup> (Mean diff = 18Nm; 95%CI = 9-28Nm;  $p<0.05$ ), +60°.s<sup>-1</sup> (Mean diff = 14Nm; 95%CI = 6-22Nm;  $p<0.05$ ) and +180°.s<sup>-1</sup> (Mean diff = 9Nm; 95%CI = 3-16Nm;  $p<0.05$ ) in the injured leg compared to the contralateral limb. Lower voluntary biceps femoris activation at long muscles lengths at -180°.s<sup>-1</sup> (Mean diff = 0.13; 95%CI = 0.06 - 0.19;  $p<0.05$ ) and -60°.s<sup>-1</sup> (Mean diff = 0.13; 95%CI = 0.05 - 0.22;  $p<0.05$ ) was also found in the previously injured leg compared to the contralateral limb. No difference was found for voluntary activation of the medial hamstrings at any speed. In the control group there were no differences in torque or voluntary activation between dominant and non-dominant limbs.

**CONCLUSION:** Strength deficits during both concentric and eccentric contractions are found following HSI. It appears that lower voluntary activation is partially responsible for this strength deficit during eccentric contractions.

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**3537** Board #258 June 2 9:30 AM - 11:00 AM  
**The Influence of Analysis Epoch on Knee Kinetics Related to Anterior Cruciate Ligament Injury**

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(No relationships reported)

Peak internal knee extension moment (KEM) and anterior tibial shear force (ATSF) are commonly identified during landing tasks between the time from initial ground contact (IGC) until peak knee flexion (PKF) to infer anterior cruciate ligament (ACL) loading. However, ACL injury likely occurs within the initial 100 ms following ground contact (INI), and the magnitude of ACL loading attributable to KEM and ATSF is mitigated as knee flexion angle increases during landing. As such, it is unknown whether identification of these variables during an epoch more closely aligned with the time of injury might be more appropriate for inferring ACL loading.

**PURPOSE:** To compare the magnitude, time of peak, and knee flexion angle at KEM and ATSF identified during INI and PKF. We hypothesized that when identified during INI, KEM and ATSF would demonstrate similar magnitudes, but occur sooner after IGC and at lesser knee flexion angles compared to KEM and ATSF identified during PKF.

**METHODS:** Dominant leg lower extremity kinematics and kinetics were measured in 50 healthy subjects (25 F, 25M) during a double leg jump landing from a 30cm box onto a force plate. Paired samples t-tests compared the magnitude, time of peak, and knee flexion angle at peak between KEM and ATSF identified during INI and PKF, respectively.

**RESULTS:** Peak KEM ( $0.177 \text{ BW} \cdot \text{Ht}$  vs.  $0.175 \text{ BW} \cdot \text{Ht}$ ,  $p = 0.047$ ) and ATSF ( $0.95 \text{ BW}$  vs.  $0.88 \text{ BW}$ ,  $p < 0.001$ ) were greater when identified during PKF than during INI. However, when identified during INI, KEM ( $62.2 \text{ ms}$  vs.  $51.9 \text{ ms}$ ,  $p = 0.024$ ) and ATSF ( $122.9 \text{ ms}$  vs.  $64.4 \text{ ms}$ ,  $p < 0.001$ ) occurred sooner after IGC and with the knee positioned in lesser flexion (KEM:  $55.1$  vs.  $53.0$ ,  $p = 0.010$ ; ATSF:  $71.2$  vs.  $59.1$ ,  $p < 0.001$ ) than when identified during PKF.

**CONCLUSION:** The results indicate that identifying KEM and ATSF during INI may be more appropriate for inferring ACL loading. Although small reductions in the magnitudes of KEM and ATSF were noted when identified during INI, these peak kinetics occurred earlier and with the knee positioned in lesser flexion, likely indicating greater ACL loading. Moreover, as the results obtained using each analysis epoch differed, peak KEM and ATSF were identified in some participants more than 100 ms after IGC when using PKF; and after the time when ACL injury likely occurs. Future studies should identify KEM and ATSF during INI.

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3538 Board #259 June 2 9:30 AM - 11:00 AM

### Changes in Hip Muscle Performance and Lower Extremity Biomechanics Following a Hip-Focused Training Program

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(No relationships reported)

Females have a higher incidence of ACL injury compared to males. Decreases in hip and knee flexion during landing, along with increased knee valgus angles and moments, have been identified as potential risk factors for ACL injury in females. Deficits in hip muscle performance have been proposed as an underlying cause of "at risk" lower extremity biomechanics.

**PURPOSE:** To determine if an intervention program aimed at improving hip muscle rate of force development (RFD) can influence lower extremity biomechanics during a drop-jump task in females.

**METHODS:** Twenty recreationally active females (18-25 years of age) participated in biomechanical and RFD testing before and after a 4 week training program (3 times/week, 30 min/session) consisting of hip-focused plyometric and balance perturbation exercises. Hip abductor (HA), hip extensor (HE), and knee extensor (KE) maximal RFD was assessed during a rapid isometric contraction using a custom testing set-up (ie. load cell aligned perpendicular to the segment being tested). Lower extremity kinematics and kinetics were obtained as subjects performed a double-leg drop-jump from a 36 cm platform. Variables of interest were calculated over the early deceleration phase of landing and included peak hip and knee flexion angle, peak knee abduction angle, and peak knee adductor moment. Differences pre- vs. post-training were evaluated using paired-samples t-tests ( $p \leq 0.05$ ).

**RESULTS:** Post-training, there was a significant increase in HA RFD ( $757.9 \pm 164.4$  vs.  $863.5 \pm 220.2 \text{ Nm/ms}$ ;  $p=0.002$ ) and HE RFD ( $1253.3 \pm 440.4$  vs.  $1368.6 \pm 436.7 \text{ Nm/ms}$ ;  $p=0.0002$ ). There was no significant difference in KE RFD ( $792.3 \pm 204$  vs.  $823.3 \pm 214.0 \text{ Nm/ms}$ ;  $p=0.15$ ). Biomechanical testing revealed a significant increase in the peak knee ( $89.6 \pm 7.7$  vs.  $92.3 \pm 8.7^\circ$ ;  $p \leq 0.001$ ) and hip flexion angle ( $79.3 \pm 8.4$  vs.  $83.9 \pm 9.6^\circ$ ;  $p=0.04$ ); and decreases in the peak knee abduction angle ( $5.3 \pm 3.9$  vs.  $3.9 \pm 3.6^\circ$ ;  $p \leq 0.02$ ) and the peak knee adductor moment ( $0.24 \pm 0.1$  vs.  $0.18 \pm 0.1 \text{ Nm/kg}$ ;  $p \leq 0.003$ ).

**CONCLUSIONS:** Changes in lower extremity biomechanics following training were primarily driven by increases in hip muscle RFD as opposed to knee extensor RFD. We propose that injury prevention training programs targeting hip muscle RFD may be important in mitigating biomechanical risk factors associated with ACL injury in females.

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3539 Board #260 June 2 9:30 AM - 11:00 AM

### Knee Rotational Kinematics After Anterior Cruciate Ligament Reconstruction Using Computer Navigation

Jothi Murali<sup>1</sup>, Robert Shalvoy<sup>1</sup>, Nicholas Beretta<sup>2</sup>, Elizabeth I. Drewniak-Watts<sup>2</sup>, Susan E. D'Andrea<sup>2</sup>. <sup>1</sup>Brown University Warren Alpert School of Medicine, Providence, RI. <sup>2</sup>Gait and Motion Analysis Laboratory, Providence VA Medical Center, Providence, RI.

(No relationships reported)

**BACKGROUND:** It is unknown whether in vivo dynamic biomechanical testing demonstrates restored rotational stability in patients with single-bundle ACL reconstruction performed using computer navigation.

**PURPOSE:** To investigate the intraoperative and in vivo range of tibial rotation (ROM) in patients with ACL reconstruction (ACL-R) performed using computer navigation. The authors hypothesized that the tibial ROM during walking and two pivoting tasks is comparable to the contralateral leg (CL).

**METHODS:** Intraoperative rotational data was collected for ten subjects using a computer navigational system (OrthoPilot). Subjects performed walking trials and two pivoting tasks consisting of a stair descent and a two-footed platform jump, at a mean follow-up time of 18.1 months post-reconstruction. The peak internal (IR), peak external (ER), and ROM of the ACL-R and CL knees were measured with a motion capture system (Qualisys). Independent t-tests were performed to investigate significant differences between the two limbs. Statistical significance was set at  $p < 0.05$  a priori.

**RESULTS:** Intraoperative ROM values significantly decreased ( $p = .0023$ ) from  $44.1^\circ$  pre-reconstruction to  $30.8^\circ$  post-reconstruction. ROM for ACL-R and CL during stair descent ( $32.4^\circ$  vs.  $32.3^\circ$ ), platform ( $28.5^\circ$  vs.  $28.3^\circ$ ), walking stance phase ( $12.9^\circ$  vs.  $12.6^\circ$ ) and walking swing phase ( $14.3^\circ$  vs.  $12.9^\circ$ ) did not significantly differ. However, ACL-R peak IR values were significantly lower than CL peak IR values for stairs, platform, and stance ( $16.0^\circ$  vs.  $18.2^\circ$ ;  $15.4^\circ$  vs.  $17.5^\circ$ ;  $1.8^\circ$  vs.  $4.4^\circ$ , respectively). Peak ER values increased significantly in the ACL-R limb vs. CL for all tasks ( $16.4^\circ$  vs.  $14.1^\circ$ ;  $13.1^\circ$  vs.  $10.9^\circ$ ;  $11.1^\circ$  vs.  $8.1^\circ$ ;  $16.3^\circ$  vs.  $13.5^\circ$ ).

**CONCLUSION:** Anatomic single-bundle ACL reconstruction using computer navigation restores rotational stability during walking and two high-demand tasks at intermediate-term follow-up. Although overall tibial ROM is comparable to an uninjured knee, alterations in the peak IR and ER may have implications for future development of osteoarthritis in these patients.

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3540 Board #261 June 2 9:30 AM - 11:00 AM

### Hip Function in Femoroacetabular Impingement

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(No relationships reported)

**PURPOSE:** Cam-type femoroacetabular impingement (FAI), with an anatomic deformity at the femoral head-neck junction, is a known risk factor for hip osteoarthritis. Repetitive contact of the deformity with the labrum and cartilage during daily activities can lead to traumatic degeneration. The purpose of this study is to evaluate the hip kinematics and kinetics during a variety of common daily tasks in subjects with FAI and healthy matched controls.

**METHODS:** 7 patients with cam-type FAI (5 M, 2 F; mean age =  $36.6 \pm 9.7$  years, mean BMI =  $26.2 \pm 6.9$ ) and 14 normal volunteers (10 M, 4 F; mean age =  $30.4 \pm 10.6$  years, mean BMI =  $23.3 \pm 2.8$ ) had 3T hip MRI scans to evaluate anatomical deformity. 3-D motion analysis was performed for four tasks: 1) gait, 2) deep-squat, 3) drop jump, 4) single leg hop. Timed Up and Go (TUG) was used for functional performance. Student's t tests were used for between group comparisons and paired t-test for involved and contralateral side ( $\alpha = 0.05$ )

**RESULTS:** During walking, FAI group had less flexion-extension motion compared to contralateral side and a similar trend was seen when compared to controls ( $p = 0.068$ ). During the drop jump, FAI group had more external rotation at the hip compared to controls with similar trend seen when compared to contralateral side ( $p = 0.073$ ). FAI group absorbed less power while flexing during drop jump. During drop jump ( $p = 0.067$ ) and deep-squat ( $p = 0.058$ ), FAI group showed a trend for lower external rotation moment when compared to controls. Finally, patients were significantly slower ( $9.7 \pm 1.3$  sec) than controls ( $8.4 \pm 0.9$  sec) at completing the TUG task.

**CONCLUSIONS:** Reduced sagittal motion was consistent with the literature. During drop-jump, lower hip power while flexing could be due to poor eccentric control resulting from hip and leg muscle weakness. Greater external rotation motion and lower external rotation moment during drop-jump and deep-squat indicate forced motion due to the cam deformity and avoidance of internal rotation during deep hip flexion. Finally, while the difference in TUG was small, it does indicate that the patients' condition adversely affects their mobility. Abnormal pathomechanics can lead to altered load patterns which can affect cartilage health. Future analysis will correlate functional biomechanics and the cartilage T1rho and T2 relaxation times.

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3541 Board #262 June 2 9:30 AM - 11:00 AM

**Influence of Hip Flexibility on Dynamic Alignment During the Overhead Squat Test in Adolescent Athletes**

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(No relationships reported)

The overhead squat test is a clinical screening tool that may be used to assess dynamic malalignments of the lower extremities that potentially increase the risk of knee injuries. While rotational flexibility of the hip has been suggested to contribute differences in lower extremity motion during the overhead squat, this relationship remains unclear.

**PURPOSE:** To determine the influence of hip range of motion on hip and knee kinematics during the overhead squat test.

**METHODS:** Clinical measures of hip internal (HIR) and external (HER) rotation range of motions were measured on the dominant limb of 76 adolescent athletes (48 M, 28 F: 15.7±1.2 yrs, 173.9±11.0 cm, 67.9±12.9 kg) as part of a larger, multi-center risk factor screening project. Three-dimensional kinematics of the hip and knee during the descent phase (start to maximum knee flexion) were also assessed during five consecutive overhead squats. The average of three trials for HER and HIR, and five trials for peak hip and knee kinematics were used for analyses. Separate step-wise linear regressions determined the extent to which HIR and HER predicted hip and knee kinematics during the overhead squat in males and females.

**RESULTS:** In males, HER was a positive predictor of hip flexion ( $R^2 = .210$ ,  $P = .002$ ) and hip adduction ( $R^2 = .110$ ,  $P = .032$ ) motion during the overhead squat. HIR was a significant positive predictor of knee external rotation motion, explaining 20.4% of the variance ( $P = .003$ ). In females, HER was a significant negative predictor of knee valgus motion, explaining 15.5% of the variance ( $P = .046$ ) while HIR was a significant negative predictor of knee flexion motion, explaining 19.0% of the variance ( $P = .026$ ).

**CONCLUSIONS:** Based on these results, flexibility of the hip internal and external rotators influence joint motions during the overhead squat test. This may in part be due to the changes in the length-tension relationship of the surrounding muscles, which can lead to dynamic malalignments known to be predictive of knee injuries. Ongoing research is examining whether these range of motion differences increase the risk of knee injuries in adolescent athletes.

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3542 Board #263 June 2 9:30 AM - 11:00 AM

**A Comparison of Eversion Ankle Function Between Stable and Chronically Unstable Ankles**

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(No relationships reported)

**PURPOSE:** To compare the peak evertor torque (PT), average evertor torque (AT), and angular displacement at peak torque (PT) of chronically unstable ankles and their contralateral stable ankle.

**METHODS:** Ten males (Age=21±2 yr; Height=182±8 cm; Weight=80±7 kg) with one chronically unstable ankle (CU) and one stable ankle (ST) volunteered to participate in this study. Prior to testing, each participant completed a five-minute lower extremity stretching program. Using an isokinetic dynamometer, each participant performed maximal efforts of concentric and eccentric eversion were completed at 60/s and 180/s for each ankle. A 2 x 2 x 2 (Contraction Type x Testing Speed x Ankle Stability) multivariate analysis of variance (MANOVA) was completed to determine differences for AT, PT, and PT. An analysis of variance (ANOVA) was performed as a post hoc test where differences occurred.

**RESULTS:** Significant main effects for Testing Speed ( $p < .015$ ) and for AT, PT, PT across Contraction Type ( $p < .004$ ). No significant main effects were found for Ankle Stability. No significant interactions were found for any dependent variable. At 60/s, the ankle was more inverted when peak torque occurred than at 180/s (PT<sub>60</sub>=11±10; PT<sub>180</sub>=7±8;  $p < .01$ ) Peak torque also occurred in a more inverted position during the eccentric phase than during the concentric phase (PT<sub>CON</sub>=7±10; PT<sub>ECC</sub>=13±8;  $p < .004$ ). In all subjects, AT and PT during eccentric contractions were consistently higher than during concentric contractions (AT<sub>CON</sub>=14.6±3.5 Nm; AT<sub>ECC</sub>=22.8±6.0 Nm;  $p < .003$ ) (PT<sub>CON</sub>=18.4±4.4 Nm; PT<sub>ECC</sub>=32.8±9.7 Nm;  $p < .002$ ).

**CONCLUSIONS:** The lack significant differences for PT, AT, or PT between chronically unstable ankles and stable ankles, suggests that muscle weakness and proprioceptive loss may not be the primary reason for chronic ankle instability.

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3543 Board #264 June 2 9:30 AM - 11:00 AM

**Knee Biomechanics Of A Crossover Task Following A Neuromuscular Training Program**

Ashley Rickman<sup>1</sup>, Nelson Cortes<sup>1</sup>, Eric Greska<sup>2</sup>, Jatin P. Ambegaonkar<sup>1</sup>, James Onate<sup>3</sup>. <sup>1</sup>George Mason University, Fairfax, VA. <sup>2</sup>Old Dominion University, Norfolk, VA. <sup>3</sup>The Ohio State University, Columbus, OH.  
(No relationships reported)

High-risk knee biomechanics in the frontal and sagittal planes have been shown to predispose female soccer players to anterior cruciate ligament (ACL) injuries. Neuromuscular training programs have been shown to improve knee biomechanics during athletic tasks. Despite such efforts, the injury rate remains steady over the past decade.

**PURPOSE:** The aim of this study was to examine the effect of a 10-month neuromuscular training program on knee biomechanics during the execution of a crossover cutting task (CO).

**METHODS:** Eighteen injury-free female collegiate soccer players with no history of ACL injury (age=19.6±1.0 years, mass=63.1±5.7 kg, height =1.67±0.05 m) volunteered for the study. Subjects performed 5 trials of an unanticipated CO cutting task before and after completing a 10-month neuromuscular training program during soccer off-season. The training program was performed two times per week and consisted of plyometric, agility, and speed development exercises. The unanticipated CO task was triggered by an automated system that projected a scenario onto a screen simulating an actual soccer event. Lower extremity biomechanics were evaluated during the CO task using a 3D motion capture system and 2 force plates. Paired *t*-tests evaluated differences between pre- and post-training for each dependent variable. Alpha level was set *a priori* at 0.05.

**RESULTS:** Significant differences included decreases in the knee adduction angle at initial contact ( $8.61^\circ \pm 4.78^\circ$  to  $3.61^\circ \pm 7.17^\circ$ ;  $P = 0.029$ ), and knee flexion moment at initial contact ( $-0.15 \pm 0.12$  Nm/kgm to  $-0.02 \pm 0.14$  Nm/kgm;  $P = 0.029$ ). No other statistically significant differences were observed ( $p > 0.05$ ).

**CONCLUSION:** The neuromuscular training produced some knee biomechanical changes. While the participants at pre-training had an increased knee adduction angle, post-training they were closer to neutral alignment, possibly suggesting an increase in frontal plane control. The decreased knee flexion moment at initial contact post training may represent an increased knee extensor activity in the sagittal plane, which may be disadvantageous to the ACL. Overall, neuromuscular training programs should focus on increasing knee frontal plane control, as well as target other neuromechanical characteristics that may influence joint mechanics.

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3544 Board #265 June 2 9:30 AM - 11:00 AM

**Stability Of Knee-Ankle Joint Coupling Variability Measures During Walking In Chronic Ankle Instability**

Patrick O. McKeon<sup>1</sup>, Matthew C. Hoch<sup>2</sup>, David R. Mullineaux<sup>3</sup>. <sup>1</sup>University of Kentucky, Lexington, KY. <sup>2</sup>Old Dominion University, Norfolk, VA. <sup>3</sup>University of Lincoln, Lincoln, United Kingdom.  
(No relationships reported)

Alterations in knee and ankle sagittal plane kinematics have been identified in those with chronic ankle instability (CAI). The joint coupling variability between these joints and the stability of their relationship over time during gait in those with CAI is unknown. This information is critical for understanding the interaction between these 2 joints in this population.

**PURPOSE:** To determine the inter-session reliability of ankle-knee joint coupling variability during walking in those with CAI.

**METHODS:** Twelve adults with CAI (6 males, 6 females) participated. The CAI group reported 5 ± 5 previous ankle sprains, 8 ± 7 episodes of instability in the past 3 months. On 2 testing sessions separated by 1 week, all subjects walked on a treadmill instrumented with force plates at a speed of 1.32 m/s. Three-dimensional ankle and knee kinematics of the self-reported worse limb were captured for 30 seconds using a 15 camera motion analysis system. Gait cycles (GC) were normalized to 101 points from initial contact (0%) to subsequent initial contact of the same limb (100%) identified from force plate data. Vector-coding coefficients (VCC) ranging from 0 (no variability) to 1 (maximum variability) were calculated for 5 nonconsecutive GC for all subjects on each day. Peak VCC were found for the stance and swing phases. Intraclass correlation coefficients (ICC 2,1) were calculated for the reliability of peak VCC across days.

**RESULTS:** Peak VCC in stance (Day 1 mean = 0.55 ± 0.26, Day 2 = 0.57 ± 0.26, ICC = 0.79, SEM = 0.10, p = 0.001) and swing phases (Day 1 mean = 0.73±0.15, Day 2 mean = 0.64 ± 0.20, ICC = 0.76, SEM = 0.08, p = 0.001) were found to be highly reliable. The peak for stance consistently occurred in mid-stance (40-48% of GC) and in the terminal swing phase (98-0% of GC).

**CONCLUSION:** Individuals with CAI exhibited very stable ankle-joint coupling variability patterns during walking across 2 different days. The timing and magnitude of peak joint coupling variability were consistent across the 2 days of testing. The peaks in coupling variability were associated with the transitions between absorption and propulsion (mid-stance) and swing to stance phases (terminal swing). Ankle-knee joint coupling variability appears to be reliable over time in those with CAI and offers insight into the stability of the relationship around gait transitions.

**3545 Board #266 June 2 9:30 AM - 11:00 AM**  
**Perceptions of Function Differ from Quantitative and Qualitative Tests of Physical Performance After ACL Reconstruction**

Caitlin Gollehon, Maggie Dewitz, Jenna Kokes, Ryan L. Mizner. *University of Montana, Missoula, MT.*  
*(No relationships reported)*

There are a wide variety of assessments available to quantify outcomes post anterior cruciate ligament reconstruction (ACLR). Most studies use questionnaires to measure patients' perception of their functional ability. Others employ assessments like the Y balance test and hop test to quantify physical performance. Relatively few studies go so far as to include 3D motion analysis of patients completing sports related tasks. The relative interplay between these levels of outcome assessments as they relate to evaluation of outcomes after ACLR remains understudied.

**PURPOSE:** To assess the relationships present between a wide variety of means to quantify clinical outcomes in patients with unilateral ACL reconstruction.

**METHODS:** Participants included 17 (7 males) physically active (≥ 4 Tegner Scale) subjects, ages 16-31 with unilateral ACLR. A onetime session was completed where participants were assessed with an 8 camera Vicon system with force plates for peak knee flexion moment during a single leg land (SLL) and vertical ground reaction forces (VGRF) during a drop vertical jump (DVJ). Patients completed the International Knee Documentation Committee (IKDC) questionnaire. Performance was quantified by the difference between limbs for both the anterior reach of the Y Balance Test and the single leg hop for distance.

**RESULTS:** Our results show that the IKDC was only significantly correlated to the Hop test for distance (r=0.62, p=.008). The Hop test was significantly correlated to peak knee moment during the SLL (r=0.59, p=0.013), but was not correlated to asymmetries in VGRF during the DVJ land (r=0.16, p= 0.53). The Y balance is not correlated with asymmetry in VGRF during the DVJ (r=-0.16, p= 0.54) or the peak knee moment during the SLL (r= -0.35, p= 0.17).

**CONCLUSION:** No one measure seems to give a complete picture of an athlete's outcome following ACLR. None of the correlations between measures were strongly correlated to each other. While the commonly used questionnaires are inexpensive they fail to relate to qualitative assessment of the motion analysis. The performance assessments were a closer approximation of the motion analysis, but the motion analysis seems to provide additional information to quantify performance. A broad assessment is needed to fully appreciate patient outcomes after ACLR.

**3546 Board #267 June 2 9:30 AM - 11:00 AM**  
**Functional Weight Bearing Exercises Normalized to Leg Length Among Males and Females**

Lucinda E. Bouillon, Jacqueline Wihelm, Patricia Eisel, Jessica Wiesner, Megan Rachow, Lindsay Hatteberg. *University of Findlay, Findlay, OH.*  
*(No relationships reported)*

Researchers have used various step heights and lunge distances when assessing functional exercises. These height and distance variations make comparisons difficult between gender and tasks. Leg length differences may also affect the ability to perform the task.

**PURPOSE:** Determine if muscle activity of the rectus femoris (RF), rectus abdominus (RA), external oblique (EO), erector spinae (ES), gluteus medius (GMed), gluteus maximus (GMax), tensor fascia latae (TFL), and biceps femoris (BF) differs between gender among three single-limb weight bearing exercises using normalized leg length distances.

**METHODS:** Twenty men (23.2± 2 yrs, 1.8±.09m; 85± 20 kg) and 20 women (23.2± 2 yrs, 1.6±.07m; 86± 7 kg) who were healthy and recreationally active participated in the study. Surface electromyography (SEMG) and 2-D video were used to collect SEMG data for the RF, RA, EO, ES, GMed, GMax, TFL, and BF muscles of the dominant lower extremity. Maximal voluntary isometric contractions (MVIC) were used to normalize SEMG root mean square values for each muscle, which were expressed as %MVIC. Participants completed unilateral functional exercises (step down, forward lunge, and side-step lunge) in a randomized exercise order. The subjects performed 2 x 10 repetitions at a pace of 80 bpm. Distances for each exercises were normalized to the participant's lower limb length, (25% step down, 65% forward lunge, 80% side-step). Descriptive statistics, ANOVAs, and ICCs with 95% confidence intervals were calculated. Normalized SEMG values were analyzed using 8 X 3 X 2 ANOVA with follow up using Bonferroni post-hoc testing.

**RESULTS:** Descriptive statistics found males were taller and heavier compared to the women. No differences were found between gender by task for the eight muscles. Regardless of gender, the step down task resulted in higher GMax %MVIC compared to lunge, (p=0.002). Step down exercise was also higher for GMed %MVIC than lunge (p=0.002) and side step (p=0.013). ICC<sub>3,1</sub> ranged from moderate to high (0.74 to 0.97) for the three tasks.

**CONCLUSIONS:** Muscle activity was similar for males and females during the step down, side-step and lunge with distance normalized to the participant's leg length. The step down task recruited higher GMax %MVIC activity when compared to the lunge, and greater GMed %MVIC activity than lunge and side step tasks.

**3547 Board #268 June 2 9:30 AM - 11:00 AM**  
**Efficacy Of Goniometry-based Q-angle For Measuring Change**

Lawrence W. Weiss, FACSM, Kelley G. Hammond, Brian K. Schilling, Lucas C. Ferreira. *The Univ. of Memphis, Memphis, TN.*  
*(No relationships reported)*

*Quadriceps angle (Q-angle)* has been used to reflect the extent of genu valgum and may have implications for activity selection, training considerations, and/or potential medical interventions. Q-angle evaluation must be stable and sufficiently precise in adults if it is to have clinical and/or research utility.

**PURPOSE:** To establish the stability reliability, precision, and minimum difference needed to represent a change in Q-angles obtained using surface goniometry.

**METHODS:** Q-angle was assessed for 25 men and 27 women with surface goniometry on two separate occasions separated by 48 hours. Well-rested subjects assumed a supine position with: 1) extended hips and knees, 2) a neutral hip rotational position, 3) a neutral foot position, and 4) a contracted quadriceps femoris muscle. The axis of a manual goniometer was placed over the center of the right patella with the fixed arm situated over the anterior-superior iliac spine and the mobile arm over the center of the tibial tuberosity. Stability reliability was calculated using intraclass correlation (ICC, 2-way random) and precision by standard error of measurement (SEM). 95% limits of agreement (LOA) was also calculated to estimate the magnitude of difference needed to represent actual change. Acceptable ICC's were set at ≥0.70 for reliability.

**RESULTS:** The following ICC (SEM) were found: all subjects = 0.88 (1.0 deg), men = 0.77 (1.0 deg), women = 0.85 (1.0 deg) (See Table 1).

**CONCLUSION:** The surface goniometry protocol described herein was reliable for all subjects, men only, and women only. Although precision also appeared to be reasonable, a minimum difference of three degrees would be needed to represent a change or difference in Q-angles.

Table 1. Q-angle based on surface goniometry.

| Subjects | n  | Mean1 (SD1) (deg) | Mean2 (SD2) (deg) | ICC  | ICC Conf Limits | SEM (deg) | SEM Conf Limits | 95% LOA (deg) |
|----------|----|-------------------|-------------------|------|-----------------|-----------|-----------------|---------------|
| All      | 52 | 11 (3.2)          | 11 (3.1)          | 0.88 | 0.81 - 0.92     | 1.0       | 0.9 - 1.3       | 3.0           |
| Men      | 25 | 9 (1.9)           | 9 (2.1)           | 0.77 | 0.58 - 0.88     | 1.0       | 0.8 - 1.3       | 3.0           |
| Women    | 27 | 13 (2.6)          | 13 (2.9)          | 0.85 | 0.73 - 0.92     | 1.0       | 0.8 - 1.3       | 3.0           |

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3548 Board #269 June 2 9:30 AM - 11:00 AM  
**The Acute Effect of Pre-exercise Static and Dynamic Stretching of the Leg Extensors**

Jocelyn Riordan, Barbara L. Warren. *University of Puget Sound, Tacoma, WA.*  
(No relationships reported)

**The Acute Effect of Pre-exercise Static and Dynamic Stretching of the Leg Extensors in Trained and Untrained Females**

Jocelyn Riordan & Barbara L. Warren, ACSM  
University of Puget Sound, Tacoma, WA

**INTRODUCTION:** Although warm-up and stretching exercises are routinely used as physical preparation before athletic events, stretching immediately prior to an event may negatively affect performance.

**PURPOSE:** The purpose of this study was to investigate the acute effects of pre-exercise static and dynamic stretching on peak torque of the knee flexors in trained and untrained females.

**METHODS:** Fifteen healthy, college aged, female NCAA Division III athletes (mean age= 20.2 years, height= 171±7.7 cm weight= 71±9.2 kg) and fifteen healthy, female non-athletes (mean age= 20.93, height= 167±5.2 cm, weight= 68.7±9.9 kg) were tested on a Cybex NORM isokinetic dynamometer. Subjects completed two familiarization sessions and three experimental testing sessions. In all sessions, subjects warmed up on a stationary bike for five minutes and performed one of three randomly assigned stretching protocols (no stretching, static or dynamic stretching). Subjects then performed eight maximal knee extensions through a 90 degree range of motion at each of three descending velocities (180, 120 and 60 deg/s). Flexion was held constant at 300 deg/sec for all velocities and there was a 60 second rest period following each velocity set. A repeated measures ANOVA was used to analyze data with  $\alpha < 0.05$ .

**RESULTS:** There were no significant ( $p < 0.05$ ) differences observed in the peak torque production between the three stretching protocols when comparing athletes and non-athletes.

**CONCLUSION:** In this population of athletes and non-athletes female athletes, the type of stretching performed prior to exercise did not appear to affect the peak knee torque produced, indicating that either static or dynamic stretching is acceptable prior to exercise, regardless of activity level.

Research was funded by a Math and Science Summer Research Fund.

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3549 Board #270 June 2 9:30 AM - 11:00 AM  
**Relationships Among Core Stability, Dynamic Balance, and Functional Movement Screen For Collegiate Baseball and Softball Players**

Trina L. Hosang, Ryan M. Hoffman, Richard A. Maag, Greg S. Barga, Cindy Bouillon. *The University of Findlay, Findlay, OH.*  
(No relationships reported)

**PURPOSE:** Injuries in baseball and softball players may be the result of inadequate core strength, poor dynamic balance, or asymmetrical movement patterns. The Functional Movement Screen® (FMS) assesses core, balance, and movement patterns. The aim of this study was to examine if a relationship exists among the FMS, core stability, and dynamic balance tests.

**METHODS:** Seventeen Division II collegiate athletes (7 baseball, 10 softball; 19.0 ± 1.2 years) Randomized measurements consisted of four tests: [double leg lowering: degrees (DLL); trunk extensor endurance: repetitions (EE); Star Excursion Balance Test (SEBT); and FMS]. The athletes performed 3 excursions of the SEBT (anterior, postmedial, and postlateral) bilaterally. A composite reach distance (sum of 3 directions and divided by 3 times LL and multiplied by 100). This score was recorded as % of LL. The FMS included seven tests that were summed together for each limb (R total score, L total score) and was scored by two raters for all tasks. All tests were performed three trials and best score was recorded. Repeated-measures ANOVAs were performed to compare change in time (pre and post season) for core stability and SEBT scores. Wilcoxon Signed Rank test was performed to assess time for FMS scores. Spearman Rho correlation assessed the relationship among core stability, SEBT, and FMS scores. Inter- and intraclass-coefficients (ICC) were used to examine rater and ratings across trials.

**RESULTS:** No relationships were found among outcome measurement scores. A time effect was found for the SEBT scores pre-to post season with improvement for the right composite score from 83% to 89% of LL ( $p > .001$ ) and the left increased from 81% to 88% of LL ( $p = .001$ ). The ICCs were very reliable for the two raters (.99 to 1.0) and between trials (.81 to .98).

**CONCLUSIONS:** Core stability, SEBT, and FMS tools were reliable between two raters and across trials among the collegiate athletes, however no relationships were found among these outcome measures. The only change that was found was an increase in excursion distance on right (6% of LL) and left (7% of LL). Right and left limb distance were <4cm suggesting bilateral dynamic balance symmetry among the athletes. Clinicians and coaches should be aware that scores on the core stability and dynamic balance tests do not relate to FMS scores.

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3550 Board #271 June 2 9:30 AM - 11:00 AM  
**Asymmetry in Stop Jump Mechanics Correlates to Asymmetry in Deep Squat Mechanics in Patients 6 Months Following ACL Reconstruction**

Robert J. Butler, Boyi Dai, William E. Garrett, FACSM, Robin M. Queen. *Duke University, Durham, NC.*  
(No relationships reported)

Asymmetries in lower extremity loading are well documented between the surgical and non-surgical side following Anterior Cruciate Ligament (ACL) reconstruction during jump landings. In order to alter these asymmetries a number of programs have focused on altering landing mechanics with various forms of feedback. However, no studies have examined how the asymmetries in the jump landing correlate with more fundamental movement patterns, like a deep squat, that may provide a more controlled environment for intervention development.

**PURPOSE:** To examine how asymmetries in lower extremity mechanics during a stop jump task correlated with asymmetries in lower extremity mechanics during a deep squat.

**METHODS:** Twelve patients who were six months following ACL reconstruction were recruited for the study. All patients were cleared for jumping activities by their medical physician. The patients underwent a standard motion analysis for a stop jump and bilateral deep squat. The asymmetry (Surgical - Non Surgical) for peak sagittal plane lower extremity motion as well as the vertical ground reaction force impulse was examined. Asymmetry values during the stop jump were correlated to the values obtained during the deep squat using Pearson product moment correlations. Statistical significance was established at  $p < 0.05$ .

**RESULTS:** Asymmetry in the vertical impulse during the stop jump was significantly correlated with asymmetry during the deep squat ( $p < 0.04$ ,  $r = 0.61$ ). Similarly the asymmetry in the peak vertical ground reaction force during the eccentric phase of the deep squat was correlated with the asymmetry in the peak vertical ground reaction force ( $p = 0.03$ ,  $r = 0.62$ ) and the peak knee angle ( $p = 0.02$ ,  $r = 0.67$ ) during the stop jump. Statistically significant correlations were also observed between the peak knee flexion asymmetry during the deep squat and the asymmetry in the vertical impulse ( $p < 0.01$ ,  $r = 0.78$ ), peak ankle motion ( $p < 0.01$ ,  $r = 0.77$ ) and peak knee flexion ( $p < 0.03$ ,  $p = 0.64$ ) during the stop jump.

**CONCLUSIONS:** Asymmetries in landing mechanics strongly correlate to asymmetries during the deep squat pattern. As a result, it may be appropriate to focus interventions and injury prevention programs on more fundamental movement patterns when attempting to address asymmetries in higher level tasks like jump landings.

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## G-43 Free Communication/Poster - Micronutrients and Dietary Intake

JUNE 2, 2012 7:30 AM - 11:00 AM  
ROOM: Exhibit Hall

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3551 Board #272 June 2 8:00 AM - 9:30 AM

### The Effect of Betaine on Delayed Onset Muscle Soreness

J. Luke Pryor<sup>1</sup>, Casey Cathrall<sup>2</sup>, Marq Bittarelli<sup>2</sup>, Timothy Reynolds<sup>2</sup>, William Rogers<sup>2</sup>, Thomas Swensen<sup>2</sup>. <sup>1</sup>University of Connecticut, Storrs, CT. <sup>2</sup>Ithaca College, Ithaca, NY.

(No relationships reported)

**PURPOSE:** We examined the effects of betaine supplementation on delayed onset muscle soreness (DOMS) in 14 male and 18 female college students (mean  $\pm$  SD; height = 170.0  $\pm$  10.2 cm, weight 73.8  $\pm$  11.6 kg, and age = 19.2  $\pm$  1.0 years).

**METHODS:** Subjects were familiarized with all laboratory tests: peak torque for triceps extension using the Cybex isokinetic dynamometer, relaxed arm angle (RANG), brachium circumference, active elbow range of motion (AROM), visual analog soreness scale (VAS), and the profile of mood states (POMS). Subjects were matched paired based on dominant arm peak torque into initial treatment groups in a double-blind, cross-over design. Subjects consumed either 2.5 grams of betaine in 355 ml of Gatorade or 355 ml of Gatorade every day for seven days prior to the intervention and throughout the 96 hr post-intervention; a two week washout separated trials. Exercise intervention consisted of two sets of 20 repetitions of eccentric triceps extensions on the cybex; subjects used their dominant arm for the first treatment and non-dominant arm for the second. Data were collected before intervention, and at 24, 48, 72, and 96 hr post-intervention and analyzed with a two-way, repeated measures ANOVA; alpha was set at 0.05.

**RESULTS:** There were no treatment differences or interactions between groups. Tukey's post hoc revealed across time peak torque ( $p < 0.05$ ) and AROM ( $p < 0.05$ ) decreased by 12 and 3.3%, respectively, whereas arm circumference ( $p < 0.01$ ), RANG ( $p < 0.05$ ), and VAS ( $p < 0.01$ ) increased by 3, 19, and 39%, respectively.

**CONCLUSION:** The exercise intervention induced DOMS, but betaine supplementation did not ameliorate its effects compared to placebo.

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3552 Board #273 June 2 8:00 AM - 9:30 AM

### Effects of Betaine Supplementation on Strength and Power Adaptations Following an 8-week Resistance Training Program

Will Martin<sup>1</sup>, Rhonda Boros<sup>1</sup>, Robert Sawyer<sup>2</sup>, Joaquin Gonzales<sup>1</sup>. <sup>1</sup>Texas Tech University, Lubbock, TX. <sup>2</sup>Utah Valley University, Orem, UT. (Sponsor: Jacalyn McComb, FACSM)

(No relationships reported)

Betaine is present in a variety of foods and occurs naturally in the body as a choline metabolite and potent methyl donor. Betaine may play a role in exercise performance by working as an osmolyte or by enhancing creatine synthesis. Short-term supplementation of betaine has been shown to increase muscular strength, power, and endurance during a single bout of resistance exercise. However, no long term studies (greater than 4 wks) have examined the effects of betaine supplementation on performance measures such as strength and power.

**PURPOSE:** The purpose of this study was to examine the effects of betaine supplementation on training adaptations in college-aged males following an 8-week resistance training program.

**METHODS:** Eleven college aged, resistance trained males (22.6 $\pm$ 1.1yr; 180.2 $\pm$ 6.7 cm; 86.4 $\pm$ 11.0 kg) were randomized to a betaine supplementation (B, n=6) or placebo (Pl, n=5) group. Betaine supplementation consisted of 1.25 g of powder (BetaPower, Danisco Limited) dissolved in 10 oz of Gatorade, ingested twice daily throughout the 8 week study. The placebo was 10 oz of Gatorade only, ingested twice daily. Both treatments were provided in a double blind fashion. All subjects completed an 8 week, 3 x/week, whole body resistance training program with undulating periodization. Light days = 3 sets of 12-14RM, moderate days = 3 sets of 8-10RM, heavy days = 3 sets of 3-5RM. Subjects were tested pre and post training for body composition, bench press and squat 1-RM, bench press and squat repetitions to exhaustion (at 75% 1-RM), vertical jump power, and Profile of Moods States.

**RESULTS:** Both groups increased bench press 1RM (B = 264  $\pm$  83.9 to 280  $\pm$  75.5 lbs, Pl = 258  $\pm$  72.2 to 279  $\pm$  65.4 lbs;  $P < 0.05$ ), squat 1RM (B = 315  $\pm$  76.4 to 342  $\pm$  56.8 lbs, Pl = 309  $\pm$  63.0 to 342  $\pm$  44.4 lbs;  $P < 0.05$ ), and peak power from maximum squat vertical jump (B = 7106  $\pm$  628.5 to 7264  $\pm$  402.1 watts, Pl = 6702  $\pm$  848.1 to 6961.5  $\pm$  791.0 watts;  $P < 0.05$ ). However, there were no significant differences between groups on any measure.

**CONCLUSION:** It appears that betaine supplementation coupled with an 8-week periodized resistance training program does not have an effect on strength and power adaptations over and above that of the training program itself. Supported by Danisco - Health and Nutrition.

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3553 Board #274 June 2 8:00 AM - 9:30 AM

### Betaine Supplementation Enhances Circulating Anabolic Hormones And Akt Muscle Signaling In Humans

Jenna M. Apicella<sup>1</sup>, Elaine C. Lee<sup>2</sup>, Brooke L. Bailey<sup>3</sup>, Catherine Saenz<sup>1</sup>, Jeffrey M. Anderson, FACSM<sup>1</sup>, Stuart A.S. Craig<sup>4</sup>, William J. Kraemer, FACSM<sup>1</sup>, Jeff S. Volek<sup>1</sup>, Carl M. Maresh, FACSM<sup>1</sup>. <sup>1</sup>University of Connecticut, Storrs, CT. <sup>2</sup>Mount Desert Island Biological Laboratory, Salisbury Cove, ME. <sup>3</sup>Florida Atlantic University, Boca Raton, FL. <sup>4</sup>Danisco A/S, Tarrytown, NY.

(No relationships reported)

**PURPOSE:** The aim of this study was to further investigate betaine ergogenicity. Specifically, we characterized betaine effects on circulating hormone concentrations and Akt muscle signaling proteins.

**METHODS:** Twelve men (age, 19.7  $\pm$  1.23 years; body fat, 18.7  $\pm$  7.0%) performed an Acute Exercise Test (AET) before and after two weeks of supplementation with either betaine (B) (1.25g BID) or placebo (P) with a two-week washout period between treatments. Circulating (serum/plasma) GH, IGF-1, cortisol, and insulin were measured. Vastus lateralis muscle samples were analyzed for select signaling proteins (Akt, p70 S6k, AMPK).

**RESULTS:** B (vs. P) supplementation increased GH (mean  $\pm$  SD (Area Under the Curve, AUC), B: 40.72  $\pm$  6.14, P: 38.28  $\pm$  5.54,  $p = 0.060$ ) and IGF-1 (mean  $\pm$  SD (AUC), B: 106.19  $\pm$  13.44, P: 92.45  $\pm$  10.14,  $p = 0.010$ ), but decreased cortisol (mean  $\pm$  SD (AUC), B: 1149.63  $\pm$  80.83, P: 1228.53  $\pm$  130.32,  $p = 0.007$ ). There were no differences in insulin (AUC). B increased resting total muscle Akt ( $p = 0.003$ ). B potentiated phosphorylation (relative to P) of Akt (Ser473) and p70 S6k (Thr389) ( $p = 0.016$  and  $p = 0.005$ , respectively). Phosphorylation of AMPK (Thr172) decreased during both treatments (both  $p = 0.001$ ).

**CONCLUSION:** Betaine supplementation fostered an anabolic endocrine profile: increased GH and IGF-1 and decreased cortisol. This hormonal profile suggests signaling that promotes increased protein synthesis. We conclude that betaine supplementation may provide ergogenic benefit via a heightened anabolic endocrine profile that supports increases in protein synthesis.

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3554 Board #275 June 2 8:00 AM - 9:30 AM

### Magnesium Status In The Metabolic Syndrome

Stella L. Volpe, FACSM<sup>1</sup>, Lauren Forte<sup>2</sup>. <sup>1</sup>Drexel University, Philadelphia, PA. <sup>2</sup>University of Pennsylvania, Philadelphia, PA.

(No relationships reported)

Magnesium (Mg) status has been shown to be compromised in individuals with the metabolic syndrome (MetSyn) and type 2 diabetes mellitus (T2DM). Most researchers and clinicians have used serum Mg to evaluate Mg status; however, serum Mg levels are not the best indicator of Mg status. Ionized Mg, red blood cell (RBC) Mg, and urinary Mg using the Mg Loading Test (MLT) are all better markers of Mg status.



**PURPOSE:** The purpose of this study was to evaluate the Mg status, using four different methods, in individuals with the MetSyn or T2DM. This study is part of a larger clinical trial that is on-going.

**METHODS:** Participants arrived at the Clinical and Translational Research Center at the University of Pennsylvania, after an overnight fast, to be evaluated for Mg status. Serum Mg, ionized Mg, RBC Mg, and urinary Mg via the MLT were all assessed.

**RESULTS:** Our 23 participants (10 men, 13 women) were 55.6±9.9 years of age and had a body mass index (BMI) of 35.1±3.6 kg/m<sup>2</sup>. Serum Mg levels were 1.98±0.2 mg/dL (normal values 1.8 mg/dL). Ionized Mg concentrations were 0.48±0.05 mmol/L (normal values 0.5 mmol/L). RBC Mg concentrations were 1.94±0.3 nmol/L (normal values 1.5 nmol/L). Finally, MLT results were 19.12±9.8% (normal values 15.5%).

**CONCLUSIONS:** Evaluation of four methods of assessing Mg status in this small sample size of participants with MetSyn and T2DM showed that serum and RBC Mg levels were overestimated, and ionized Mg and MLT may have underestimated Mg status. However, because MLT is considered a gold standard of assessing Mg status, we conclude that ionized Mg may be the best method for analyzing Mg status, if MLT cannot be used.

Funding Support: This work supported by NIH-NIDDK 5 R21 DK 78368 02

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3555 Board #276 June 2 8:00 AM - 9:30 AM

**High Isoflavones and Magnesium as Anti-Inflammatory Agents to Enhance Performance of Aerobic and Resistance Exercise**

Brooke E. Starkoff, Robert A. DiSilvestro, Brian C. Focht, FACSM, Steven T. Devor, FACSM. *The Ohio State University, Columbus, OH.*

(No relationships reported)

Free radical accumulation initiates inflammation during exhaustive exercise and may subsequently induce fatigue through mechanisms that damage myofibrillar proteins. Protecting against free radical damage is essential in maintaining cell function. Many nutritional agents, including high isoflavone soy protein and magnesium, have claimed to aid in reducing free radical accumulation and thus delaying muscle fatigue.

**PURPOSE:** To evaluate the change in aerobic and resistance exercise performance following a 4-week nutritional intervention aimed to delay fatigue via anti-inflammatory agents. We tested the hypothesis that, compared with subjects who consumed low isoflavone soy protein (CON), those who consumed high isoflavone soy protein (HIGH) or low isoflavone combined with magnesium (MG) will see a delay in fatigue during aerobic and resistance exercise.

**METHODS:** Subjects were a subsample of young adults (18-30 years) participating in a similar study. Following an initial fitness evaluation to determine 1-repetition maximum (1RM), subjects returned to perform an exercise assessment including a 70% 1RM for chest press, biceps curl, and leg extension to exhaustion followed by 2 sets of upright rows; one set of 50 and another to fatigue. Subjects then ran 3 miles, cycled for 25 minutes, and lastly completed a 90 second step-test. Time, distance, and steps were recorded, respectively. Each subject was assigned to 1 of 3 supplement combinations containing low or high isoflavone soy protein, pumpkin seed oil, and/or magnesium glycinate to consume for 4-weeks. Subjects then returned to repeat the same pre-intervention exercise assessment.

**RESULTS:** Univariate ANOVA analysis revealed that all treatments resulted in significant, comparable pre- to post-intervention improvements in chest press, biceps curl, leg extension, cycling, and step test performance ( $p \leq 0.05$ ). Additionally, the treatment main effect for cycling performance approached significance ( $p = 0.06$ ). Post hoc analysis of change in performance revealed that the HIGH treatment resulted in superior improvement in cycling performance when compared to the CON treatment ( $d = .937$ ).

**CONCLUSIONS:** Nutritional supplementation with high isoflavone soy protein may provide an attenuation of muscle fatigue during aerobic exercise.

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3556 Board #277 June 2 8:00 AM - 9:30 AM

**25(OH)D Status is Not Related to Bone Mineral Density or Inflammatory Cytokines in Collegiate Athletes**

Regina M. Lewis, Maja Redzic, Peter B. Shores, David T. Thomas. *University of Kentucky, Lexington, KY.* (Sponsor: Jody L Clasey, FACSM)

(No relationships reported)

Vitamin D insufficiency is becoming increasingly prevalent in the athletic population, especially among athletes who primarily train and compete indoors. Studies have suggested that in some populations, including the elderly, there is an inverse relationship between 25(OH)D status and bone mineral density (BMD). Recently, suboptimal 25(OH)D levels have also been associated with increased inflammatory cytokine expression and frequency of illness and injury; variables which may be detrimental to achieving optimal athletic performance.

**PURPOSE:** As part of a novel, randomized, placebo-controlled, double-blinded, Vitamin D trial, we examined the baseline relationship between 25(OH)D, BMD, and inflammatory cytokines in 37 collegiate swimmers and 8 divers.

**METHODS:** Prior to the start of the athletic season in late August, blood was drawn to measure 25(OH)D and cytokine levels. Measures of lumbar spine (LS), proximal dual-femur, and total body BMD were obtained by DXA. Questionnaires collected dietary and lifestyle data.

**RESULTS:** Mean 25(OH)D levels were 55.6 ± 2.3 ng/mL with a range of 33 ng/mL to 93 ng/mL. Seventeen percent of the sample had 25(OH)D levels less than 40 ng/mL. Mean BMD for the proximal femur, LS, and total body were 1.27 ± 0.02 g/cm<sup>2</sup>, 1.11 ± 0.01 g/cm<sup>2</sup>, and 1.20 ± 0.1 g/cm<sup>2</sup> respectively. Correlations were examined between 25(OH)D status proximal femur BMD ( $r = -0.08$ ;  $p = 0.96$ ), LS BMD ( $r = 0.09$ ;  $p = 0.53$ ), and total body BMD ( $r = -0.11$ ;  $p = 0.47$ ). Mean concentration of TNF-alpha was 10.98 ± 1.38 pg/ml and IL-6 was 4.0 ± 1.38 pg/ml. Correlations were examined between 25(OH)D status and TNF-alpha ( $r = -0.05$ ;  $p = 0.76$ ), and IL-6 ( $r = -0.11$ ;  $p = 0.48$ ).

**CONCLUSION:** While these findings are preliminary in nature, they demonstrate no significant relationship between 25(OH)D and bone or cytokine measures in athletes who primarily train and compete indoors. Perhaps preseason resistance and dry-land training have a stronger association with these measures in this population. Additional studies are needed to determine if season-long Vitamin D supplementation can improve body composition, decrease inflammation, and improve overall health in Vitamin D insufficient indoor athletes.

Supported by Grant UL1RR033173

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3557 Board #278 June 2 8:00 AM - 9:30 AM

**The Effects of 4 Weeks Vitamin D3 Supplementation on Athletic Performance**

Adrian B. Hodgson<sup>1</sup>, Andrew J. Ingham<sup>2</sup>, Jonathon Martin<sup>1</sup>, Timothy Roberts<sup>1</sup>, Asker E. Jeukendrup<sup>1</sup>. <sup>1</sup>University of Birmingham, Birmingham, United Kingdom.

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(No relationships reported)

**BACKGROUND:** Vitamin D deficiency is a growing pandemic worldwide. Growing evidence in the elderly has shown that individuals with a higher vitamin D status (>75nmol/L) exhibit improved musculoskeletal performance. However it is unknown whether improving vitamin D status in athletes' leads to improved athletic performance.

**PURPOSE:** To investigate the effects of 4 weeks vitamin D3 supplementation on a number of indicators of aerobic and anaerobic performance as well as muscle strength.

**METHODS:** 36 endurance trained male cyclists/triathletes (Age 39±8y, Height 1.80±0.66m, Weight 76.3±6.2kg, VO<sub>2</sub> max 60.0±3.8 ml/kg/min) were recruited and randomly assigned into one of four supplementation groups: Placebo (PLA), 1500IU D3/d, 3000IU D3/d and 6000IU D3/d, lasting for 4 weeks, as part of a double blind study design. Athletes reported to the lab for 2 days of performance testing pre and post supplementation, including VO<sub>2</sub> max test, 1 repetition max single leg strength test (1RM), maximal voluntary contraction hand grip test, 1 hour time trial and repeated Wingate tests. All data collection was performed at latitude of 52°29'N, between December and March.

**RESULTS:** Pre supplementation, 53% and 33% of athletes were vitamin D deficient (>50 nmol/L) and insufficient (50-75 nmol/L) respectively. Vitamin D supplementation caused 25(OH)D to increase to a sufficient status (>75 nmol/L), while those receiving PLA saw small non significant changes to 25(OH)D. Small significant improvements in 1 RM leg extension for those athletes receiving 6000IU were observed on both the dominant (5.3±1.4kg (6000IU) and 2.0±1.9kg (PLA)  $p < 0.05$ ) and non dominant leg (5.8±1.0kg (6000IU) and 1.5±1.8kg (PLA)  $p < 0.05$ ). Furthermore there was a tendency for peak power output to improve during the wingate test for 3000IU/d and 6000IU/d, however this difference did not reach significance. For the remaining performance tests no difference was observed.

**CONCLUSIONS:** The study shows that 4 weeks vitamin D supplementation, above the currently debated IOM RDI 600IU/d, can improve vitamin D status in athletes. Small significant improvements in 1RM leg extension performance were observed at the highest dose. Based on these results it could be argued that the potential benefits of vitamin D to athletic performance may be specific to resistance based exercise.

3558 Board #279 June 2 8:00 AM - 9:30 AM

**Vitamin D Status, Adiposity and Performance Measures in College-Aged Students**

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(No relationships reported)

Studies suggest that increased serum concentrations of 25-hydroxyvitamin D (25-OHD) are associated with slowing the development of many age-related chronic diseases. Recent data supports a positive relationship between 25-OHD and muscle synthesis, strength, power and decreased body fat in elderly individuals. However, these findings have not been consistently replicated in younger, healthy populations.

**PURPOSE:** To investigate the relationship between 25-OHD levels, body composition, measures of aerobic fitness and muscular strength and power in a young, physically active population.

**METHODS:** Twenty-six subjects (9 male, 17 female, 23.4 ± 3.9 years old) reported to the lab six times for testing. Blood was drawn to determine 25-OHD concentrations using an ELISA. Primary outcomes included: Body composition (DXA); resting metabolic rate, VO<sub>2</sub>max, power output (Wingate); and strength (8RM of bench press, upright row, leg extension and leg flexion). While our primary analysis included all participants, we also performed a sub-group analysis on those individuals considered to be sub-optimal or lower (<30 ng/mL); LOW (n=11, 22.15 ± 0.85 ng/mL) and HIGH (n=15, 40.59 ± 2.51 ng/mL).

**RESULTS:** Overall, we observed no significant correlations between 25-OHD and any major outcome variables. While the HIGH 2-OHD group showed a positive correlation between RMR and 25-OHD status (r = .622; p<.05), neither group showed a significant correlation between 25-OHD levels and our other designated outcomes.

**CONCLUSIONS:** RMR was significantly correlated with 25-OHD status in individuals with normal 25-OHD levels, indicating there may be an underlying mechanism relating 25-OHD to body composition and increased energy expenditure.

3559 Board #280 June 2 8:00 AM - 9:30 AM

**Vitamin D Status among Norwegian National Team Athletes Living at Latitude 60°N**

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(No relationships reported)

There is increasing evidence that many athletes are vitamin D deficient. Athletes at risk are those participating in indoor sports, those living at higher latitudes and those with dark-pigmented skin. The high latitude of Norway indicates that vitamin D status is a concern among Norwegian athletes. Vitamin D deficiency may have severe health consequences including risk of bone injuries. Additionally it is discussed whether vitamin D deficiency affects performance and the athlete's ability to train effectively through its impact on muscle function and the immune system.

**PURPOSE:** 1) To determine the vitamin D status of Norwegian national team athletes living at latitude 60°N; and 2) to evaluate training (outdoor vs indoor) and dietary factors affecting their vitamin D status.

**METHODS:** Athletes representing national teams were invited to participate in the study. Blood tests were analysed for serum 25-hydroxyvitamin D (25(OH)D). Serum 25(OH)D levels were defined as deficient (<50 nmol/L); insufficient (<80 nmol/L); and sufficient (>80 nmol/L). Vitamin D intake were calculated from 7-day weighed food records using a computerized nutrient database.

**RESULTS:** Fifty-five women (mean±SD: 24±4 yrs) and 78 men (24±3 yrs) participated. Mean 25(OH)D-level was 82±30 nmol/L. Seventeen (13%) athletes had levels consistent with vitamin D deficiency (range: 15-49 nmol/L), 47 (25%) had levels defined as insufficient and 69 (52%) had levels defined as sufficient (80-162 nmol/L). Athletes training outdoors (n=108) had higher 25(OH)D-levels than athletes training indoors (n=25), 85±25 vs 69±34 nmol/L (p=0.02). Mean vitamin D intake was 5.3±3.4 µg (0.6-8.0 µg), and 85% (n=113) did not meet the RDA of 7.5 µg vitamin D in Norway.

**CONCLUSIONS:** The mean 25(OH)D-level of athletes living at altitude 60°N were within sufficient levels, still half of the athletes had levels regarded as deficient or insufficient. Due to these results, we recommend screening of vitamin D deficiency in Norwegian athletes. Athletes training outdoors had significant higher 25(OH)D-level than those training indoors, suggesting further research on the sun exposure effect on vitamin D status in athletes living at high altitudes. In general Norwegian athletes should be recommended to increase their vitamin D intake to meet the RDA.

3560 Board #281 June 2 8:00 AM - 9:30 AM

**Micronutrient Intake In Young Athletes**

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(No relationships reported)

A balanced diet is important to maintain growth, health and athletic performance. Adequate micronutrient intake in athletes is required to prevent nutrient deficiencies and concomitant diseases. However, little is known about habitual micronutrient intake of young German athletes.

**PURPOSE:** To analyze micronutrient intake of young German athletes and to identify micronutrients where supply is crucial.

**METHODS:** 252 young German athletes were included in the study (55 % male; 12 ± 1 yrs; 158 ± 9 cm; 46 ± 9 kg; 20 ± 4 % body fat). Dietary intake was recorded for three days using a validated dietary protocol. Intake of 25 micro nutrients was analyzed based on the German Food Database. Micronutrient intake was compared with German recommended daily intake (RDI) for children. Data are given in mean ± SD. Student's t-test was used to test for differences between genders (α=0.05).

**RESULTS:** Intake of folic acid, vitamin E and iron was significantly higher in males than in females (p<0.05; table 1). No male and only 2 females reached RDI for folic acid. RDI for vitamin D was not achieved by 96 % of males and 95 % of females. Fluoride intake was below RDI in 98 % of all athletes. Two thirds of females did not reach RDI for iron. Overall, males did not reach RDI of 7 ± 3 micronutrients, and females failed to meet RDI of 8 ± 4 of the 25 micronutrients analyzed (p=0.016).

**CONCLUSION:** Crucial amounts of intake were identified for folic acid, vitamin D, vitamin E, iodine and fluoride. Therefore, intake of those micronutrients must be increased. In addition should be discussed if implementation of nutritional education programs can lead to a higher micronutrient supply.

Table 1: Extract of critical micro nutrient intake of male and female young German athletes

| Micro nutrient    | Males       |          | Females     |          | p-values |
|-------------------|-------------|----------|-------------|----------|----------|
|                   | Mean Intake | % of RDI | Mean Intake | % of RDI |          |
| Folic acid [µg/d] | 232 ± 62    | 58 ± 16  | 211 ± 61    | 53 ± 15  | 0.010    |
| Vitamin D [µg/d]  | 2.2 ± 1.4   | 44 ± 28  | 2.2 ± 1.5   | 44 ± 30  | 0.928    |
| Vitamin E [mg/d]  | 12.2 ± 4.3  | 94 ± 33  | 10.7 ± 3.7  | 97 ± 34  | 0.004    |
| Fluoride [µg/d]   | 934 ± 342   | 47 ± 17  | 873 ± 347   | 44 ± 17  | 0.164    |
| Iodine [µg/d]     | 109 ± 39    | 61 ± 22  | 105 ± 43    | 58 ± 24  | 0.356    |
| Iron [mg/d]       | 15.1 ± 4.0  | 126 ± 33 | 14.0 ± 3.6  | 93 ± 24  | 0.014    |

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3561 Board #282 June 2 8:00 AM - 9:30 AM

**Low UV Index Does Not Increase The Risk Of Stress Or Lower Limb Fractures**

Scott J. Montain, FACSM<sup>1</sup>, Susan M. McGraw<sup>1</sup>, Matthew R. Ely<sup>1</sup>, Tyson Grier<sup>2</sup>, Joseph J. Knapik, FACSM<sup>2</sup>. <sup>1</sup>US Army Research Institute of Environmental Medicine, Natick, MA. <sup>2</sup>US Army Public Health Command, Aberdeen Proving Ground, MD.  
(No relationships reported)

Low vitamin D status increases the risk of stress fractures. As Ultraviolet (UV) light is required for vitamin D synthesis, low UV light availability is thought to increase the risk of vitamin D insufficiency and poor bone health.

**PURPOSE:** To determine if individuals with low UV intensity at their home of residence are at increased risk of developing stress and lower limb fractures during Army Basic Combat Training (BCT).

**METHODS:** A retrospective cohort study utilized the Armed Forces Health Surveillance Center data repository. Basic trainees were identified from January 1997 to January 2007. Cases were recruits diagnosed with stress and lower limb fractures during BCT. The recruit's home of record (HOR) was identified from the Defense Manpower Data Center database. The average annual UV intensity at the recruits' HOR was determined using a U.S National Weather Service database and stratified into low (0-3.9); moderate (4.0-5.4), and high (5.5+) UV index regions.

**RESULTS:** The dataset had 553,078 males and 117,948 females. There were 211,603, 243,637 and 215,786 recruits in the low, moderate and high UV index regions, respectively. Compared to men, females had greater risk of developing stress fractures (odds ratio (OR)= 4.3, 95%CI= 4.2-4.4, p<0.01). Contrary to the hypothesized effect, male and female recruits from low UV index areas had a slightly lower risk of stress fractures (male OR (low UV/high UV)= 0.92, 0.87-0.97; females OR= 0.89, 0.84-0.95, p<0.01) and were at similar risk for lower limb fractures (male OR= 0.97, 0.88-1.06; female OR= 0.95, 0.81-1.10) than recruits from high UV index areas. Blacks had lower risk of stress and lower limb fractures than non-blacks, and there was no indication that Blacks from low UV areas were at increased risk for bone injuries.

**CONCLUSIONS:** The UV index at home of record is not predictive of stress or lower limb fractures in BCT. These data indicate that solar intensity is not a risk factor for poor bone health in young USA adults.

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**G-44 Free Communication/Poster - Neuroscience - Cognition**

JUNE 2, 2012 7:30 AM - 11:00 AM

ROOM: Exhibit Hall

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3562 Board #283 June 2 9:30 AM - 11:00 AM

**Behavioral and Electrophysiological Performance during Task Switching in College Students with Different Cardiorespiratory Fitness Levels**

Fu-Jie Kang<sup>1</sup>, Chia-Liang Tsai<sup>2</sup>, Feng-Ying Chou<sup>3</sup>, Tzu-Chi Chen<sup>2</sup>. <sup>1</sup>Kaohsiung Chang Gung Memorial Hospital of the Chang Gung Medical Foundation, kaohsiung, Taiwan. <sup>2</sup>National Cheng Kung University, Tainan, Taiwan. <sup>3</sup>Chi Mei Medical Center, Tainan, Taiwan.  
(No relationships reported)

In contrast to the many studies examining the behavioral and neural indexes of cognitive functioning in individuals with different physical activity levels, there is a lack of research focused on the relationship between cardiorespiratory fitness and behavioral and event-related potential (ERP) performance of cognitive processing.

**PURPOSE:** The current study was to investigate whether individuals with higher cardiorespiratory fitness had better executive control function during task switching using a behavioral measure (i.e., reaction time, RT) and the P3 component.

**METHODS:** Thirty-eight male college students were separated into high fitness (n=19, VO<sub>2max</sub>=58.17±6.06 mL\*kg<sup>-1</sup>\*min<sup>-1</sup>) and low fitness (n=19, VO<sub>2max</sub>=36.17±4.09 mL\*kg<sup>-1</sup>\*min<sup>-1</sup>) groups on the basis of their cardiorespiratory fitness by measuring maximal oxygen consumption. Participants simultaneously performed a task switching paradigm which consisted of two conditions: a pure task condition (e.g., 111111...222222...) and a mixed-task condition (e.g., 112211...) with concomitant electrophysiological recording. Behavioral performance and ERP measures were separately submitted to a mixed-model analysis of variance (ANOVA).

**RESULTS:** A conditional difference (i.e., switching cost) on RT was observed for the high fitness (34.46±49.07ms) and low fitness (80.52±73.68ms) groups (both p<.05), but the main effect of group did not reach significance. In terms of the electrophysiological characteristics, although there was no significant difference between both groups with regard to P3 latency, the P3 amplitude was significantly larger in the high fitness (7.26±5.01µV) group than in the low fitness (3.97±2.71µV) one (p<.05). In addition, the P3 amplitude during the pure task condition (6.43±4.31µV) was larger compared to the mixed-task condition (3.97±2.71µV) only for the low fitness group (p<.05).

**CONCLUSION:** Male college students with higher cardiorespiratory fitness exhibited better neurophysiological performance with regard to executive control function as represented by the task switching paradigm.

**Keywords:** cardiorespiratory fitness, college student, event-related potential, task switching

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3563 Board #284 June 2 9:30 AM - 11:00 AM

**Ambulatory Status in Multiple Sclerosis is Linked to Disease Progression and Brain Atrophy**

Anette S. Fjeldstad<sup>1</sup>, Hanieh Seraj<sup>1</sup>, Monica Rojas<sup>1</sup>, Dee Husebye<sup>1</sup>, Noel G. Carlson<sup>2</sup>, John W. Rose<sup>1</sup>. <sup>1</sup>University of Utah, Salt Lake City, UT. <sup>2</sup>VA Medical Center, Salt Lake City, UT.  
(No relationships reported)

Progressive disability is prevalent in patients with multiple sclerosis (MS) and frequently impacts ambulatory status. Improving knowledge of the disease progression in MS may advance treatment strategies and facilitate clinical assessment of the degree of central nervous system (CNS) degeneration.

**PURPOSE:** The objective of these studies is to examine the relationship between brain atrophy, disease progression, and ambulatory status in MS patients.

**METHODS:** A total of 398 MS patients participating in the Intermountain MS Project were classified by disease course (310 Relapsing Remitting (RR-MS); 88 Primary Progressive (PP-MS) & Secondary Progressive (SP-MS)) and ambulatory status (unassisted, assisted or wheelchair). Brain MRI scans were reviewed for all patients to determine which individuals demonstrated a high degree of atrophy of either or both of the cerebral hemispheres and corpus callosum. Correlations between brain atrophy with disease course and ambulatory status were evaluated.

**RESULTS:** Two significant associations were observed among these patients. First, patients with progressive forms of the disease (PP-MS, SP-MS) had a higher incidence of brain atrophy (43%) than RR-MS patients (17%) (p < 0.0001 (Fisher's Exact Test)). Second, patients that required ambulatory assistance (or wheelchair) had a significantly higher incidence of brain atrophy (42%) than unassisted patients (15%) (p < 0.0001).

**CONCLUSIONS:** There was a significant relationship between brain atrophy, disease progression and ambulatory status. These results suggest that incidence of brain atrophy is associated with disease progression (PP-MS, SP-MS) and an enhanced need for ambulatory assistive devices. Neurodegenerative processes are implicated as a contributor to disability in this patient population and may be associated with other biomarkers of disease progression.

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3564 Board #285 June 2 9:30 AM - 11:00 AM

**The Intensity And Amount Of Daily Physical Activity Necessary For Maintaining The Neurocognitive Function**

Ken Kimura<sup>1</sup>, Akitomo Yasunaga<sup>2</sup>, Kohei Sato<sup>3</sup>, Ai Hirasawa<sup>3</sup>, Yukihiko Ito<sup>4</sup>. <sup>1</sup>Tokyo Denki University, Tokyo, Japan. <sup>2</sup>Bunka Gakuen University, Tokyo, Japan. <sup>3</sup>Japan Women's College of Physical Education, Tokyo, Japan. <sup>4</sup>FANCL Research Institute, Yokohama, Japan.  
(No relationships reported)

**PURPOSE:** Recently, there has been emerging evidence that a regular physical exercise program can reduce neurocognitive attenuation caused by aging in elderly people. Likewise, it has been reported that daily physical activity also has an important role in regards to maintaining cognitive health in the elderly. However, it is still not clear exactly what intensity and amount of daily physical activity are most effective in guarding against neurocognitive decline. The present study conducted a cross-sectional assessment to define the intensity and amount of daily physical activity which would have a favorable influence on neurocognitive function.

**METHODS:** More than 100 people aged over 60 years old participated in this study. They wore an electronic accelerometer throughout their waking hours for a month or more to assess the amount and intensity of their individual daily physical activity. This recorded the number of steps per day and the duration per day as one of ten intensity levels (0.5, 1 to 9). Executive cognitive function was evaluated with a task-switching reaction time (RT) test measuring percent RT increase in the switching task, correct response rate, and intra-individual coefficient of variation (ICV).

**RESULTS:** Within this study, stepwise multiple regression analysis revealed that the amount of 4 Mets intensity of daily physical activity could have a positive influence on the executive performance (i.e., explained 29.3% of the variance in ICV (p=.012)).

**CONCLUSIONS:** The present study's data suggests that moderate physical activity in daily life maintains proper neurocognitive function. In this study, we will confirm the validity of the results by using further analysis taking into account latent confounders such as physical fitness level, QOL, social and cognitive activity, and nutrition.

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3565 Board #286 June 2 9:30 AM - 11:00 AM

**Effects of Acute Exercise on Visuospatial Attention in Undergraduates with Different Levels of Cardiopulmonary Fitness**

Chia-Liang Tsai<sup>1</sup>, Tzu-Chi Chen<sup>1</sup>, Feng-Ying Chou<sup>2</sup>, Yu-Ting Tseng<sup>1</sup>, Meng-Chih Hsieh<sup>1</sup>. <sup>1</sup>National Cheng Kung University, Tainan, Taiwan. <sup>2</sup>Chi Mei Medical Center, Tainan, Taiwan.  
(No relationships reported)

To date, no study has examined the effects of acute exercise on covert orienting of a visuospatial attention task in undergraduate students with different levels of cardiopulmonary fitness.

**PURPOSE:** The aim of the present study was to assess the effects of acute exercise on executive function using the endogenous Posner paradigm by comparing behavioral (e.g., reaction time, RT) and event-related potential (ERP) performance.

**METHODS:** Twenty-eight undergraduate students aged 18-24 years were assessed by a continuous graded maximal exercise test to identify their cardiorespiratory fitness and divided into high-cardiopulmonary (n=14) and low-cardiopulmonary (n=14) groups. All undergraduate students performed the endogenous Posner paradigm task with ERP recording before and after a 30-min bout of acute exercise. The behavioral and ERP performances in the pre-exercise session were taken as the baseline and compared with those in the post-exercise session in both groups. The behavioral and ERP results were subjected separately to repeated measures ANOVA. A level of p < .05 was accepted as statistically significant.

**RESULTS:** In the pre-exercise session, the low-cardiopulmonary group had significantly longer RT (278.89±48.03 vs. 236.40±27.93ms, p<.05) and smaller P3 amplitude (8.09±4.88 vs. 11.59±3.47µV, p<.05) than the high-cardiopulmonary group. After acute exercise, the high-cardiopulmonary group showed faster RT (236.40±27.93 vs. 216.13±23.10ms, p<.05) and greater P3 amplitude (11.59±3.47 vs. 14.26±4.26µV, p<.05) as compared to in the pre-exercise session. However, the low-cardiopulmonary group only exhibited the effect of acute exercise on the RT (278.89±48.03 vs. 257.11±33.50ms, p<.05).

**CONCLUSION:** These findings showed that behavioral performance could be improved in the Posner paradigm task in undergraduate students with low- and high-cardiopulmonary fitness. However, the electrophysiological signal was only significantly affected in the undergraduate students with high-cardiopulmonary fitness.

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3566 Board #287 June 2 9:30 AM - 11:00 AM

**Measurement of Attention from a Cognitive Neuroscience Perspective: An Essential Element of Human Performance**

Bartlett A.h. Russell, Fallon Goodman, Brad D. Hatfield, FACSM. University of Maryland, College Park, College Park, MD. (Sponsor: Bradley D. Hatfield, FACSM)  
(No relationships reported)

**PURPOSE:** Cognitive reserve, or the amount of residual neural processing capacity available to attend to unexpected stimuli and contexts, is a critical component of adaptive human performance and may be inversely related to primary task load. The purpose of this study was to find an objective measure of cognitive reserve, which would provide a way to study how factors such as expertise, stress, and personality types affect performance in sporting contexts.

**METHODS:** To objectively index cognitive reserve, Electroencephalography (EEG) was used to record brain responses to task-irrelevant sounds in 21 healthy adults while they completed "Easy" and "Difficult" serial subtraction tasks. Auditory probes were standard (180ms complex tone + 520ms of silence) and deviant (100ms complex tone + 600ms of silence) sounds played in a pseudorandom, 80/20 "Oddball" ratio. EEG was time-locked to tone onset and averaged to examine differences in the Event Related Potential (ERP) waveforms in each condition. It was predicted that as task difficulty increased, the amplitude of the attention-sensitive P2 component would decrease, reflecting a decrease in cognitive reserve.

**RESULTS:** As expected, as primary task difficulty increased, percent accuracy (F(2,17) = 32.55, p < 0.001) and number of subtractions attempted (F(2,17) = 172.63, p < 0.001) decreased. Though plots show decreased P2 amplitude in the Difficult compared to the Easy task condition, contrary to prediction, the difference was not significant (F(1,16) = 1.108, p = 0.308). Additionally, plots show a depression in later potentials in the Difficult compared to the Easy condition, that was closer to, but also failed to reach significance (F(1,16) = 2.781, p = 0.115).

**CONCLUSIONS:** This study failed to distinguish between conditions and was thus unable to index cognitive reserve. This may be partly because the self-paced tasks allowed participants to adjust speed as difficulty changed, thus limiting differences between conditions. Future studies should control pacing to determine whether this method may still provide a useful metric for gauging cognitive reserve in various human performance contexts.

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3567 Board #288 June 2 9:30 AM - 11:00 AM

**An fMRI Investigation of the Relationship Between Physical Activity and Executive Function in Older Adults**

Katie Becofsky<sup>1</sup>, Gerhild Ullmann<sup>2</sup>, Roger Newman-Norlund<sup>1</sup>, Harriet G. Williams<sup>1</sup>. <sup>1</sup>University of South Carolina, Columbia, SC. <sup>2</sup>Clemson University, Clemson, SC. (Sponsor: Sara Wilcox, FACSM)  
(No relationships reported)

**PURPOSE:** The purpose of this study was to test whether cognitive executive function and level of physical activity are related in healthy older adults. We predicted that the self-reported level of physical activity would be positively correlated with the intensity of brain activation recorded during the execution of a task requiring executive function.

**METHODS:** A sample of older adults (n=12, 75% female, mean age=70 +/- 5.7) underwent an initial session in which they completed the Physical Activity Scale for the Elderly based on their physical activity behavior during the previous week. Each subject completed computer-based versions of two executive function tasks, Trail Making Test A & B, while undergoing functional magnetic resonance imaging (fMRI).

**RESULTS:** First, we examined the contrast (Trails B - Trails A) in order to identify cortical sites specifically involved in cognitive flexibility and inhibition, two important components of executive function. A large cluster of voxels (306) in the left inferior frontal gyrus (brodmann's area 47; coordinates -50, 38, 10) was significantly more active during execution of the Trails B as compared to the Trails A task ( $t=6.6$ ,  $p < .001$ ). A smaller cluster (19 voxels) in the left premotor cortex (brodmann's area 6; coordinates -60, 6, 12; 19 voxels) was also more active during execution of the Trails B task ( $t=5.25$ ,  $p < .001$ ). Subsequent correlational analyses examining the relationship between the strength of these activations and self-reported physical activity were not significant ( $r = .36$  and  $r = .28$  for brodmann's area 6 and 47, respectively).

**CONCLUSIONS:** In healthy older adults, cognitive flexibility and inhibition were associated with increased activity in the left inferior frontal gyrus and left premotor cortex. Brain activity recorded during execution of an executive functioning task was not significantly correlated with self-reported physical activity. Future studies might use a larger sample size and/or adopt objective measures of physical activity to examine the association between physical activity and executive function in healthy older adults.

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**3568** Board #289 June 2 9:30 AM - 11:00 AM

**Cardiorespiratory Fitness and the Effects of Acute Exercise on Executive Function in Young Adults**

Feng-Ying Chou<sup>1</sup>, Chia-Liang Tsai<sup>2</sup>, Tzu-Chi Chen<sup>2</sup>, Yu-Ting Tseng<sup>2</sup>. <sup>1</sup>Chi Mei Medical Center, Tainan city, Taiwan. <sup>2</sup>National Cheng Kung University, Tainan city, Taiwan.

(No relationships reported)

Few studies have assessed the relationship between cardiorespiratory fitness and event-related potential with regard to executive functioning, and thus the current findings are somewhat inconclusive.

**PURPOSE:** The aim of this study was to examine cardiorespiratory fitness and the effects of acute moderate aerobic exercise on executive function by comparing behavioral and electrophysiological performance in young adults.

**METHODS:** After using a graded maximal exercise test to measure cardiorespiratory fitness by assessing maximal oxygen uptake, twenty-eight young male adults were classified into high fitness ( $n=14$ ,  $VO_{2max}=57.69\pm 6.84$  mL\*kg<sup>-1</sup>\*min<sup>-1</sup>) and low fitness ( $n=14$ ,  $VO_{2max}=37.24\pm 3.53$  mL\*kg<sup>-1</sup>\*min<sup>-1</sup>) groups. Each participant performed a task switching paradigm, which included a pure task condition with a repeated single task (e.g., AAAAAA...) and a mixed-task condition with different tasks using an alternating-runs paradigm (e.g., AABBA...), before and after a 30-min session of acute exercise on a treadmill with a carefully controlled workload intensity (60%  $VO_{2max}$ ) while the behavioral and electrophysiological indices were collected. A mixed-model analysis of variance (ANOVA) was used to analyze reaction time (RT), P3 latency, and P3 amplitude.

**RESULTS:** A smaller switching cost on RT was only shown for the high fitness group relative to the low fitness group in the post-exercise session (18.85±45.68 vs. 64.45±67.68 ms,  $p<.05$ ). The P3 amplitude in the high fitness group was significantly larger in the post-exercise session compared to the pre-exercise one (8.30±5.73 vs. 6.51±5.33  $\mu$ V,  $p<.05$ ) in the mixed-task condition. In addition, in the post-exercise session, the P3 amplitude was significantly larger for high fitness group relative to the low fitness one (8.30±5.73 vs. 4.90±4.43  $\mu$ V,  $p<.05$ ).

**CONCLUSION:** Based on the behavioral performance results, high fitness adults demonstrated a more efficient executive function than the low fitness ones in the post-exercise session. In addition, the acute exercise used in this work improved the electrophysiological performance of the higher fitness adults when performing the task switching paradigm.

**Keywords:** cardiorespiratory fitness, acute exercise, executive function, task switching, event-related potential

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**G-45 Free Communication/Poster - Sports Equipment**

JUNE 2, 2012 7:30 AM - 11:00 AM

ROOM: Exhibit Hall

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**3569** Board #290 June 2 8:00 AM - 9:30 AM

**Practice With A Prophylactic Brace Alters Knee Flexion During a Run Stop Jump Task**

Jeff Nessler, Natalie Terwilliger, Andres Lopez, Trevor Long-Anastasia, Jacob Studer. California State University, San Marcos, San Marcos, CA.

(No relationships reported)

Anterior cruciate ligament (ACL) injuries are among the most prevalent in sports. Previous study has related decreased knee flexion at specific points during athletic maneuvers with increased likelihood of ACL injury, and a knee brace that promotes increased knee flexion might therefore contribute to reduced risk. Unfortunately, athletes may be hesitant to wear a prophylactic knee brace during competition. These individuals may therefore benefit from a brace that can promote motor learning such that athletes demonstrate increased knee flexion even when the brace is not worn.

**PURPOSE:** To determine whether one week of practice with a knee extension constraint brace can promote increased knee flexion while un-braced at the instant of greatest ground reaction force (GRF) during a run-stop-jump (RSJ) task.

**METHODS:** Seventeen recreationally active athletes performed 3 RSJ tasks both with and without the knee brace (6 trials total). Ten subjects then took their brace home and were instructed to use it for at least 3 hours over 3 exercise sessions throughout the following week. The remaining 7 subjects did not use the brace during the week. All subjects returned one week later and repeated the 6 RSJ tests. Data were acquired via eight camera Vicon motion capture system and two Bertec force platforms, and were analyzed using custom routines written in MATLAB.

**RESULTS:** When the second visit was compared to the first for subjects who wore the brace throughout the week, knee flexion angle was increased at the instant of greatest GRF during the RSJ trials in which the brace was not worn, though this increase was not significant (34.49±13.48° vs 51.99±15.86°,  $p=0.109$ ). No change in knee angle at the instant of greatest GRF was noted for the control group. Both groups demonstrated significant increases in knee flexion at the instant of touch down during the push off phase of the jump (14.5±11.62 vs. 23.46±17.01,  $p=0.046$  for both groups combined).

**CONCLUSIONS:** These data suggest that a knee extension constraint brace has potential for use as a training tool in teaching athletes to avoid movements that might place them at higher risk for ACL injury. While initial results are promising, future study with additional subjects and more specific training regimens will be useful for understanding these effects in greater detail.

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**3570** Board #291 June 2 8:00 AM - 9:30 AM

**The Effects of Ankle Support on Kinematics and Kinetics of Maximal Vertical Jumping Performance**

Justus D. Ortega, James H.N. Kealialio. Humboldt State University, Arcata, CA.

(No relationships reported)

Evidence suggests that ankle support such as adhesive tape and ankle braces restrict range of motion at the ankle joint. However, it is unclear how ankle support may affect functional performance.

**PURPOSE:** To investigate the effects of prophylactic ankle support on the kinematics and kinetics of the lower limbs during vertical jumping performance.

**METHODS:** Kinematic and kinetic data were collected for 12 healthy young NCAA Division II Collegiate female athletes (age 22.3 ± 3.6 yrs, mass 65.8 ± 9.4 kg) jumping without ankle support and with two different types prophylactic ankle supports (ankle stabilizing orthosis brace and closed Gibney basket weave ankle tape). For each of the three conditions, subjects performed three maximal height jumps with five minutes rest between each jump. For each jump, maximum center of mass (CoM) jump height was measured using a force platform. In addition, we used digital motion capture and force platform data to quantify ankle, knee, and hip joint angle, torque, and power output. We used a MANOVA to determine statistical differences due to ankle support.

**RESULTS:** Center of mass jump height were similar between the two ankle support conditions (tape = 53.5 ± 7.1 cm and brace = 52.0 ± 7.3 cm) and the “no support” condition (51.2 ± 7.0 cm, p=0.506). However, maximal plantar flexion motion during the force phase of the jump was reduced by approximately 23% in both ankle support conditions (24° ± 6) compared to the “no support” condition (31° ± 7; p=0.016) without affecting maximum joint torque and power generation at the ankle, knee or hip joints (Table 1).

**CONCLUSION:** The results of this study suggest that the use of prophylactic ankle support effectively reduces excessive ankle motion without compromising jump performance.

Lower limb kinematics and kinetic during maximum height jumping

|                               | No Brace |      | ASO Brace |      | Tape |      |
|-------------------------------|----------|------|-----------|------|------|------|
|                               | Mean     | SD   | Mean      | SD   | Mean | SD   |
| Peak Ankle Plantarflexion (°) | 32       | 6    | 24        | 8    | 24   | 6    |
| Peak Knee Extension (°)       | 7        | 4    | 3         | 6    | 3    | 5    |
| Peak Hip Extension (°)        | 10       | 7    | 11        | 6    | 10   | 7    |
| Peak Ankle Moment (Nm/kg)     | 3.5      | 2.0  | 3.7       | 1.4  | 4.0  | 1.0  |
| Peak Knee Moment (Nm/kg)      | 0.85     | 0.91 | 0.89      | 0.81 | 1.0  | 0.87 |
| Peak Hip Moment (Nm/kg)       | 3.7      | 1.5  | 3.9       | 1.5  | 3.9  | 1.0  |
| Peak Ankle Power (Watt/kg)    | 26.6     | 18.2 | 23.9      | 13.5 | 28.9 | 12.5 |
| Peak Knee Power (Watt/kg)     | 11.1     | 8.7  | 9.2       | 5.2  | 11.6 | 5.5  |
| Peak Hip Power (Watt/kg)      | 15.5     | 7.3  | 19.1      | 11.5 | 17.0 | 7.2  |

**3571 Board #292 June 2 8:00 AM - 9:30 AM**

**A Commercialized Mouthguard Material Compared to a Family of Novel Thermosetting Materials**

Trenton E. Gould, Olivia D. McNair, Scott G. Piland, Daniel A. Savin. *The University of Southern Mississippi, Hattiesburg, MS.* (Sponsor: Michael J. Webster, FACSM)

(No relationships reported)

Mouthguards have been shown to provide a protective effect against orofacial injury. However, the most common material (i.e., ethylene vinyl acetate or EVA) has been demonstrated to have mechanical and thermal performance limitations.

**PURPOSE:** To synthesize two novel thiol-ene networks (TENs) and compare their physical, mechanical and thermal characterizations to a commercial, EVA-based (EVA), mouthguard material

**METHODS:** The durometer hardness, water absorption, tear strength, impact attenuation, glass transition, loss modulus, and storage modulus of the EVA and synthesized mouthguard materials were tested according to ASTM guidelines. Thermal measurements were acquired with standard differential scanning calorimetry (DSC) and dynamic mechanical analysis (DMA) techniques. Tests were conducted on 5 separate specimens at both room 23 ± 2°C and intra-oral 37 ± 2°C temperatures. Several 2 (temperature) X 3 (material) factorial ANOVAs were conducted with Tukey HSD post-hoc tests as necessary.

**RESULTS:** DSC results noted different mean glass transition temperatures (F2,12 = 10119.64, p < .05) between the materials. A Tukey HSD post hoc test revealed two homogeneous subsets with EVA as sole membership in one group and AMTEN and UMTEN as members of the second group. DMA results confirmed the finding (F2,12 = 3911.13, p < .05) and follow-up results. Mean hardness decreased at a greater rate (F2,24 = 20.29, p < .05) for UMTEN than it did for either AMTEN or EVA at approximate intra-oral temperature. Water absorption rate between temperatures was equivocal for UMTEN and EVA and higher (F2,24 = 43.77, p < .05) for AMTEN. The rate of decrease in tear strength was greater (F2,24 = 67.75, p < .05) for UMTEN than for AMTEN or EVA at the elevated temperature. The mean impact resistance increased for EVA and decreased for AMTEN and UMTEN materials (F2,24 = 113.65, p < .05) at intra-oral temperature.

**CONCLUSIONS:** Urethane-based TENs are promising as a thermosetting class mouthguard material with values matching or exceeding those obtained by EVA-based mouthguard materials across multiple types of physical, mechanical, and thermal tests. In order to abate orofacial injury, it is important to continue making strides in novel material development and testing to offer the best protection possible.

**3572 Board #293 June 2 8:00 AM - 9:30 AM**

**Performance Effects of a Self-Adapted Jaw Repositioning Mouthguard in Male Athletes**

Devon L. Golem, Shawn M. Arent, FACSM. *Rutgers University, New Brunswick, NJ.*

(No relationships reported)

Previous evidence suggests that jaw repositioning mouthguards may improve anaerobic performance. However, the technical and expensive process of development often limits accessibility of these ergogenic aids. Manufacturers have attempted to produce a more affordable, self-adapted (SA) jaw repositioning mouthguard.

**PURPOSE:** To determine the effects of a SA jaw repositioning mouthguard on aspects of physical performance in athletes.

**METHODS:** College-aged, male athletes (N = 13, M<sub>wt</sub> = 77.5 ± 3.4 kg, M<sub>ht</sub> = 174.5 ± 1.9 cm, M<sub>age</sub> = 21.0 ± 0.5 yr.) participated in this crossover study. Subjects were randomly assigned to order of use of the SA jaw repositioning mouthguard (SA), a placebo mouthguard (PLA), and a no-mouthguard control (CON). Following a familiarization and fitting session, subjects completed 3 separate testing sessions in which they completed a dynamic balance test, vertical jump (VJ), hexagon agility test, 3-repetition maximum test for bench press (3RM BP), and maximal aerobic capacity treadmill test (VO<sub>2max</sub>).

**RESULTS:** RM ANOVA revealed a trend for significant difference on time in center balance (P=.078). Follow-up tests suggested that this was due to a trend for improved balance with SA compared to PLA (SA: 19.1 ± 1.8 s; PLA: 16.9 ± 1.3 s, P=.064). The difference between SA and CON was not significant (CON: 17.9 ± 1.5 s, P=.16). There were no significant condition effects for VJ (CON: 23.0 ± 0.6 in; PLA: 22.9 ± 0.6 in; SA: 22.5 ± 0.6 in; P = 0.43), agility (CON: 11.1 ± 0.5 s; PLA: 10.8 ± 0.3 s; SA: 10.5 ± 0.3 s; P = 0.19), 3RM BP (CON: 95.8 ± 5.3 kg; PLA: 94.2 ± 5.3 kg; SA: 95.5 ± 5.2 kg; P = 0.11), or VO<sub>2max</sub> (CON: 46.8 ± 4.1 ml/kg/min; PLA: 47.0 ± 4.3 ml/kg/min; SA: 47.7 ± 4.1 ml/kg/min; P = 0.73).

**CONCLUSION:** The SA jaw repositioning mouthguard did not generally affect performance when compared to the CON and PLA conditions. Neuro-dentistry techniques may be required to promote jaw positioning necessary to elicit improvements in performance. The absence of significant differences still supports the use of mouthguards for safety. The recommendation for mouthguard use is often ignored by athletes concerned about possible negative influences on performance. This study provides evidence that mouthguard use does not interfere with physical performance. Funding was provided by Shock Doctor™

**3573 Board #294 June 2 8:00 AM - 9:30 AM**

**Change In Hind Foot Kinematics: Effect Of Footwear**

Mako Fukano, Toru Fukubayashi. *Waseda University, Tokyo, Japan.*

(No relationships reported)

The relationship of athletes and footwear is important to sports performance. The bones and soft-tissues of the hind foot act as a shock attenuator at foot strike and the relative bony motions within the hind foot are the subject of intense research interest for their roles in lower extremity pathology. However, there is little quantity data of the effect of footwear on the hind foot kinematics.

**PURPOSE:** The purpose of this study was to demonstrate the footwear effects on the hind foot kinematics during landing.

**METHODS:** 6 healthy male subjects participated in this study (age: 23.4±3.4 y. o., height: 172.5±6.1 cm, weight: 63.3±10.8 kg). IRB approved informed consent was obtained from all subjects. All subjects performed single leg landing from a height of 10 cm with the knee extended under two conditions; barefoot and shod. All trials were recorded using cineangiography at a rate of 60 Hz. CT scans from 15 cm proximal to the lateral malleolus to the plantar surface were obtained for each foot/ankle using CT imaging with a slice thickness of 0.4 mm. 3D bone surface models of the tibia, talus and calcaneus were created from the CT images. In vivo three dimensional bone positions during landing were determined using 3D-2D model-image registration techniques with bone models and single-plane cineangiographic images between the times of toe contact and 250 msec after landing. All angles were referenced to zero at the toe contacts.

**RESULTS:** The range of motion of the talocrual joint in shod condition was comparable between shod and barefoot conditions. The range of motion of the subtalar joint in shod condition was significant smaller than that of barefoot. The range of motion of dorsiflexion/plantarflexion at the subtalar joint between barefoot and shod conditions were 5°±3 and 4°±3, respectively. Range of motion of eversion/inversion were 6°±3 and 5°±2°, respectively and external/ internal rotation were 6°±2° and 4°±2°, respectively.

**CONCLUSION:** This study suggested that footwear effect a change in the kinematics of the hind foot during landing.

**3574 Board #295 June 2 8:00 AM - 9:30 AM**

### Mechanical Evaluation Of Elastic Devices Used In Resistance Training.

Wagner Martins, Rafael Souza, Juscelino Blasczyk, Michel Santos Silva, Ariel Vieira, Hugo Paulista, Ricardo Oliveira. *Universidade de Brasília, Brasília, Brazil.*  
(No relationships reported)

**PURPOSE:** Determine Load vs. Strain (LS) values of Elastic Devices (ED) (Elastos®) in a laboratory traction test.

**METHODS:** Our sample was composed by 105 ED (elastic tubes with average 7cm) of 7 different diameters (identified by different colors) with hooks at their extremities. For the test we utilized a traction machine (MTS® System Corporation, model MTS 810). To measure the elastic force, a load cell with capacity of 100kgf and sensitive of 2mV/V was connected to one extremity of the ED and the upper arm of a traction machine, and the other extremity was connected to the inferior arm of machine. To measure force and dislocation data, we used the Station Manager Software MTS 810. The dislocation speed for each ED was 5 mm/min. The room temperature was constant at 23° Celsius and 50% air relative humidity. The tests were realized at the Mechanical Engineer's Lab (University of Brasilia). Statistical analysis was realized using average and standard deviation for each color at each stretching position.

**RESULTS:** We obtain results for each sample of each color (15 samples for each color) for loads at 50%, 100%, 150% and 200% stretching.

**CONCLUSIONS:** The traction test allowed the determination of values for LS of ED used in this study, offering a possibility of quantitative control of intensity, an important variable to manipulate the resistance training

Loads vs. Strain values

| Strain(%) | Yellow(n=15) | Red(n=15)    | Green(n=15)  | Blue(n=15)   | Black(n=15)  | Grape(n=15)  | Gold(n=15)    |
|-----------|--------------|--------------|--------------|--------------|--------------|--------------|---------------|
| 50        | 1.05 (±0.24) | 1.59 (±0.16) | 1.81 (±0.18) | 2.27 (±0.33) | 2.99 (±0.19) | 4.25 (±0.26) | 6.48 (±0.09)  |
| 100       | 1.56 (±0.32) | 2.34 (±0.17) | 2.64 (±0.21) | 3.48 (±0.48) | 4.36 (±0.29) | 6.21 (±0.33) | 9.45 (±0.16)  |
| 150       | 1.95 (±0.33) | 2.93 (±0.18) | 3.27 (±0.23) | 4.39 (±0.56) | 5.45 (±0.27) | 7.63 (±0.35) | 11.86 (±0.28) |
| 200       | 2.36 (±0.33) | 3.51 (±0.24) | 3.86 (±0.24) | 5.49 (±0.95) | 6.43 (±0.28) | 8.85 (±0.59) | 13.88 (±0.60) |

**3575 Board #296 June 2 8:00 AM - 9:30 AM**

### Linear Impact Energy Attenuation Of A Novel American Football Helmet Liner

David E. Krzeminski, James T. Goetz, Nadine M. Lipka, Andrew P. Janisse, Scott G. Piland, Trenton E. Gould, James W. Rawlins. *University of Southern Mississippi, Hattiesburg, MS.* (Sponsor: Michael J. Webster, FACSM)  
(No relationships reported)

Abating sport-related concussion necessitates evaluation of protective head gear product claims. Research associated with the initial development of a novel inner liner technology was published in peer reviewed scientific literature. Furthermore, multiple patents have been awarded to the American football helmet manufacturer for the novel liner technology.

**PURPOSE:** To verify, further define, and substantiate published findings and product claims related to linear impact energy management of a thin-walled collapsible air chamber (absorbers).

**METHODS:** Absorbers (N=15) from three adult football helmets were impacted at predefined velocities of V1=1.3 m/s, V2=2.3 m/s, V3=3.0 m/s, V4=4.0 m/s, and V5=4.7 m/s using an instrumented drop tower. Force data were acquired via an 88 kN load cell and compression behavior was captured via high speed video at 2100 fps.

**RESULTS:** Mean peak compression forces, mean maximum compression height, and percent compression were: V1 (734.67 N ±30.98; 21.78 mm ±.33; 42.6%), V2 (955 N ±13.11; 13.04 mm ±.60; 65.6%), V3 (1637.67 N ±12.42; 7.70 mm ±.35; 76.8%), V4 (9254.67 N ±297.61; 5.01 mm ±.36; 86.8%), and V5 (15849 N ±401.43; 4.04 mm ±.05; 89.4%). A bell-shaped curve was observed at V1, while V2 and V3 exhibited trapezoidal behavior. V4 and V5 curves exhibited an initial trapezoidal region followed by a leptokurtic region.

**CONCLUSIONS:** Impulsive forces appear to be ideally managed up to a V3 threshold, whereas reported velocities associated with on-field outer shell impacts exceed 7.0 m/sec. Thus, focal outer shell impacts should be investigated to examine the degree to which velocity is diminished prior to liner load transfer and the extent adjacent absorbers participate. Additionally, the leptokurtic region of the V4 and V5 curves indicates a third phase that may be defined as densification as demonstrated by the compression approaching 90%. Further investigation into physical, mechanical, and thermal characteristics of shock absorber constituent materials is warranted to potentially provide higher levels of prevention of sport-related concussion.

**3576 Board #297 June 2 8:00 AM - 9:30 AM**

### Evaluation Of Novel Football Helmet Liner Claims

Andrew P. Janisse, Nadine M. Lipka, James T. Goetz, David E. Krzeminski, Trenton E. Gould, James W. Rawlins, Scott G. Piland. *University of Southern Mississippi, Hattiesburg, MS.* (Sponsor: Michael J. Webster, FACSM)  
(No relationships reported)

Athletes have been reported to incur multiple impact exposures during practice and games. To abate injury, protective head gear liner systems must match up to product claims. A novel liner associated with a new design of football helmet is comprised of multiple thin-walled air-filled chambers (absorbers), each outfitted with a foam-filled pad purported to improve impact attenuation and maintain chamber durability.

**PURPOSE:** To investigate specific claims, detailed in the patent literature, that the foam-filled pad improves impact force attenuation and durability of the absorber system.

**METHODS:** Absorbers (N=18) were randomly assigned into two groups: foam pad intact (n=9) and removed (n=9). Absorber attenuation and durability were assessed across three impact velocities (V1=1.3 m/s, V2=3.0 m/s, V3=4.0 m/s) via 15 impacts at one minute intervals. Force data were obtained using an instrumented drop tower. For each impact velocity, a 2 (Condition: pad, no pad) X 15 (Trials: impacts 1-15) mixed model repeated measures ANOVA was conducted.

**RESULTS:** No interaction or main effects were observed for peak compression force at V1. However, between, within and interaction effects were found at V2 (F(1,4)=70.51, p=.001, f=4.36; F(14,56)= 32.13, p=.001, f=2.84; and F(14,56)=17.25, p=.001, f=2.06, respectively). V3 elicited both a between (F(1,4)=213.43, p=.001, f=7.00) and within (F(14,56)=18.01, p=.001, f=2.13) effect, but no interaction effect.

**CONCLUSIONS:** No improvement in damping or durability was provided with foam pad at V1. Absorber force attenuation degraded over multiple impacts at V2 and V3. The foam pad improved force attenuation and absorber durability at V2, but this protective effect diminished at V3. Findings provide velocity-specific support for the novel helmet liner claims.

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**3577** Board #298 June 2 8:00 AM - 9:30 AM  
**Watts Up - Measuring Power. A Mobile Device For Measuring Muscular Power: A Validation Study**

Andy Matthews, Rachel Klimetz, Michelle Gray. *University of Arkansas, Fayetteville, AR.*  
(No relationships reported)

The testing of speed and power is vital to accurately assessing many sport movements and activities of daily living. The current devices used to measure power accurately in a lab setting are prohibitively expensive and limited in the movements that can be performed. Many of the field measures for power are contraindicated for older adults. The Tendo Weightlifting Analyzer (Tendo; Tendo Sports Machines, Trencin, Slovak Republic) device is both affordable and flexible in the measures that can be taken. The Tendo can be used to safely measure power in an older adult population, and can assess sport specific movement.

**PURPOSE:** The purpose of this study was to compare the power measurements of the Tendo to two well-established measures of power in an attempt to validate the Tendo.

**METHODS:** Fifty-two individuals ( $n = 52$ ) participated in a field measure and a lab measure in an attempt to validate the Tendo. The field measure included connecting the participant to the Tendo and performing a vertical jump as measured on a Vertec Jump Training System (Vertec, Sports Imports, Hilliard, OH). Participants repeated attempts until failing to move an additional vane on two consecutive attempts. The lab measure included connecting the participant to the Tendo and analyzing power in knee extensions using the Biodex isokinetic dynamometer (Biodex; Biodex Medical Systems, Inc. Shirley, NY). The Biodex was set to move at 240 degrees/second. The average maximum power in watts from the Tendo and average watts from the Biodex were paired. A Pearson's product moment correlation coefficient was performed comparing the Tendo and the vertical jump results as well as comparing the Tendo and the Biodex results.

**RESULTS:** A significant positive correlation was found in both the established field and power measures when compared to the Tendo. The Tendo and Biodex outputs resulted in a large positive correlation ( $r = .55, p = .01$ ). The Tendo and Vertec outputs resulted in a similarly large positive correlation ( $r = .55, p = .01$ ).

**CONCLUSION:** These results indicate a strong correlation between the Tendo and both the Vertec and the Biodex validating the use of the Tendo as an appropriate measure of power in both lab and field settings. The flexibility and ease of use of the Tendo open the possibility of studies of power that were formerly unrealistic.

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**3578** Board #299 June 2 8:00 AM - 9:30 AM  
**A Comparison of Three Brands of Knee Wrap on Peak Knee Torque**

Glen E. Fincher, II, Steven K. Rohr, Taylor D. Sams. *Ashland University, Ashland, OH.*  
(No relationships reported)

**PURPOSE:** The purpose of this study was to determine if there were statistically significant differences in the effects of three commonly used brands of knee wrap (EFS, Inzer Gripper, and Titan RPM) on peak knee torque among highly strength trained collegiate athletes.

**METHODS:** Eight healthy male, highly strength trained competitive collegiate athletes, ranging in age from 19-22, were utilized in this study. A CSMI Humac Norm isokinetic extremity testing system was used to evaluate peak torque during continuous passive movement isokinetic leg extension with knees (a) unwrapped and (b) wrapped (utilizing each of the three brands of knee wrap). The "crossed" taping method was utilized in this study. Paired samples t-tests were used to determine if there were statistically significant differences between the "wrapped" and "unwrapped" conditions. One-way analysis of variance was then used to determine if there were statistically significant differences in peak torque among the three knee wrap brands during the testing conditions. Alpha levels were set a priori at 0.05 to determine statistical significance.

**RESULTS** (reported by mean change  $\pm$  SD): The changes in peak torque utilizing EFS ( $23.38 \pm 11.11$  ft-lb), Inzer Gripper ( $25.50 \pm 8.62$  ft-lb), and Titan RPM ( $23.50 \pm 8.90$  ft-lb) were all significant compared to the unwrapped condition ( $p = 0.000$ ). There were no significant differences in peak knee torque among the three brands of knee wrap utilized in this study ( $p = 0.684$ ).

**CONCLUSIONS:** The data from this study indicate that the use of knee wraps, regardless of brand, significantly improve peak knee torque among highly strength trained male collegiate athletes. The data also indicate that there are no significant differences among EFS, Inzer Gripper, and Titan RPM knee wrap brands with respect to peak isokinetic knee torque.

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**3579** Board #300 June 2 8:00 AM - 9:30 AM  
**Effects of Chaining Design on 1km Time Trial Performance Over Six Weeks in Competitive Cyclists and Triathletes**

Robert D. Clark, Christiane R. O'Hara, Todd Hagobian, Karen McGaughey. *Cal Poly State Univ, San Luis Obispo, CA.*  
(No relationships reported)

**PURPOSE:** The purpose of this study was to examine the effects of chaining type (circular vs. the non-circular Rotor Q-Ring) on performance during a 1km time trial and physiological responses over a six week period.

**METHODS:** Eight competitive male cyclists and triathletes were pre-tested using the original circular chaining. Graded submaximal exercise tests were followed by the 1km time trial with subjects using their own racing bicycle. The circular chainings were then removed and replaced with Rotor Q-Rings during the intervention period. Subjects trained and raced with this alteration to their bicycles and repeated the submaximal and 1km performance tests for the next four weeks. Post-testing occurred with the original circular chainings for the final week of testing. Oxygen consumption, carbon dioxide output, heart rate, ventilation, respiratory exchange ratio, and perceived exertion were continuously measured during the submaximal tests. Blood lactate concentration was measured during the last 30 s of each three minute stage.

**RESULTS:** The main findings were: Significant increases in performance in the 1km time trial with Rotor Q-Rings compared to circular chainings. Subjects completed the time trial on average 1.6 seconds faster ( $p < 0.05$ ), increased average speed approximately 0.7 kph ( $p < 0.05$ ), and increased average power approximately 26 watts ( $p < 0.05$ ). Furthermore, these performance measures were consistent during the four weeks employing the Rotor Q-Rings. Post-test performance levels returned to initial values during week 1 pre-testing with the circular chainings.

**CONCLUSION:** It appears from this study that cycling with the Rotor Q-Ring offers an ergogenic effect that is apparent after only one week of exposure and that long term physiological adaptations are not required. It appears that the coordinative structure employed during cycling is well adapted to this alteration in the bicycle drivetrain.

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**3580** Board #301 June 2 8:00 AM - 9:30 AM  
**Validation Of A Novel Mouthguard For Measurement Of Linear And Rotational Accelerations During Head Impacts.**

James Mattson, Rebecca Shultz, Jeremy Goodman, Scott Anderson, Daniel Garza. *Stanford University, Stanford, CA.*  
(No relationships reported)

**PURPOSE:** As many as 3.8 million sports-related brain injuries occur annually in the United States, yet our understanding of the mechanism remains unclear. Cadaveric and animal studies have sought to characterize this mechanism, including relative contributions of linear and rotational accelerations of the head. Methods for measuring head impacts have included laboratory reconstruction of concussive events and utilization of instrumented helmets. This study seeks to validate the use of an instrumented mouthguard (MG) to measure head impacts in vivo.

**METHODS:** Three instrumented MGs (X2Impact, Seattle) were individually placed and secured with an adjustable mandible in a helmeted headform of similar dimensions as a Hybrid III anthropometric headform. Linear accelerometers and gyroscopes were mounted at the head's center of gravity (CG). The headform was impacted using a twin-wire drop test to the standards of the National Operating Committee on Standards for Athletic Equipment from a minimum of 7 heights ranging from .05m to 1.72m, with at least 5 drops per height. Impact locations were from  $-180^\circ$  to  $180^\circ$  azimuth in  $45^\circ$  increments at elevations of  $0^\circ$ ,  $45^\circ$ , and  $90^\circ$ . A custom analysis software (X2Impact, Seattle) transformed MG accelerations to calculate peak linear acceleration (PLA), peak rotational velocity (PRV), and peak rotational acceleration (PRA) of the head's CG. Mixed effected linear models compared transformed data from MGs to data from the CG sensors, creating 95% confidence intervals for  $r^2$ , slope, and average offset.

**RESULTS:** Analysis showed strong correlations for PLA ( $r^2 = .9374 \pm .0047$ ), PRV ( $r^2 = .9663 \pm .0026$ ), and PRA ( $r^2 = .8822 \pm .0086$ ). Slopes of linear regressions were  $.976 \pm .009$  for PLA,  $.988 \pm .007$  for PRV, and  $1.039 \pm .014$  for PRA. Average percent offsets were  $-2.88 \pm 2.16\%$  for PLA,  $3.61 \pm 2.32\%$  for PRV, and  $2.83 \pm 4.85\%$  for PRA. Average offset for location of impact was  $1.63 \pm 3.74^\circ$  azimuth and  $-1.57 \pm 0.48^\circ$  in elevation.



**CONCLUSIONS:** Results from this study showed that instrumented MGs can accurately measure head impacts. Utilization of this device will provide further characterization of linear and rotational biomechanics of head impacts in helmeted and non-helmeted sports, with future studies allowing for stronger understanding of possible thresholds and mechanisms of traumatic brain injury.

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**3581**     *Board #302*     **June 2**     **8:00 AM - 9:30 AM**

**Effects Of A Soccer Specific Warm-up And A Competitive Match On Knee Proprioception**

José Oliveira<sup>1</sup>, Eduardo Salgado<sup>1</sup>, Fernando Ribeiro<sup>2</sup>. <sup>1</sup>*University of Porto, Faculty of Sport, Porto, Portugal.* <sup>2</sup>*CESPU, Polytechnic Health Institute of the North, Gandra PRD, Portugal.*

*(No relationships reported)*

Changes in skeletal muscle function induced by pre-participation warm-up and prolonged fatiguing exercise might lead to alterations of proprioception, namely knee joint position sense.

**PURPOSE:** To assess the effect of pre-participation warm-up and fatigue induced by an official soccer match on knee joint position sense of soccer players.

**METHODS:** Fourteen healthy adult male soccer players (age:  $25.9 \pm 4.6$  years old) were assessed for rate of perceived exertion and knee joint position sense at rest, immediately after a standard warm-up (duration 25 min), and immediately after a competitive soccer match (90 minutes duration). The evaluation of rate of perceived exertion was performed using Borg's rating of perceived exertion scale (scale of 6 to 20 points). Subjects were considered to be fatigued if they reported an RPE of 15 or above. Knee joint position sense of the dominant limb was evaluated by ipsilateral active limb matching responses of a passively determined position, without visual input, in open kinetic chain.

**RESULTS:** Perceived exertion increased significantly from rest to the other assessments (rest:  $8.6 \pm 2.0$ ; after warm-up:  $12.1 \pm 2.1$ ; after soccer match:  $18.5 \pm 1.3$ ;  $p < 0.001$ ). Compared to rest, after the warm-up, absolute angular error decreased significantly ( $4.1 \pm 2.0^\circ$  vs  $2.0 \pm 1.0^\circ$ ;  $p < 0.05$ ). After the match, absolute angular error ( $8.7 \pm 3.8^\circ$ ) increased significantly comparatively to both rest and the end of warm-up ( $p < 0.05$ ). The relative error showed directional bias with underestimation of the test position.

**CONCLUSIONS:** Joint position sense acuity was increased by pre-participation warm-up exercise and decreased by soccer match induced fatigue.